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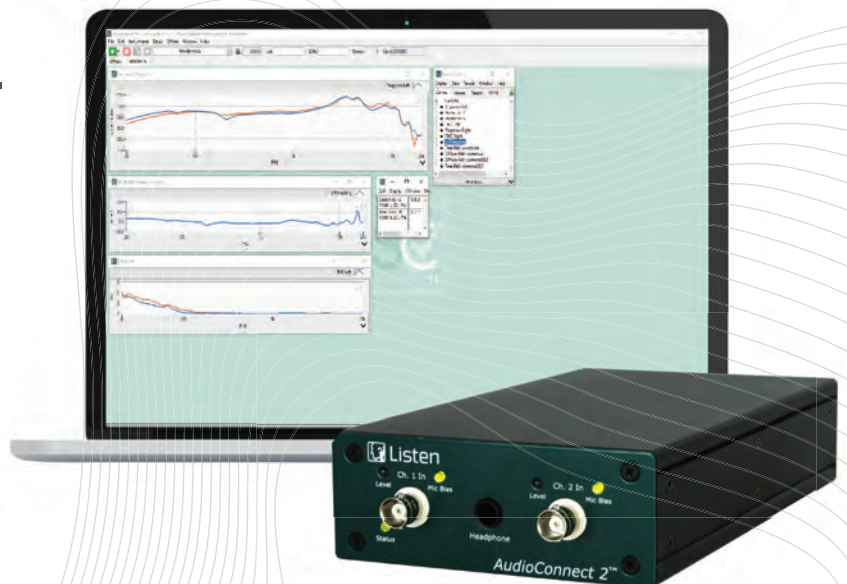
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Contacts

Publisher

Juliet Loiseau

Contributions, letters and information on new products to:

Nicky Rogers

Email:

nicky@warnersgroup.co.uk

Tel: 01778 391128

Advertising:

Dennis Baylis MIOA

Email: dennis.baylis@ioa.org.uk

Tel: 00 33 (0)5 62 70 99 25

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ACOUSTICS BULLETIN

Acoustics Bulletin Volume 49 No 5 September/October 2023



Cover image: With acoustic measurements, acoustic models, and extensive archival research, acousticians are reconstructing the sounds of Notre-Dame Cathedral through the ages after it was damaged by fire on 15 April 2019. Page 48

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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.

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

I hope this letter finds you all in good health, having enjoyed a well-earned break over the summer. As we delve into another edition of *Acoustics Bulletin*, I am delighted to present a magazine which reflects the richness and diversity of our IOA community.

One of the focal points throughout this issue is women and STEM in which we celebrate the achievements of women in acoustics, recognising their valuable contributions to our field. As a professional body, we are committed to fostering inclusivity and diversity in acoustics, and this feature acknowledges the impact that women continue to make in what traditionally may have been perceived as male-dominated industries. This theme continues with an article that sheds light on the experiences, challenges, and triumphs of women engineers. These narratives will not only influence current member attitudes, but also pave the way for a more equitable and progressive future for acousticians and engineers.

International Conference on Underwater Acoustics

I am pleased to point you to the International Conference on Underwater Acoustics (ICUA) call for papers. This prestigious event always delivers an enriching platform for professionals to exchange knowledge, ideas and innovations in underwater acoustics and I would encourage those of you who specialise in this area to participate actively in this conference by attending and submitting your research findings.

IOA Bursary Fund

On the subject of contributing to and attending events, I would also point you to an update on the IOA Bursary Fund (page 22). We are keen to provide financial support to encourage aspiring acousticians and members who find costs a barrier to attending and benefiting from valuable development opportunities. Nurturing and mentoring young talent will ensure a bright and prosperous future for our Institute.

Noise guidance for onshore wind turbines.

On page 26, Mike Lotinga explores the contentious topic of noise guidance for onshore wind turbines. In light of the renewed policy interest at government level, coupled with the IOA Good Practice Guidance having now been in use for 10 years, our Council took the decision to reconvene our Windfarm Noise Working Group. In previous issues of *Acoustics Bulletin* I have emphasised the importance of basing regulatory policy and standards on well-researched data, and that these should be applied using robust and proportionate



enforcement practices. Therefore, the aim is for this group to be comprised of acoustics professional practitioners with policy, regulatory, industry, consultancy and research expertise and experience.

Notre-Dame comes back to life

Last but not least, we explore the awe-inspiring technical challenges and triumphs behind the rebuilding of one of the most iconic symbols of architecture and history. A technical article by Brian Katz on page 48 takes us into the captivating world of the rebuilding of Notre-Dame cathedral in Paris. Brian's article explores the acoustic considerations in preserving the historical and cultural significance of this magnificent structure.

Royal Charter

Before I conclude, I would like to highlight what could be a momentous milestone in the history of our institute. We have been diligently working towards becoming a Chartered Institute, and we are now at the stage of presenting members with the opportunity to vote on whether we should continue to submit our petition for the Royal Charter. The voting will take place in October, and your active participation and valuable feedback in this process are crucial to shaping the future.

Warm regards,

Alistair Somerville, IOA President

Engineering Division



The IOA Engineering Division will support you through the process to help you become one of almost 229,000 registrants that hold international professional recognition.

By Blane Judd BEng FCGI CEng FIET FCIBSE, Engineering Manager

In this issue (page 8) we have the feedback from four successful candidates who recently underwent their professional review interviews.

The training of new assessors continues, but we can never have enough, so if you want the chance to be part of the progression of other engineers, please let us know. I have just completed some professional review interviews for another Institute as a volunteer, these interviews were in my area of expertise, and it is important to us that we provide candidates with assessors who know about the area of acoustics they are working in. If you have experience in a specialist area of acoustics, we'd love to hear from you so that we can broaden our offering to new candidates. I look upon conducting these interviews as a way of keeping my own CPD up-to-date and there is always something to learn and reflect on.

Just recently we have been sending out a redacted version of a good professional review report, which seems to have helped people to put a good first draft forward. The better you demonstrate the competencies the more likely you are to get to interview quickly. We still get a few candidates who, once they have paid their invoice, ask what the next steps are. These are all clearly laid out in the guidance so please take the time to study it as it will tell you what documents are needed, and which items need to be endorsed by your sponsors. It also explains what to do if you cannot find IOA members to act as your sponsors.

Below:
We are now interviewing using the Engineering Council UK SPEC version 4

We are always ready to comment on the content of your professional review report prior to submitting the final draft. We are grateful to the volunteers who take the time to comment on submissions and give feedback to candidates. We will always comment on submissions and ask for re-drafted versions, but to avoid an iterative process, try to include evidence that shows you have the underpinning knowledge related to the projects you have submitted. For example, if you have selected a particular software to conduct modelling, explain why you chose it, what the shortfalls are, what results you were expecting and how you validated the outputs.

These are all part of the A and B competencies and will save you having to do several rewrites.

The recent ring round from Emma Lilliman has resulted in some candidates who had stalled beginning the process again. Since we have a limited resource, we try to respond as quickly as possible, but high numbers of candidates all looking for feedback at the same time can cause a backlog, please bear with us as we try our best to turn around your drafts quickly.

Neil Ferguson still helps us with academic equivalence support for those candidates who do not have recognised qualifications. You can check for yourself if your qualifications meet the required



The UK Standard for Professional Engineering Competence and Commitment (UK-SPEC)

Fourth edition

Published August 2020




specification by visiting the Engineering Council website <http://www.engc.org.uk/courses>. But please don't panic if your specific qualification is not listed, as we can still help you through the process using individual assessment (see later in the article).

Next interview dates

We hold several interview events through the year, depending on the number of candidates we have

coming forward for registration. Our next set are scheduled for 11 and 12 October 2023. If you are interested in taking the next step to becoming a professionally registered engineer, email us at acousticsengineering@ioa.org.uk sending a copy of your CV and copies of certificates and transcripts of your qualifications. It is important that we have all your further and higher education certificates, not just your highest attainment.

There are two routes to registration:

The **recognised qualification** route, if you have achieved the required learning outcomes through recognised qualifications in acoustics. Qualifications which provide the required level of knowledge and understanding are for IEng an accredited Bachelor's degree and for CEng an accredited integrated Master's degree or a combination of accredited Bachelor's and Master's degrees (see table below).

Recognised qualifications

Incorporated Engineer (IEng) One of the following:	Chartered Engineer (CEng) One of the following:
An accredited Bachelor's or honours degree in engineering or technology	An accredited Bachelor's degree with honours in engineering or technology, plus either an appropriate Master's degree or engineering doctorate accredited by a licensee, or appropriate further learning to Master's level*
An accredited Higher National Certificate (HNC) or Higher National Diploma (HND) in engineering or technology started before September 1999	An accredited integrated MEng degree
An HNC or HND started after September 1999 (but before September 2010 in the case of the HNC) or a foundation degree in engineering or technology, plus appropriate further learning to degree level	An accredited Bachelor's degree with honours in engineering or technology started before September 1999
A National Vocational Qualification (NVQ) or Scottish Vocational Qualification (SVQ) at level 4 that has been approved by a licensee, plus appropriate further learning to degree level*	Equivalent qualifications or apprenticeships accredited or approved by a licensee, or at an equivalent level in a relevant national or international qualifications framework†
Equivalent qualifications or apprenticeships accredited or approved by a Licensee, or at an equivalent level in a relevant national or international qualifications framework†	

* See: www.engc.org.uk/ukspec4th for qualification levels and HE reference points.

† For example, UNESCO's International Standard Classification of Education (ISCED) framework.

The **individual assessment** route, for applicants who do not have the recognised qualifications and who will have an individual assessment of their qualifications and any other relevant learning such as: formal academic programmes, in-employment training and experiential learning self-directed learning. In many instances, it is likely to be a combination of some or all these options.

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

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

The Institute recognises the IOA Diploma course and the several 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. If you need to follow the technical route, we will discuss this with you before you embark on that process.

Election process

The election process is overseen by the Institute's Engineering Division Committee, which is made up of volunteers from the membership. They represent the ever-growing number of members holding EC registration and provide the essential peer review process that affirms that you are at the appropriate level for recognition as an Engineering Council Registered Professional Engineer. ☺

Our video explains how members can gain professional recognition and Engineering Council registration through the IOA.

<https://www.ioa.org.uk/video/recognising-your-professionalism-0>

Engineering Council successful candidates



The Engineering Council is the UK regulatory body for the engineering profession. It holds the national registers of Engineering Technicians (EngTech), Incorporated Engineers (IEng), Chartered Engineers (CEng) and Information and Communications Technology Technicians (ICTTech).

It also sets and maintains the internationally recognised standards of professional competence and ethics that govern the award and retention of these titles. This ensures that employers, government and wider society can have confidence in the knowledge, experience and commitment of professionally registered engineers and technicians.

The IOA is pleased to announce that Gareth Davies, George van Hout, Harout Taghilian and George Xanthoulis have all attained the standard required for admission to the national register.

Gareth Davies CEng



Gareth gained his Institute of Acoustics Diploma at the University of Salford in 2013 after 10 years as a professional sound engineer in the entertainment industry. He has worked as an acoustic consultant for almost 10 years; moving to Buro Happold Engineering in 2018. Gareth has been involved with the acoustic design of schools, universities, entertainment venues, and large residential and commercial projects, numerous planning applications comprising

Left: Gareth Davies CEng

external building fabric and plant noise, as well as completing environmental noise, noise nuisance and noise at work assessments.

Gareth started his application for CEng in 2020 as part of his CPD process with Buro Happold, and he said: "As an employee of an engineering firm, the title of CEng is held in great regard and is also useful personally to demonstrate high quality standards.

"Although it was a bit of a drawn out process for me; it took almost three years from start to finish due in no small part to starting a young family and the disruption of COVID, it has been an interesting journey to evidence the quality of my work up to this point.

"My biggest tip for prospective candidates would be to get to know your projects inside and out. If you are confident that you are applying all your knowledge and skills to a project then you should find the CEng process a validation of all the hard work you have already done."

George van Hout CEng

George is part of the acoustics team at WSP New Zealand and has been working as an



Right: George van Hout CEng

acoustic engineer since 2014. He has experience in providing acoustic consultancy services for a wide variety of building and environmental projects from business case to post-completion. George has a comprehensive experience within the building acoustics field, completing his Masters in Engineering looking at ceiling flanking noise, and the use of in-ceiling treatment to reduce flanking sound. George has also worked on major environmental noise projects across New Zealand including being an expert witness at Environment Court both for Applicants and Council.

George lives with his wife and two-year-old twins in Christchurch, New Zealand. When he isn't working or running after his twins, George can usually be found out under the night sky photographing the Milky Way and Auroras, or up a mountain hiking.

Reflecting on his new qualification George said: "In consultancy, there is very little time to step back and realise just how much you have accomplished. Processes like chartership provide the ability to stop and reflect on the years you have been working (in my case eight years when I started my PRI report), and the projects you have been involved within (hundreds for me).

"During this process, I looked at all the projects I have ever worked on, from my first one for a school doing reverberation time calculations, and my first solo project at a pre-school, right up to my current project where I have been working on large infrastructure projects (in New Zealand terms). **P10**



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“The reflection process has given me renewed belief in myself and the progress I have made in the past nine years of working as an acoustic engineer. Because the chartership application is also forward-looking, it made me realise how I want my career to progress and allowed me to develop educational and professional goals and a pathway to get to where I want to be.

“Overall, even without the bragging rights that come with being Chartered, the process is very rewarding and fulfilling, and I would recommend (and support) anyone going through the process.”

Harout Taghilian CEng



Left:
Harout Taghilian
CEng

Harout started his career in a small organisation in Lebanon in 2013 before moving to Dubai in 2018 to join Ramboll as a senior engineer. His role expanded at Ramboll and he was recently made the Head of Acoustics (for Middle East region) responsible for projects in the Middle East and Asia Pacific regions.

He obtained his Diploma in Acoustics and Noise Control from Institute of Acoustics with distinction in 2016. He also holds bachelor's degree in physics from Lebanese University. Harout is a member of IOA Middle East Branch, which aims to further connect with colleagues within the region, to create public awareness regarding acoustics, and to organise CPD sessions for the members.

Harout said: “After obtaining the IEng status back in 2017, I always wanted to achieve CEng status. When I approached the IOA for advice, Blane and Emma were extremely supportive and guided

me throughout the entire journey by providing all the necessary information and documentation.

“Although the process of achieving CEng took a while because of back-and-forth submissions of my professional review interview report and feedback from the volunteer assessors, eventually it was accepted and I was finally ready for the interview which was conducted online. The interview was very smooth and relaxed thanks to the professionalism and positive attitude of the interviewers.

“Some questions caught me off guard but since I had couple of minutes at the end of the interview while the panel discussed my performance among themselves, I was able to provide further supporting documentation for the questions they had asked.

“I highly encourage anyone considering professional registration to do it sooner rather than later as life gets busier and busier; initially the process might look difficult or time-consuming but at the end of the day it's worth all the hard work as it boosts your confidence and makes you proud of your achievements.

“With this, I would like to extend my utmost gratitude to the IOA Engineering and Education teams and my colleagues at Ramboll who helped me throughout my career and this process.”

George Xanthoulis CEng

Raised in a family of professional classical musicians, George's early years were immersed in a musical environment. However, as a teenager, his interests shifted towards STEM subjects, which

eventually led him to pursue a degree in civil engineering at the National Technical University of Athens.

Towards the end of his studies, he discovered the fascinating field of acoustics, which merged his engineering background with his love for music. For his MEng thesis, he focused on auditorium acoustics under the guidance of Dr Alexandra Sotiropoulou.

Since graduating in 2014, George's career has encompassed a wide range of projects; he has led the acoustic design of performance spaces, developed acoustic solutions for TV and radio studios, managed engineering teams, and worked on modern methods of construction (MMC) products. His areas of expertise include noise and vibration control, acoustic modelling, and acoustics testing.

Alongside his professional work, George is proud to be the instructor of two engineering courses on Udemy, which have attracted students from 72 countries since 2020.

Reflecting on his CEng process, George said: “Becoming a Chartered Engineer with the IOA has been a transformative journey, enhancing my professional standing and expanding my knowledge in the field.

“It required meticulous planning and gathering of evidence to effectively demonstrate my competence and expertise and the support and guidance provided by Blane and Emma from the IOA Engineering Division were invaluable in navigating the complexities of the application process, ensuring a successful outcome.

“I am also grateful to my colleagues at Atkins for their mentorship and collaboration, which played a crucial role in my pursuit of chartership. Their insights and feedback helped me refine my application, particularly in creating a compelling professional review interview (PRI) report.” 



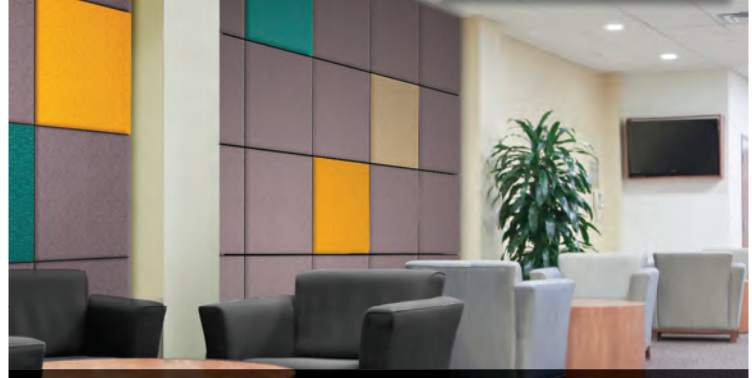
Right:
George Xanthoulis
CEng

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Reproduced Sound 2023

The IOA Electro-Acoustics Group Committee is pleased to announce **Reproduced Sound 2023: Audio accessibility – the ingredients for success.** The conference will be held in Bristol on 14-16 November 2023.

Audio enthusiasts from all over the world will gather in Bristol for the **39th Annual Conference and Exhibition, Reproduced Sound 2023, in November, and it promises to be a game-changer in the audio industry.**

The venue, The Bristol Hotel, on Princes Street, Bristol will set the stage for an extraordinary three-day journey into the world of acoustics, sound technology and innovation, with discussions and demonstrations that will pave the way for a more inclusive and accessible audio landscape.

Programme

The first day will start with a workshop and demonstrations by Audioscenic, 3D audio experts, who will bring their cutting-edge spatial audio technology to delegates. The Razer Leviathan V2 Pro soundbar and a laptop integrated with their technology promise to redefine the way people experience sound for gaming and more.

On the second day, delegates will be able to explore the world of audio accessibility, advancements

in acoustics, and sound technology. Ludovico Ausiello, Chairman of the Electroacoustic Group (EAG), will set the tone for an enriching experience.

The prestigious Peter Barnett Memorial Award, will be presented to Professor Angelo Farina from the University of Parma, Italy, to honour his significant contributions to the field of acoustics and signal processing.

Technical sessions

The technical sessions will focus on live sound and venues covering measurement, transducers, signal processing and modelling. Experts and researchers will share their insights on audibility criteria, alternative methods for controlling music noise levels, and the effect of acoustically transparent materials on sound propagation. The session will provide valuable takeaways that aim to shape the future of live audio experiences.

Conference reception and dinner

The Conference reception and dinner will be held at the


Mud Dock Café which is just a short walk from The Bristol Hotel, and will provide the perfect opportunity for attendees to unwind, eat well and network with colleagues.

Day three

This day focuses on speech intelligibility, signal processing, and hearing impairment. Presenters will discuss the impact of lecturers' movements on speech transmission, innovative methods for reducing aliasing in loudspeakers, and advancements in immersive audio experiences for individuals with hearing differences.

The event will not only unveil the latest audio technologies but also underscore the importance of audio accessibility and the collective responsibility of the industry to make sound experiences more inclusive.

The impact of Reproduced Sound 2023 will be sure to reverberate throughout the industry, paving the way for a future where everyone can experience the clarity and power of sound, regardless of their abilities.

<https://reproducedsound.co.uk/> 



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 SCAN ME

IOA Early Careers Group news

In this article, Zach Simcox, member of the IOA Early Careers Group reports on a recent ECG event jointly held with the IOA Eastern Branch. We also introduce three more ECG representatives

By Josie Nixon, Chair of the IOA Early Careers Group and Zach Simcox, ECG member

On Thursday 29 June, Peter Rogers, Director, Sustainable Acoustics, and member of the IOA Sustainability Working Group, took to the ECG webinar stage, in a joint event with the Eastern Branch, to present his ethos of sustainability and acoustics, and to inspire the next generation of acousticians to be thoughtful in their designs.

Peter started by explaining that acoustics fits in to many different aspects of sustainability and how members of the ECG are in a great position as acousticians of the future to “start a design revolution” which aims to incorporate regenerative design, “where acoustics will be applied in a different way.”

He outlined that the priority of a sustainable future is to go beyond net zero carbon emissions to return to consumption levels that the planet can support. He noted that noise pollution has

the potential to affect everything on land and underwater, but with intervention from acousticians, sustainability goals can be met. He stressed that acousticians must break from the traditional designs they are comfortable with to new, environmentally-considered designs.

Acoustics and sustainability

Mindful of the ideology of responsible design using the sustainability continuum, as acousticians, we can recommend designs that use less energy to produce and operate and this, in turn, will lead to restorative and regenerative designs.

The UN Frontiers Report of 2022 identifies the top issues of environmental concern as:

- urban noise pollution;
- climate change; and
- phenology (nature’s reaction to climate change).

Right: Josie Nixon, Chair of the IOA Early Careers Group



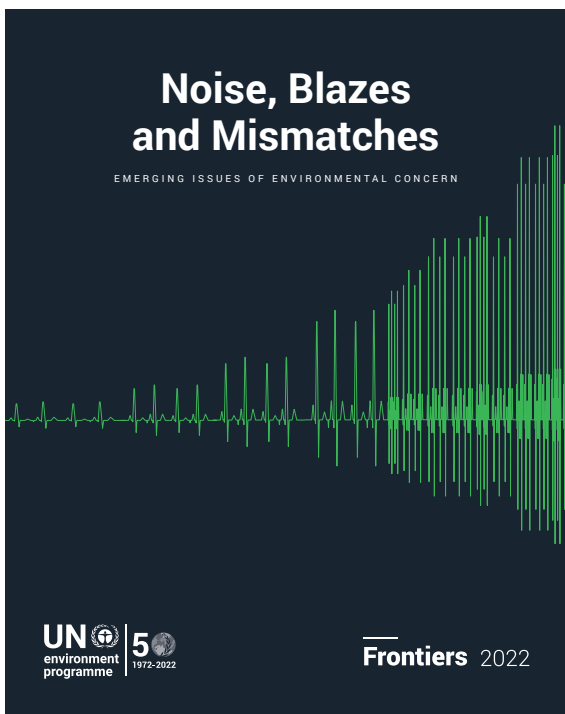
The report highlights the focus areas to be considered by acousticians:

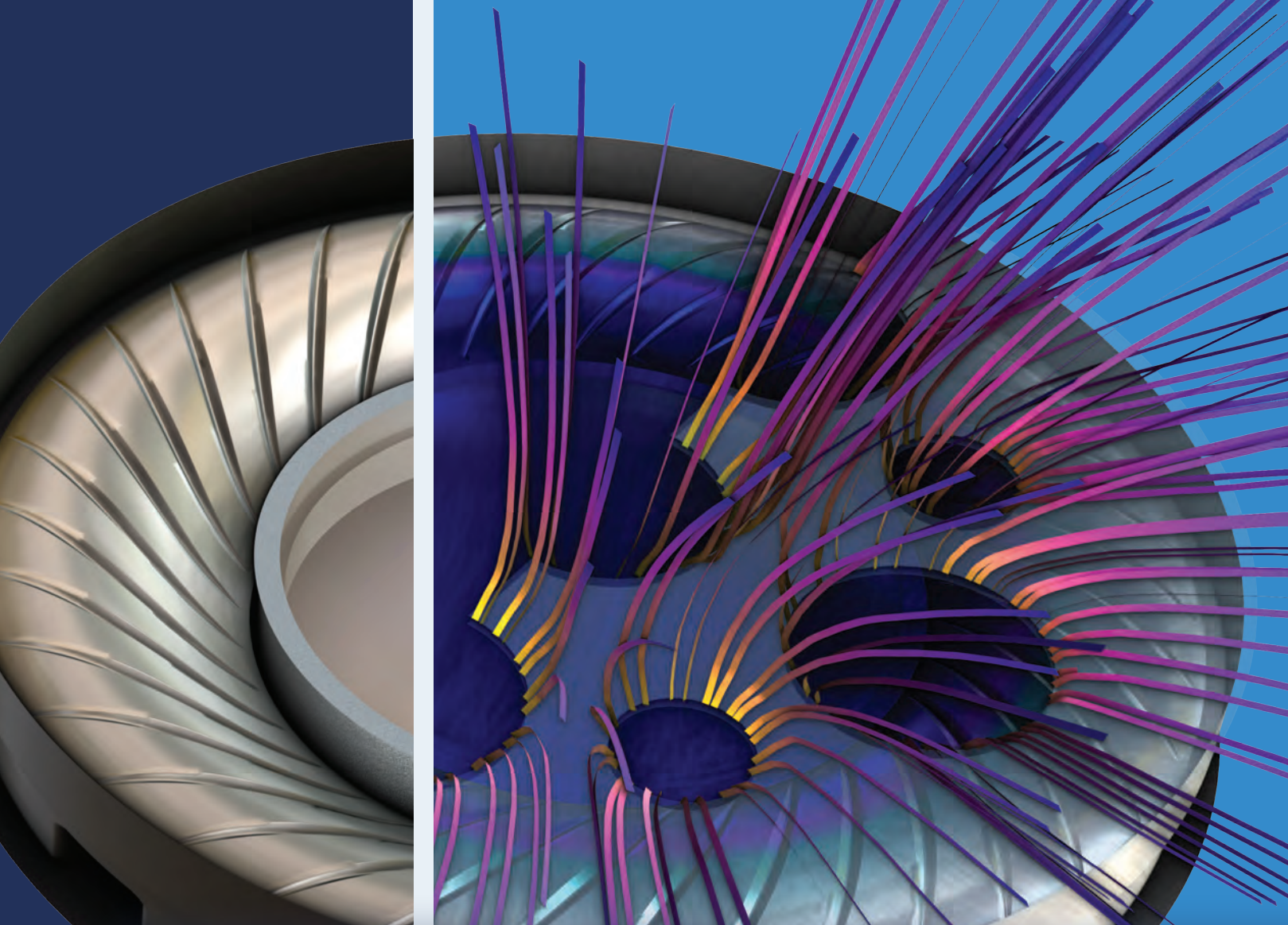
- tree belts;
- greening and rewilding;
- green roofs;
- soundscapes; and
- electric vehicles.

The (re)introduction of green spaces has the potential to improve attenuation with soft ground absorption and will create more pleasant spaces to live in.

Peter also discussed the five Ps of the sustainable development goals, which are: peace, planet, people, prosperity, and partnership. For acousticians, peace is often **P16**

Bottom: Peter Rogers





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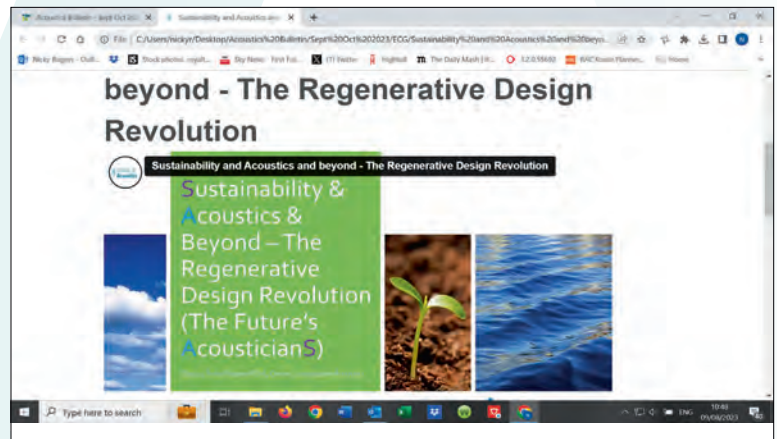
Multiphysics simulation drives acoustics innovation by providing insight into every design aspect that influences product performance. The ability to account for coupled physics phenomena lets you predict, optimise and virtually test a design under real-world conditions – even before a first prototype is built.



» comsol.com/feature/acoustics-innovation

synonymous with tranquillity and quiet so designing areas for peace can bring with it a social cohesion and tolerance for the occupants.

Designs must consider the planet and designing for reduced noise pollution, improved soundscapes, as well as using low carbon materials can lead to healthier living spaces for future generations that will allow prosperity and partnership to flourish.



Download the UN Frontiers 2022 report here:
<https://www.unep.org/resources/frontiers-2022-noise-blazes-and-mismatches>

If you missed the webinar, you can watch it here:
<https://www.ioa.org.uk/video/sustainability-and-acoustics-and-beyond-regenerative-design-revolution>

ECG representatives

Here, we introduce another three of our ECG representatives:

LAURA BROADLEY, **Education Committee** **ECG Representative**

Laura is a senior acoustics consultant with just under four years' experience, specialising in environmental noise and planning. She started working in acoustic consultancy in 2019 and started her most recent role at Cass Allen this year.

Laura studied BSc Music Technology from 2013 to 2017, including a placement year with a loudspeaker manufacturer to improve her understanding of loudspeaker design and continue to develop skills in research and design. Laura's persistent efforts throughout her studies were recognised with the Dean's Prize for Excellence in Music Enterprise. Laura moved on to study MSc Audio Engineering at Leeds Beckett University, with major projects focusing on acoustics of multi-purpose sport facilities and ice rinks.

Laura joined the IOA as a student member during her undergraduate degree and ran acoustics and audio engineering workshops for children and young people as part of being a student ambassador

during her time at university. To expand her network of like-minded professionals and to get involved with the educational side of the IOA after graduating in 2019, Laura joined the Education Committee.

JONAS LOPEZ, **London Branch ECG Representative**

Jonas is a senior acoustic consultant with more than six years of experience in the industry. He joined the ECG committee in 2020 assuming the role of London Branch Representative with the objective of contributing to the growth and development of acoustics.

Jonas said: "The Early Careers Group helps greatly in advancing the field of acoustics by enhancing the understanding of acoustics, particularly among emerging professionals and shaping the future trajectory of acoustics."

TAYLOR COOPER, **Southern Branch** **ECG Representative**

Taylor is a senior acoustic engineer at Mott MacDonald and specialises in environmental acoustics and project management. She joined the Southern Branch committee in early 2017 in order to have a more active

role in the IOA and became the ECG Representative one year later. Since becoming ECG Rep. she has attended several university events and enjoys speaking to students about different career paths in acoustics. She believes that not all acoustic consultants need to fit in a certain mould, and that speaking to students and others early in their career can show them how to use their unique skills to further their interests and goals.

Taylor has an interest in psychoacoustics and understanding how people perceive and experience sound. More recently she has been furthering her knowledge of soundscapes and auralisation and is working to develop these capabilities within her team.

The ECG is open to all members of the Institute (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>

IOA Events for 2023/24

Organised by the Underwater Acoustics Group

5th International Conference on Synthetic

Aperture in Sonar and Radar

6-8 September 2023

Villa Marigola, Italy

<https://www.ioa.org.uk/civicrm/event/info?reset=1&id=718>

11th International Conference on Auditorium Acoustics

28-30 September 2023

SNFCC, Athens Greece

<https://auditorium2023.org>

Acoustics 2023

Institute of Acoustics Annual Conference, Exhibition and Dinner

16-17 October 2023

The Guildhall, Winchester

<https://www.ioa.org.uk/civicrm/event/info?reset=1&id=750>

Organised by the Electroacoustic Group

REPRODUCED SOUND 2023

Audio accessibility – the ingredients for success

14-16 November 2023

The Bristol Hotel, Bristol

Organised by the Underwater Acoustics Group

ICUA2024

International Conference on Underwater Acoustics

17-20 June 2024

University of Bath

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



AUDITORIUM ACOUSTICS 2023

28-30 September 2023 at the SNFCC, Athens, Greece

Join us in Greece!

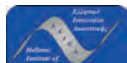
Auditorium Acoustics 2023 is set to take place in September at the Stavros Niarchos Foundation Cultural Center, Athens, Greece. This will be the 11th international conference on auditorium acoustics.

For further details please email linda.canty@ioa.org.uk or visit the official website <https://auditorium2023.org/>

We look forward to seeing you there.



SCAN ME



Women in STEM: A Levels to engineering careers

Engineering UK published a report earlier this year which found that 115,000 more girls will need to study A Levels in maths or physics (or both) to equal the number of boys studying engineering and technology degrees when using the current conversion rate from A Level to undergraduate study¹.

By Angela Lamacraft and Fiona Pizzey, IOA Equity, Diversity and Inclusion (EDI) Working Group

The disparity between the number of boys and girls studying engineering and technology is something felt by almost all engineering and technology specialisms², including our own. The result of the Engineering UK conclusion is that the number of girls that are currently studying maths and/or physics will need to triple.

As Dr Claudia Mollidor, Head of Research and Evaluation at EngineeringUK, said: “Given that A Levels in maths and physics are often a prerequisite for [engineering and technology] degrees, we need to do more to make sure these subjects are attractive and accessible to girls at school. Particularly given we know that girls perform as well as boys, or even outperform them, in these subjects.”

Dr Mollidor stresses that attracting girls to science and maths at an early age is crucial so that they are informed when choosing GCSE subjects, which then set them on their path to choosing A Levels and then a degree, if they choose to go to university.

We know from experience that even by Year 2 of primary school, and possibly even earlier, some girls consider interests such as construction toys (e.g. Lego) to be ‘for boys’, indicating that they are less likely to find them appealing (the converse is also true, affecting the number of boys going into training for caring



Above: Construction toys are not just for boys!

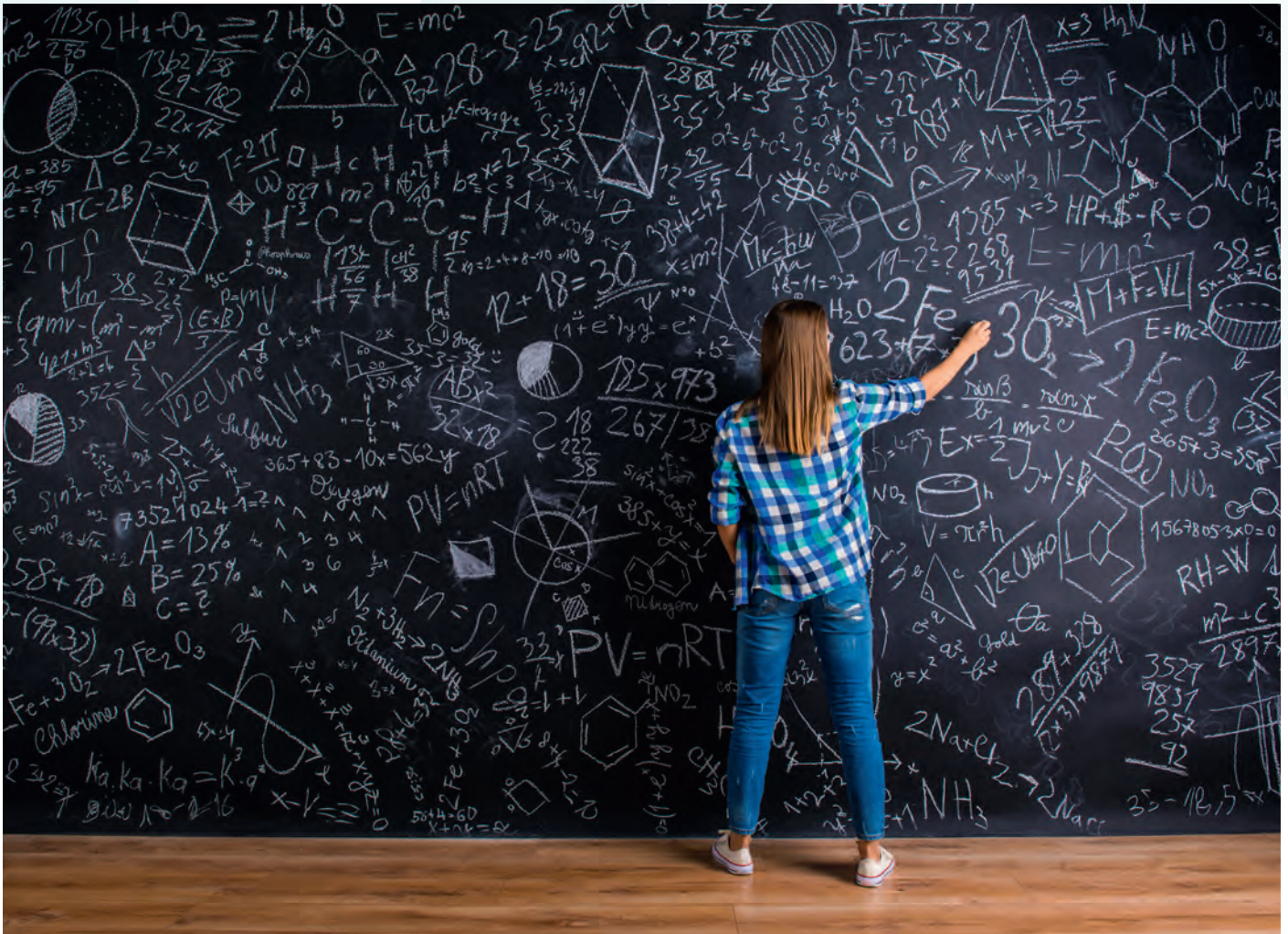
professions³). The concern is that girls then underestimate what they can achieve in these areas, going on to affect the likelihood of them engaging in related subjects at school and then selecting these subjects as their education progresses.

Increase the engineering and technology workforce

While 50% of maths undergraduate students are female, that figure is just 31% for physics undergraduates. As well as encouraging girls to study science and maths, moving away from requiring both physics and maths A Levels for engineering and technology subjects at

university and widening the entry qualifications accepted could help more girls to be accepted onto undergraduate courses.

Across the UK, 16.5% of the engineering workforce was female in 2021 compared with 48% of the overall UK workforce⁴, and there’s no reason to believe this number has improved significantly since then. In order to meet the challenges of the future, such as achieving net zero by 2050, there is an urgent need to increase the engineering and technology workforce, and appealing more to women is one way to do this.



What can you do?

So what can we do as individuals to improve the number of women in engineering? Firstly, encourage young children in your family or among your friends to move away from stereotypes with their toys and in their games, such as buying dolls for boys and encouraging girls to build Lego models, and continue this balance as children get older. Make sure that all children understand how exciting a job in designing and building things can be too!

You can also discuss women you know in engineering roles, and celebrate their achievements so that girls realise women can be successful in engineering. And, going further than that, you can offer to be a mentor for a woman in engineering or science, especially if you are a woman yourself.

(I say this because a lot of men will be excellent mentors, but some people need a mentor who has experienced, and overcome, the same struggles they are facing.)

Of course, attracting women to engineering and technology is one thing, but retaining and developing their talent is another matter: the gender pay gap for engineers is largely due to under representation of women in more senior and higher paid roles⁵. In addition, only 86 women are promoted to manager for every 100 men at the same level⁶.

There are many changes that are required in the workplace too to attract women into engineering and science and retain them once they're there, but summarising those is beyond the scope of this article.

In summary, there are far fewer women than men in engineering, and there is a similar situation for science. There are several things you can do right now to help improve this situation:

- leadership on gender bias and inequity – challenge what you experience;
- capacity development for women and girls at home, in education and in the workplace;
- encourage enabling environments – improve policies, protocols and practise;
- mentorship and networking – provide an environment in which everyone supports and advocates for each other; and
- research and data – ask the right questions and understand the 'why' of under representation. ☺

Above: While 50% of maths undergraduate students are female, that figure is just 31% for physics undergraduates

References

1. From A Levels to Engineering: Exploring the gender gap in higher education (2023). Engineering UK.
2. Diversity and Inclusion Progression Framework Report – Joint report for professional engineering institutions and scientific bodies (2021). Royal Academy of Engineering and the Science Council.
3. The health care workforce in England: Make or break? (2018). The Health Foundation, Nuffield Trust and The King's Fund.
4. Women in engineering: Trends in women in the engineering workforce between 2010 and 2021 (2022). Engineering UK.
5. Closing the engineering gender pay gap (2020). Royal Academy of Engineering.
6. Women in the Workplace 2022. McKinsey & Company.

Work shadowing, a very positive experience



Every July for the past couple of years we have welcomed students to shadow us while we work. This year we were pleased to host three mentees, two at our London office and another in Manchester, and it has been the first year we have been able to do this in-person rather than remotely.

By Reena Mahtani, with collaborations from Mollie Mitchell, Valerie Van den Hende and Jessica Wright (Sandy Brown)



Left:
A-Level student, Ava, shadowing in the Sandy Brown London office

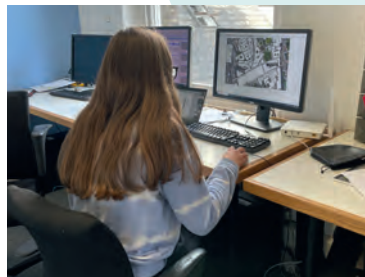
Right:
Illana building a computer model as part of her shadowing experience

In London, we join the Women's Engineering Society's (WES) work shadowing programme every year, where WES will match a 16+ person identifying as female, with an interest in engineering, to a company.

This year we were chosen by two A-Level students, Ava and Illana. In our Manchester office, the shadowing happened as part of an Apprenticeship in Design, Construction and Management where the student, Alisha, is spending time in different companies related to the construction industry.

The students completed three intensive days getting a flavour of what being an acoustic engineer is like. We planned various activities such as an environmental noise survey around our office followed by building a computer model and inputting the survey data to predict façade noise levels, or installing plant noise sources and doing an initial assessment of the predicted noise levels against noise egress criteria.

We also looked at different methods of measuring the reverberation time of a meeting room, and seeing if the on-site measurements tied up with the prediction method. This, along with the environmental noise sessions, provided a chance for the students



to use sound level meters, discuss why these measurements are important, and how we might then use and interpret the data

We ran sessions on the topic of sound insulation, covering performance standards in their legislative context, construction types, and how it is measured, then finished with the students building their own computer models of partitions using Insul and seeing if they correlated with measured data.

IOA-sponsored Springpod work experience

To cover the gaps in between sessions, the students also went through the IOA-sponsored online work experience programme on Springpod. It has sections on the different parts of the work we do, with videos and recorded webinars, providing an excellent resource for this information.

We were impressed by the level of engagement from the students and how quickly they were able to pick up the physical concepts. They could easily relate to what would happen to measurement outcomes when affected by other factors such

as reverberation and background noise levels. The theoretical sessions and videos available on Springpod complemented the practical sessions nicely.

Positive feedback

The feedback from mentees was hugely positive. As there is very little advertisement or exposure to engineering within schools, particularly for female students, the shadowing days provide prospective engineers with an opportunity to experience the workplace and gain a practical understanding before making their university choices.

They greatly appreciated the time taken to show them what working in engineering and being a woman in such a dominated male field is like. Even if none of them end up choosing acoustics as a future career, hopefully they will have gained an appreciation of the construction industry and how our role as a consultant fits into the wider design team, which can also serve to further promote other construction-related engineering careers.

Encouraging women into engineering roles and the construction industry is such an important thing to do. It invites a variety of opinions and different points of view on problems, which can only improve the sector for the better.

We really enjoyed sharing what we do with Ava, Illana and Alisha, and we wish them the best for the future! 🌟

Special mention to Vicky Wills for her invaluable help getting Springpod set up and working for the students – thank you!

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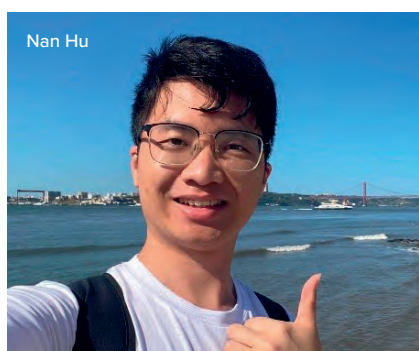


IOA Bursary Fund update: Meet Nan and Vladimiras

The Spring round of the Bursary Fund closed for applications in April 2023 with four applications received before the deadline. Two applications were successful from this round, where both authors asked for financial assistance to attend different conferences in the next few months.

By Reena Mahtani, Chair of the Bursary Fund

In this article meet Nan Hu and Vladimiras Malyskinas.



Nan Hu

Nan Hu

Nan is studying for a PhD in mechanical engineering at the University of Manchester and is attending Inter-Noise 2023 in Japan to present a paper related to his studies. He tells us his reasons for applying for the IOA Bursary Fund and how he found the process:

“I was worried about how to raise funds for conference participation, but noticed on the IOA website that the first round of the IOA Bursary Fund for 2023 was open for applications. As a student member of the IOA, I stated my situation in detail on the application form and I consider myself very fortunate to be granted the bursary.

“This fund is very helpful in achieving my plan of conference participation as it covers part of my travel and accommodation fees. Without the support of the IOA, my participation would probably have been impossible. With the assistance of the IOA Bursary Fund, I can focus my attention on preparing an excellent conference presentation.”

Vladimiras Malyskinas

Vladimiras is studying a BSc in music technology at Coventry University and is attending the Auditorium Acoustics conference in Greece to expand his knowledge of techniques, processes, technologies, and advancements in the field. He tells us how the IOA's help will enable him to complement his learning:

“During my studies, the acoustics module focused on creating music spaces, only briefly glancing over the acoustics of big spaces like auditoriums. So knowing that this was my weak spot, I was looking forward to attending or reading a report about the papers presented during the Auditorium Acoustics conference in Athens. Seeing that there was an opportunity to receive a grant to cover part of my expenses of attending the conference, I had no hesitation about applying for the IOA Bursary Fund.

“The application process was straightforward and manageable. The hardest part was to write a strong motivational letter, which took me a couple of days to perfect. As I had genuine motivation behind my application and I was excited to attend the conference, it was difficult to stick under the 250 word limit with everything I wanted to write about.

“I am very excited to undertake this activity, and I am endlessly thankful to the Institute of Acoustics for allowing me this opportunity. Not only will it deepen my knowledge of the advancements in auditorium acoustics but I also hope to create valuable connections with industry professionals. As a young student, it is a daunting task to get a first break in any industry, so this opportunity lets me take the first steps in a career in acoustics just prior to my graduation.”



Vladimiras Malyskinas

At the Bursary Fund we are extremely happy to hear the programme has been helpful to these two students, and you will be reading more about their experiences once they come back from their respective conferences.

Lastly, two of the applications received were unfortunately refused. Please note that we cannot approve applications where, if employed, the funding is proposed to be used towards training in the same field of acoustics or to attend a conference related to the employer's business. For example, a consultant working on

soundscapes would not get funding to present a soundscapes paper at a conference.

If you or someone you know could benefit from financial assistance from the Institute, please consider applying for the Autumn round of funding, which will open for applications in September. There is more information on the website, and if you have any questions, please feel free to send us an email to

ioa@ioa.org.uk .

Good luck! 🍀



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ICUA 2024 call for papers

The International Conference on Underwater Acoustics will be held 17-20 June 2024, at the University of Bath, Chancellors' Building, Bath BA2 7AY, UK.

In 2022, the IOA organised the successful ICUA conference in Southampton. The many advances in the field of underwater acoustics since then make it appropriate to hold another international conference to discuss the latest research and applications, so the organisers look forward to welcoming friends and colleagues from all over the world to present their latest research.



ICUA2024
International Conference on
Underwater Acoustics
17-20 June 2024

Left:
University of Bath,
Chancellors'
Building,
Bath
BA2 7AY

Conference content

The conference will have a series of oral sessions covering a broad spectrum of international underwater acoustic research, two keynote speakers and the A B Wood Medal Lecture. The conference reception and dinner will take place at the Roman Baths and Pump Room.

Topics for this conference include:

- Acoustic measurement of sediment transport
- Ambient sound measurement and modelling
- Bioacoustics and biosonar
- Bubble acoustics
- Geoacoustic inversion
- Effects of sound on marine life
- Fluctuations and scattering
- Habitat mapping
- Marine renewables
- Machine learning in underwater acoustics

- Measurement and modelling of acoustic particle motion
- Measurement and modelling of air guns and air gun arrays
- Metamaterials
- Noise and vibration from pile driving
- Ocean observatories
- Polar acoustics
- Radiated noise from ships
- Scattering from biota and particles in the water column
- Sea surface acoustic scattering
- Seabed and sediment acoustics
- Sediment and bathymetry imaging and mapping
- Signal processing
- Sonar, vector sensors and transducer technology, testing and calibration
- Sonar performance measurement and modelling
- Standards in underwater acoustics
- Synthetic aperture sonar
- Target scattering
- Tomography

- Underwater communications
- Underwater propagation – 2D and 3D
- Underwater acoustic detection and classification on unexploded ordnance
- Very low frequency acoustics

Abstracts

Prospective authors for both papers and posters are invited to submit a title and a maximum 300 word abstract on the conference website by 31 January 2024.

Authors will be notified by 26 February 2024 and invited to submit a full paper by 29 April 2024.

Completed papers may be up to eight pages long, including diagrams. Papers will be reviewed and will be stored and freely available on the IOA website library.

Authors should submit their abstracts on the conference website

www.icua2024.org

Award to recognise star quality in acoustics



Entries are now open for an award that recognises emerging talent in the acoustics sector. The Rising Star accolade is part of the John Connell Awards 2023, held by the Noise Abatement Society (ANC).

Sponsored by the ANC and ANV Measurement Systems, the submission deadline is 22 September 2023, and the shortlist will be announced one week later.

Finalists will be invited to attend the awards ceremony, taking place on the 25 October 2023, at the Houses of Parliament.

This is the fourth time the ANC and ANV Measurement Systems have supported The John Connell Awards, with previous accolades centred around the promotion of STEM, as well as the inaugural Rising Star Award held last year.


Graham Parry, President of the ANC, said: "The Rising Star Award is for an individual who has made impressive progress or an outstanding contribution within the first five years of their career within acoustics, either within their own team or the acoustics profession generally.

"Entries can be based on factors including the positive impact the individual has made on their organisation and/or the wider industry.

"Activity to enhance equality, diversity and inclusion in acoustics could also be put forward for consideration."

How to enter

Individuals can nominate themselves and entrants should be employed in the acoustics profession, such as consultants, environmental health and protection officers, engineers, technicians, as well as environmental and sustainability professionals.

Entrants should hold some membership of the Institute of Acoustics and should clearly demonstrate why they have been a 'rising star' in the industry. Entries should also include an endorsement from a senior manager within their own organisation. 

To find out more please visit <https://www.association-of-noise-consultants.co.uk/rising-star-award/>

50
YEARS

Conference & Awards 2023

Wednesday 20 September 2023
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Birmingham B1 1HH

This year's conference will celebrate 50 years of the ANC looking at past, present and future:

- **Historic Buildings:** refurbishment in buildings and circular economy, auralisation of spaces that are no longer there, Heritage case study
- **Clean Energy Solutions:** new guidance for onshore wind turbines; modelling battery and solar power schemes
- **Research and the Future:** Defra projects on BS4142 inside Buildings and Research work on A-Weighting

More details and the booking form are available at www.theanc.co.uk/events

ACOUSTIC
AWARDS
2023

Shortlisted Awards entrants present their projects during the conference and the results will be announced at dinner with guest speaker Robin Ince (Radio 4's The Infinite Monkey Cage presenter).

Onshore wind turbine noise: A review of the current guidance framework for the UK Government (Part 1: Introductory project overview)

This article is based on content from the project report *A review of noise guidance for onshore wind turbines*, which presented the results of a research study commissioned by the UK Government Department for Business, Energy & Industrial Strategy (BEIS¹) and was published in February 2023 (<https://www.wsp.com/en-gb/insights/wind-turbine-noise-report>). In this first part, an introductory overview is provided, describing the project background, aims and methodologies employed². (Part 2 will be published in the next issue of Acoustics Bulletin).

By Mike Lotinga, Toby Lewis and Jim Powlson, all WSP, and Bernard Berry, UK-based independent expert

In 2021, the UK Government commissioned a review of the current guidance on assessing onshore wind turbine noise. The intention of the review was to consider whether developments in the industry, technology and understanding indicated that the guidance required updating.

The existing guidance framework, as referenced in the national policies for each of the devolved UK administrations, comprises a report known as 'ETSU-R-97', and a companion Good Practice Guide (GPG), which was developed by the IOA. ETSU-R-97 was published by the Department of Trade and Industry in 1996³. Since the ETSU-R-97 guidance was published, the context of wind energy developments and government policies has changed:

- onshore wind energy generation technology has evolved, with larger, more efficient turbines, new blade designs and noise mitigation measures;
- understanding of the physical and operational conditions that influence wind turbine sound has increased;
- further research has been undertaken to investigate the effects of wind turbine sound exposure on individuals and communities; **P28**

¹ In February 2023, BEIS was split into three government departments <https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about>

² The views expressed in this article do not necessarily represent the views of the UK Government, or the national governments of any of the UK devolved administrations.

³ Energy Technology Support Unit Working Group on Noise from Wind Turbines, 1996. The assessment & rating of noise from wind farms: Final report, ETSU-R-97. Department of Trade and Industry. [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy_Searchable_.pdf]

39th ANNUAL CONFERENCE AND EXHIBITION 2023

REPRODUCED SOUND 2023

Audio accessibility – the ingredients of success

14-16 November 2023, The Bristol Hotel, Princes Street, Bristol

The 39th Reproduced Sound Conference will focus on all aspects of electroacoustics, and will bring together practitioners, educators and students in an atmosphere with a friendly and enthusiastic 'buzz', which is a hallmark of past RS conferences.



To Register

For further details please email linda.canty@ioa.org.uk
Or you can find further information online at www.reproducedsound.co.uk

ORGANISED BY THE ELECTROACOUSTICS GROUP OF THE INSTITUTE OF ACOUSTICS IN COLLABORATION WITH ABTT, AES, APRS & ISCVE



Help requested from members for IOA Education and Training

Members interested in contributing to the IOA's education portfolio in any of the following roles are invited to contact the Education Team at Education@ioa.org.uk as soon as possible

1. Examiners for the specialist modules of the Diploma on Regulation and Assessment of Noise and Environmental Noise: Prediction Measurement and Control.
2. Diploma Project mentors for the next academic year 2023/2024.
3. Education Committee Chairman — with the opportunity to contribute to the next review of IOA Education and Training.

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- amplitude modulation (AM) of the aerodynamic sound from wind turbines has been identified as a sonic characteristic that may contribute to adverse impacts beyond the extent considered in ETSU-R-97;
- National policy frameworks on planning and noise have changed; and
- The UK Government has introduced legislation mandating the target to reduce all greenhouse gas emissions to net zero by 2050 (net zero⁴), which requires increased deployment of onshore wind energy generation capacity⁵.

The IOA GPG was published in 2013⁶, with Supplementary Guidance Notes published in 2014. The GPG addressed many technical aspects of the application of ETSU-R-97 that had been subject to scrutiny and debate

- in the intervening period, but did not cover:
- further guidance on assessing and controlling the impact of AM; or
 - whether the noise limits defined in ETSU-R-97 remain consistent with government policies, and with available scientific evidence.

The 2023-published review of this guidance framework aimed to make a recommendation to the UK Government, in view of current policies on noise and net zero, developments in the industry and the available evidence, on whether the existing guidance should be updated, and, if so, which aspects require updating. This overarching policy objective was supported by several specific research questions, which are detailed in the report. The study scope did not extend to devising new guidance, and the report itself does not represent

any form of replacement for the existing guidance, which (at the time of writing) remains the applicable framework for determining planning applications in the UK.

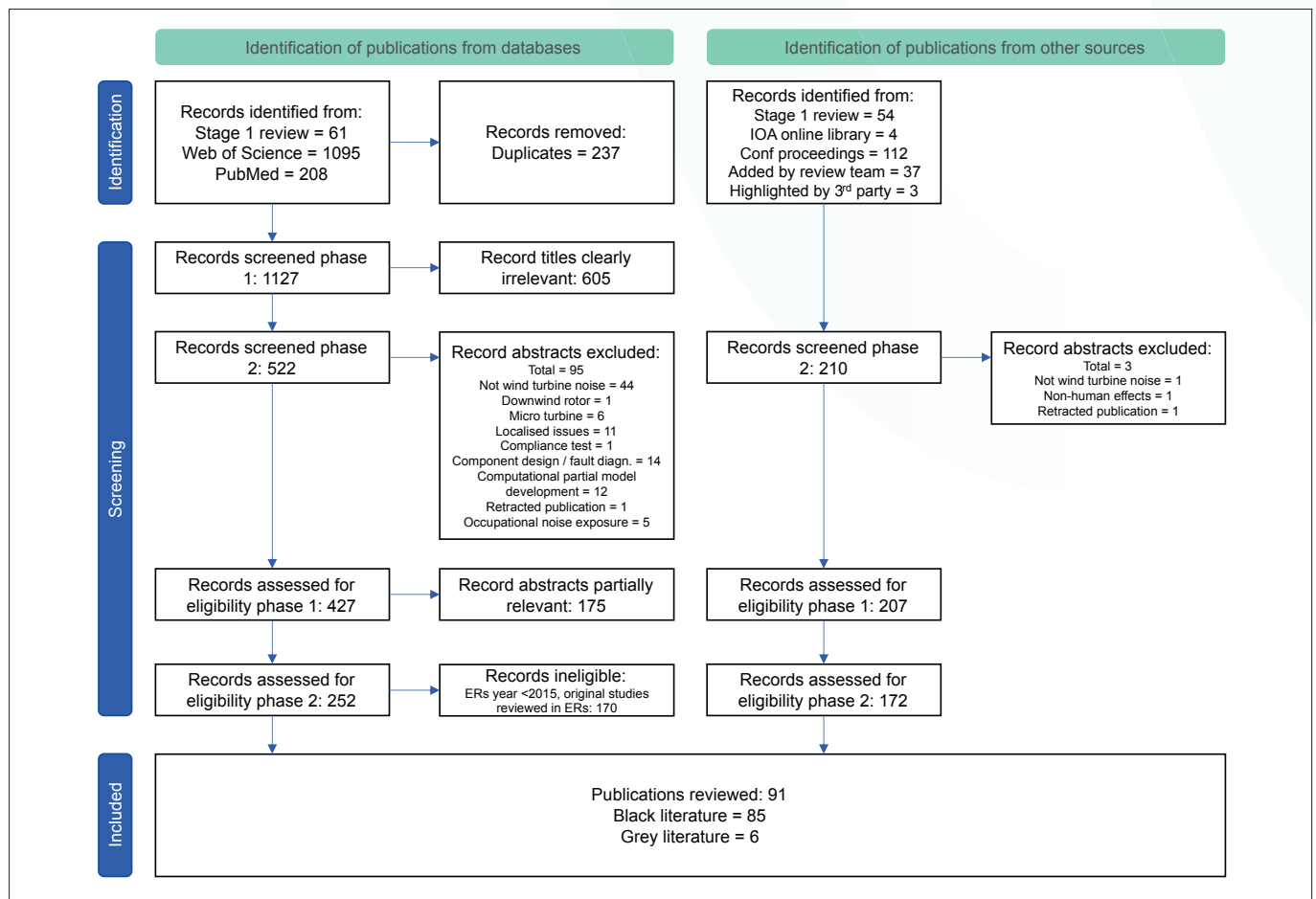
Scope and methodology

The study comprised three workstreams, which are discussed in turn below. The approach taken was developed in discussion with a government steering group, which comprised representatives for BEIS, the Department for Environment, Food and Rural Affairs (Defra), the Department for Levelling Up, Housing & Communities, the Scottish Government Energy Consents Unit, the Welsh Government, and the Northern Ireland Executive.

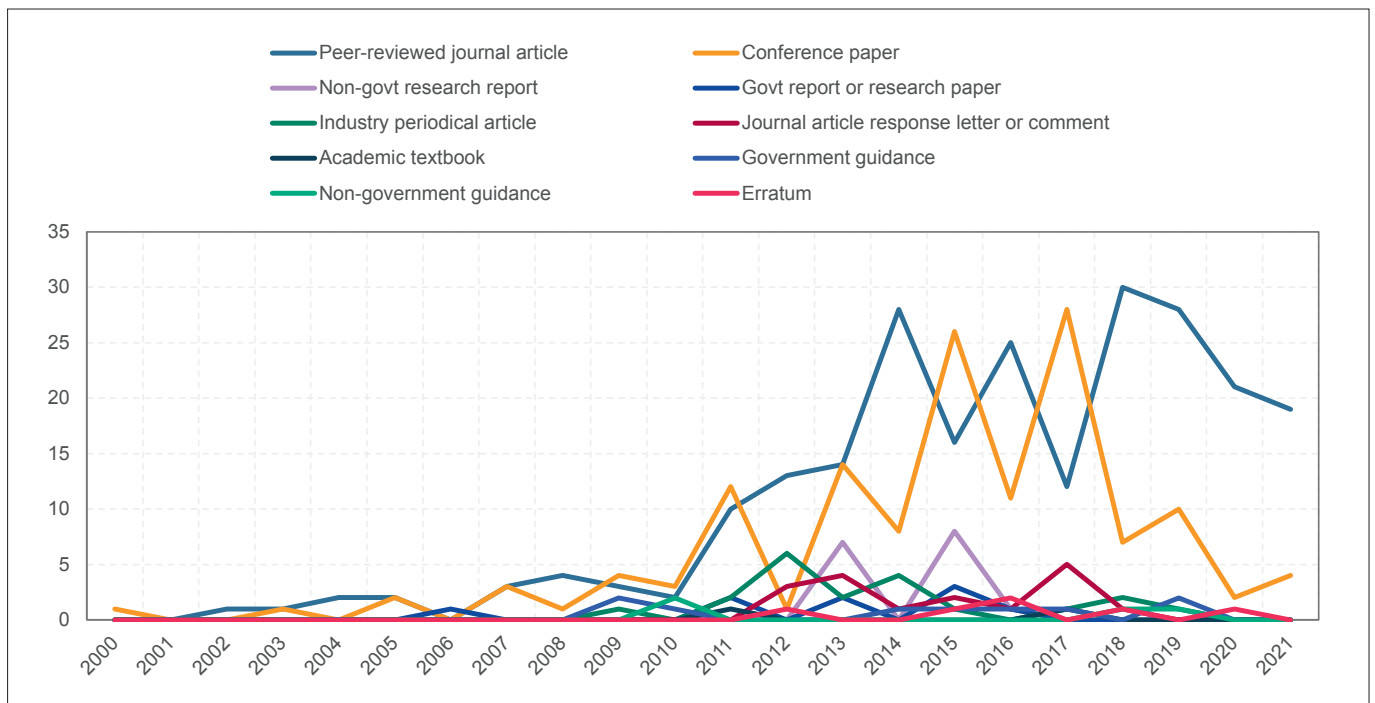
• Evidence review

A review of evidence was undertaken based on Defra/ Natural Environment Research Council (NERC) joint guidance⁷.

Below:
Figure 1: PRISMA flow diagram for the evidence review stage 2



4 The Scottish Government has introduced complementary legislation committing Scotland to achieve Net Zero by 2045.
 5 Achieving the 2050 'Net Zero' target will require increases in renewable electricity generation, which entails an increase in deployment across a range of technologies, including onshore wind. The UK Government's 2020 Energy White Paper: Powering our net zero future stated that sustained growth in the capacity of onshore wind will be needed over the next decade, alongside solar and offshore wind generation capacity. Onshore wind is also recognised as one of the lowest-cost sources of renewable electricity generation in the independent Review of Net Zero report commissioned by the UK Government.
 6 IOA, 2013. A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise. Institute of Acoustics. [<https://www.ioa.org.uk/publications/wind-turbine-noise>]
 7 Collins, A.M., Coughlin, D., Miller, J., Kirk, S. 2015. The production of Quick Scoping Reviews and Rapid Evidence Assessments: A how to guide. Department for Environment, Food & Rural Affairs / Natural Environment Research Council. [<https://www.ioa.org.uk/publications/wind-turbine-noise>]



Above: Figure 2: Research evidence metadata analysis: stratification of highly relevant evidence by publication type

The approach adopted comprised what is known in the guidance as a ‘quick scoping review’ (QSR), which in application arguably turns out to be something of a misnomer. The primary difference between a QSR, and the next two levels in the hierarchy of evidence review (ER) approaches; the ‘rapid evidence assessment’ (REA) and the ‘systematic review’ (SR) is that a QSR omits a systematic appraisal of study quality or bias risk, which is required in REA or SR. However, the search, screening, review, and synthesis elements of the QSR remain rigorous and demanding (and not necessarily ‘quick’). This includes producing a ‘systematic map’, which comprises a detailed database of the evidence identified and evaluated during the review. The overarching aim of a QSR is ‘to provide an informed conclusion on the volume and characteristics of an evidence base and a synthesis of what that evidence indicates in relation to a question’⁷. The selection of a QSR approach was made in view of the project constraints, but the systematic map supports the opportunity to advance the study further to REA or SR stages if subsequently required. In

that event, it would be expected that systematic appraisal of publication quality and risk of bias would be included, and potentially, a detailed meta-analysis of the extracted data.

The review strategy comprised two search, screening, and review stages, which were based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA⁸) framework. The first stage focused on identifying potential issues raised within the literature concerning the current guidance framework. The second stage then focused on the main topics identified from the first stage. The PRISMA flow diagram for the review stage 2 is shown in Figure 1 as an example of the approach.

As noted, a key part of a scoping review is to gain an appreciation of the volume and characteristics of the research base itself. An example of the kind of analysis undertaken is shown in Figure 2, which illustrates identified publication types as volume by publication year. Figure 2 shows that the evidence base has expanded considerably in recent years, with most of the peer-reviewed evidence appearing since 2015. These observations are consistent with the analysis of a

previous scoping review⁹, and are particularly notable because the WHO 2018 Environmental Noise Guidelines for the European Region (ENGER, which addressed wind turbine noise for the first time in a WHO guideline) were based on SRs that considered evidence up to 2015.

Given the considerable volume of evidence now available and in view of the project constraints, it was decided to focus the review on peer-reviewed evidence published from 2015 onwards, alongside the findings of existing ERs (which covered the evidence up to 2015, as well as more recently). Overall, more than 1,500 publications were identified and screened in the execution of both review stages, of which 132 were finally determined as eligible for a full review. Further details of the review methodology and data analysis can be found in the project report.

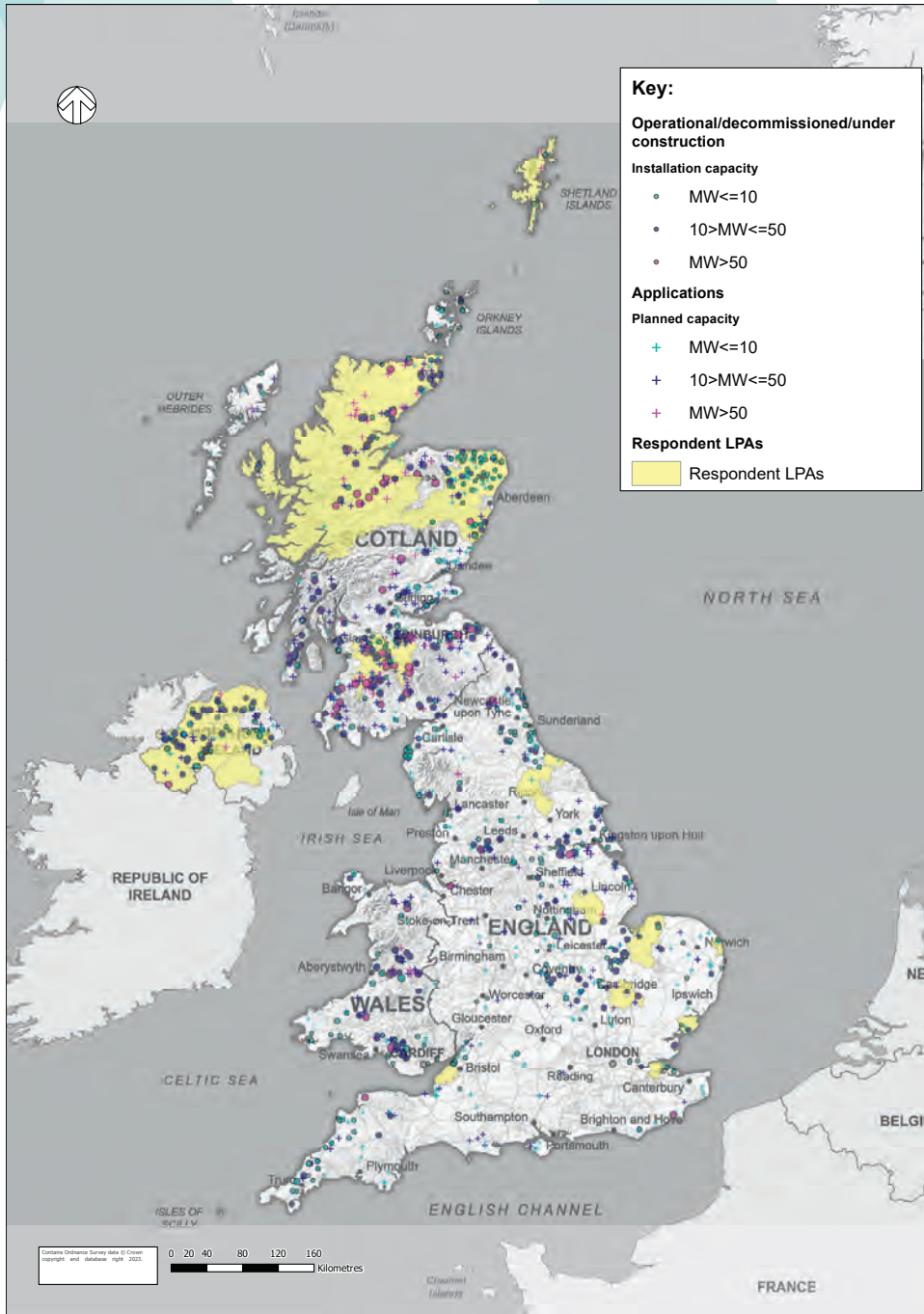
• Stakeholder engagement

The methodology applied to the stakeholder engagement was based on relevant Government Communication Service guidance¹⁰. The engagement comprised two parts: P30

⁸ <http://prisma-statement.org>

⁹ Freiberg, A, Scheffer, C, Girbig, M, Murta, VC & Seidler, A, 2019. Health effects of wind turbines on humans in residential settings: results of a scoping review. *Environmental Research*, 169, 446-463 [<https://www.sciencedirect.com/science/article/abs/pii/S0013935118306145>]

¹⁰ Government Communication Service, 2021. Ensuring effective stakeholder engagement. [<https://gcs.civilservice.gov.uk/publications/ensuring-effective-stakeholder-engagement/>]



Above: Figure 3: Map indicating LPAs responding to the engagement survey, with overlay of onshore wind energy developments (development symbol sizing is scaled to the logarithm of turbine quantity, as an indicator of turbine density)

- (1) an online/email survey questionnaire sent to all invited stakeholders; and
 - (2) telephone interviews with key stakeholders.
- Identification of stakeholders was determined by discussion with the project steering group. Local planning authority (LPA) stakeholders were identified

from the *Renewable Energy Planning Database: quarterly extract* (March 2021, published 28 April 2021¹¹) as comprising any authority that had recorded an onshore wind energy planning application. During the initial contact phase, the environmental health and development planning departments of LPA stakeholders

were specifically targeted, with the aim of ensuring that the most appropriate council officers were made aware of the exercise.

In total, 231 stakeholder organisations were invited to participate, 88% of which were LPAs. Of the invited non-LPA organisations (ie, government bodies, industry professional associations and a civic group), 44% responded to the invitation, while 10% of invited LPAs responded. This resulted in 32 completed survey questionnaires and telephone interviews with seven stakeholder organisations.

A lower response rate for LPAs compared with non-LPAs was expected, since the inclusion of LPAs was determined based on any record of an onshore wind energy application recorded in the planning database, irrespective of application date, volume of applications, development scale etc. This meant that some of the LPAs were invited based on very small, very old, or very few development applications, and the officers may therefore have had relatively limited experience with onshore wind energy developments, with correspondingly lower motivation to respond. This possibility is also supported by a geographical analysis of the responding LPAs as illustrated in Figure 3, which indicates that LPAs responding from Scotland and Northern Ireland tended to be those with a greater density of wind energy development applications. Nonetheless, the LPA response rate is acknowledged in the report as a potential limitation of the engagement, in particular noting that none of the invited LPAs from Wales responded (to the initial invitation or to the follow-up communications), despite a substantial wind energy capacity present and planned in Wales. Another aspect of note in relation to LPA participation is the fact that council resource health and planning may be currently facing greater constraints¹², which could

11 <https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract#history>

12 Fahy, K, Alexiou, A, Mason, K, Bennett, D, Egan, M, Taylor-Robinson, D & Barr, B, 2023. Inequalities in local government spending on cultural, environmental and planning services: a time-trend analysis in England, Scotland, and Wales. *BMC Public Health*, 23, 408. [<https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-15179-9>]






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reduce the capacity of officers to engage with this type of exercise.

The engagement survey questionnaire included open and closed questions intended to gather views on the current guidance and the need for any updates, as well as information about wind turbine technology, wind farm design, and how these may influence sound or noise, including any changes occurring since ETSU-R-97 was published.

The survey responses were analysed both quantitatively and qualitatively. The use of a thematic analysis approach¹³ enabled quantitative analysis to be applied to the qualitative data, to identify and highlight common themes raised by stakeholders. The qualitative data were then used to illustrate the themes identified by the thematic analysis.

• Field measurements

A field measurement exercise was undertaken around a sample of wind farm sites, with the objective of obtaining a snapshot of measurements of wind turbine sound under conditions thought most likely to result in clearly detectable AM, at distances representative of receptor locations.

Measurements were made at seven wind farm sites during the night-time, with surveyor attendance. Measurement positions at each site were selected at receptor ranges, according to public accessibility as well as the wind directions during site visits, which were monitored with the intention of targeting downwind conditions. The assumption underlying the strategy was that, at receptor ranges, AM would be more likely to be detected at night, during downwind conditions in simple, flat terrain, with wind speeds marginally in excess of the turbine 'cut-in' speeds. The reasoning underpinning this approach was that, under these conditions, background sound (in rural areas) would be likely to be at a minimum, while wind shear (thought to be an important influencing factor for AM magnitude)

would be expected to be greater than under other conditions, such as during the daytime, or in complex terrain.

The measurements were analysed to quantify AM using the Reference Method developed by the IOA¹⁴. Sound recordings and modulation spectrograms were analysed to verify the AM detection results from the AM metric.

In line with the project scope, the field measurements were limited in terms of duration, geographic coverage, and land variability, and as such the measurements were not intended to be more widely generalisable. Nonetheless (as detailed in the project report), it was found that the data exhibited some consistencies with the results of other longer-term measurement campaigns identified in the literature evidence, and provided some useful indicative information on AM in wind turbine field measurements.


Summary and preview

The three separate workstreams of the study were designed to be efficient and work in synergy to achieve the aims of the project, within the study scope and budget, and to provide a set of conclusive answers to the research questions. This was achieved by designing an approach that balanced methodological rigour

with realisability within the project scope.

The application of this methodology enabled a triangulation approach to developing the study conclusions, which considered where the findings from each workstream were consistent with those of the other study components.

The outcome of the study has included the recommendation that the current guidance should be updated to address a range of aspects identified during the project.

Part two of this series of articles will cover the study conclusions and recommendations, alongside some of the supporting evidence and considerations. 

About the authors:

Mike Lotinga MIOA

Mike joined the acoustics team at WSP (then WSP | Parsons Brinckerhoff) in 2015, and has worked in acoustics, noise and vibration engineering for more than 15 years. He has written and presented several papers on the human response to wind turbine noise and other acoustics topics at international scientific conferences. His research outputs can be viewed at: <https://www.researchgate.net/profile/Michael-Lotinga>

Toby Lewis FIOA

Toby joined WSP in 2015 and has worked in acoustics, in the public and private sectors, for more than 30 years. His published work includes papers on the regulation of wind turbine noise and the dynamics between planning and nuisance.

Jim Powlson MIOA

Jim has worked with WSP's acoustics team for 20 years, and has advised in consultant and expert witness capacities on numerous onshore wind farm developments in the UK and internationally, for developers, government, and local authorities.

Bernard Berry HonFIOA

Bernard has had a career spanning more than 50 years, being involved in many aspects of acoustics. Most recently, he has specialised in research and consultancy on the effects of noise on human health. He has published more than 150 papers, reports and book chapters. He assisted the WHO in the production of the 2018 Environmental Noise Guidelines, as a member of their External Review Group.

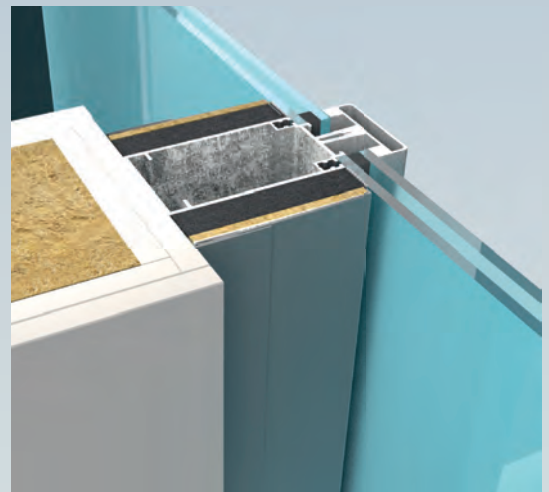
13 Kiger, ME & Varpio, L, 2020. Thematic analysis of qualitative data: AMEE Guide No. 131. Medical Teacher, 42 (8), 846-854. [\[https://www.tandfonline.com/doi/full/10.1080/0142159X.2020.1755030\]](https://www.tandfonline.com/doi/full/10.1080/0142159X.2020.1755030)

14 IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group, 2016. Final report: A method for rating amplitude modulation in wind turbine noise. [\[https://www.ioa.org.uk/sites/default/files/AMWG%20Final%20Report-09-08-2016_0.pdf\]](https://www.ioa.org.uk/sites/default/files/AMWG%20Final%20Report-09-08-2016_0.pdf)

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Current parliamentary and policy news

The IOA Parliamentary Liaison Group (PLG) is continuing to work to raise the profile of the importance of acousticians with politicians and policy makers.

Following a spring and summer of advocating the importance of noise to health, wellbeing and sustainable soundscapes, the publication of the House of Lords report covering noise and a draft strategy for noise and soundscape in Wales see aspects of noise being recognised by politicians.

There is still plenty to keep the Parliamentary Liaison Group busy with a continuous flow of consultations covering issues including transport, health and environmental assessment.

House of Lords support formation of a noise advisory group



The House of Lords Science and Technology Committee report *The neglected pollutants: the effects of artificial light and noise on human health*, was compiled following the gathering of evidence from acoustic specialists including members of IOA, ANC and CIEH. The report supports the view advocated by IOA that the Government should establish an expert advisory group on noise pollution (as exists for air pollution) to assess new evidence for health

effects and advise the Government. It notes that while the Defra 25 Year Environment Plan briefly mentions noise, there are currently no specific targets and little impetus from central government to address noise. The need identified by the Lords for more expert advice follows on from the evidence presented that noise pollution can cause annoyance and increase the risk of stroke and heart disease (see UK Health Security Agency study below). Significant gaps in knowledge on the effects of noise pollution were identified, and the report recommends that research to fill these gaps should include larger scale studies on impacts, the subjective experience of noise — particularly in indoor environments, and the efficacy of interventions to reduce noise pollution on health.

Read the full report here <https://tinyurl.com/neglected-pollutants>

England: Road and railway planning policy

The IOA responded to the consultation on strategic road and rail networks in England, which is set to update the original National Networks National Policy Statement (NNNPS) of 2014. This new draft includes a section on noise and vibration, acknowledging the impacts that excessive noise can have on quality of life and health, enjoyment of quiet places and areas of high landscape quality. Our response welcomes the retention of the bulk of the text within this section of the policy statement, given practitioners are familiar with applying the policies as set out, and overall, feel that the desired objectives are achieved. Comments are made on proposed changes within this section, and the IOA identified where current text could be improved in the light of experience in implementing the current NNNPS.

Read the IOA's response here <https://tinyurl.com/road-and-railway>

England: IOA comment on Environmental Outcomes Reports

For England, the Levelling Up and Regeneration Bill is set to bring in a new system of environmental assessment for development projects. Environmental Outcomes Reports (EORs) are set to replace the current EU-derived Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) processes. Under the proposed new scheme, instead of assessing likely significant effects of a development, projects will have to report against the achievement of specified 'outcomes'. The outcomes to be measured will be specified in secondary legislation. In responding to the consultation, the IOA recommended the form that outcomes for noise should take. We advise that given the impact and effects of noise are complex, using simple numerical noise exposure indicators will not achieve the desired outcome. An alternative would be to use a simple summary of the numbers of people still adversely affected by noise after, as policy requires, reasonable steps have been taken to mitigate and minimise those adverse effects.

Read the full response here <https://tinyurl.com/environmental-outcomes>

England: Transport noise and health study

Research by the UK Health Security Agency (UKHSA) is the first detailed assessment of the health impact of transport noise in every English local authority. The new work builds on evidence that living with higher noise levels from transport sources can lead to stress and sleep disturbance, with an increased risk of developing more serious health problems like heart disease or diabetes. The study found that 40% of all adults [P36](#)

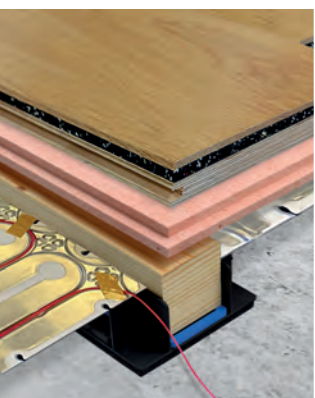


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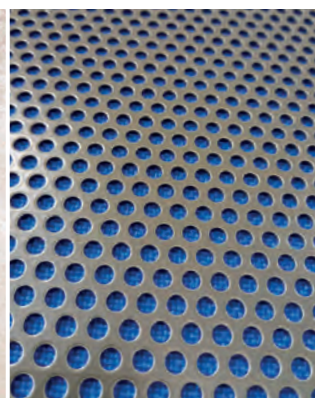
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in England were exposed to long-term averaged road traffic noise levels exceeding 50 dB. The impact on health is measured in Disability Adjusted Life Years (DALYs) – with one DALY representing the loss of one year of good health. The study reports that in 2018,

- around 100,000 DALYs were lost in England due to road traffic noise;
- a further 13,000 were lost from railway noise; and
- 17,000 from aircraft noise.

Most of these losses were due to chronic annoyance and sleep disturbance, followed by stroke, ischemic heart disease and diabetes. The study reinforces the need to consider the health impacts of noise in the decision-making for new transport infrastructure and urban planning.

<https://tinyurl.com/transport-noise-and-health>

London Housing Design Standard includes noise



As part of London Plan Guidance, the mayor’s office published a new Housing Design Standard for London, which acknowledges the importance of protecting residents from noise. The guidance states that attention should be given to the layout of homes, as well as soundproofing. It specifies high levels of soundproofing between rooms, as well as between dwellings, to provide privacy and allow different activities (including work and study) to take place simultaneously throughout the home, and that party walls should achieve sound-insulation values that are at least 5dB above Approved Document E.

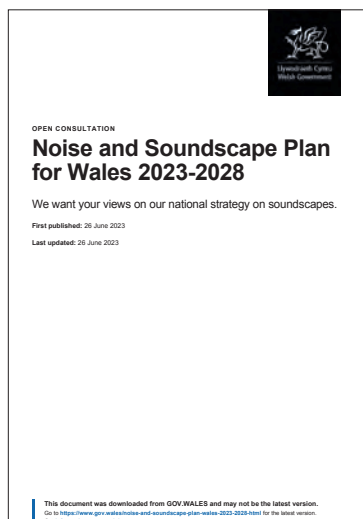
Read the full guidance here <https://tinyurl.com/London-housing-design>

Scotland: Consultation on permitted development for heat pumps

In June the Scottish Government published details of the third phase of proposals to review permitted development rights (PDR). The consultation included renewable technologies with potential to cause noise. For domestic air source heat pumps, currently only one is permitted per building, which could prevent installation where a building contains multiple dwellings. The consultation considers permitting one installation per dwelling and how this could be managed. For free-standing wind turbines, a more flexible approach to height and separation distance is considered. Solar panels, building-mounted wind turbines and shooting ranges are also included in the consultation, which closed on 23 August 2023.

Read the consultation here <https://tinyurl.com/heat-pumps-Scotland>

Wales: soundscape strategy consultation



The Welsh Government are consulting on their draft Noise and Soundscape plan for Wales 2023-2028. Building on the current Noise and Soundscape Action Plan 2018-2023, it considers the effects of noise on people and effects of sound on wildlife, pets and farmed animals (underwater noise is excluded). The strategy is intended to support wellbeing goals set out in the Programme for Government 2021-2026. In launching the consultation, Julie James MS, Minister for Climate Change, stated that the Welsh Government recognises both the positive and the negative impacts that the sound environment can have on people’s health and wellbeing.

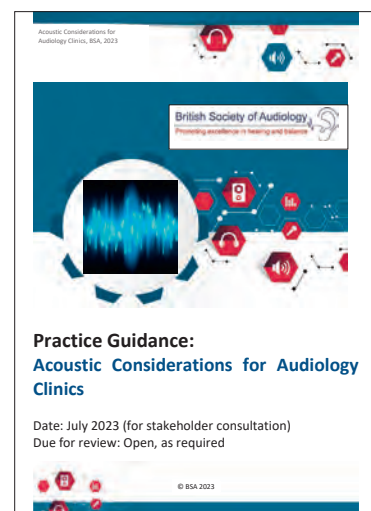
Wales is the first UK nation to include soundscapes in national policy and primary legislation. The consultation is open until 2 October 2023.

Read the Noise and Soundscape plan for Wales 2023-2028 here <https://tinyurl.com/Wales-soundscape>

Wales: 20mph for quieter streets

The Welsh Government is switching most streets with a 30mph speed limit to 20mph on 17 September 2023. In announcing the move, First Minister, Mark Drakeford, said that streets will be quieter, reducing the scourge of noise pollution, and slower speeds also boosts the confidence of people to cycle and walk around their local areas and for children to play outdoors. Dr Sarah Jones, Consultant in Environmental Public Health for Public Health Wales, added that there is clear evidence that reducing traffic speeds has multiple health and wellbeing benefits.

Consultation on acoustics in audiology clinics



The British Society for Audiology (BSA) is consulting on practice guidance for acoustic considerations in audiology clinics. BSA acknowledges that acoustic considerations apply to all types of measurement conducted in audiology clinics and recognises that some elements of acoustics may appear technical to practicing clinicians. The guidance covers acoustic principles, ambient noise, sound level meters, sound field audiometry, noise exposure and maximum stimulus levels and is open until 24 September 2023. **P38**



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Read the consultation here <https://tinyurl.com/audiology-clinics>

IOA comment on BREEAM revision

BREEAM is an established sustainability standard for buildings and BRE recently consulted on updating their guidance document. This draft version seven aims to update energy, science and BREEAM criteria, stating ‘Net zero carbon building definitions emphasise the importance of minimising energy use and carbon emissions as a primary requirement. BREEAM has a role to play in influencing the decisions made at the building level to encourage endeavours to reduce a building’s carbon emissions, and support the achievement of net zero carbon (NZC) goals.’ In responding to the consultation, the IOA highlighted areas where acoustic issues need to be better considered to avoid impacts of noise on health and wellbeing.

Read the guidance document here <https://www.ioa.org.uk/publications/response-consultations>

Policy brief on impact of WHO environmental noise guidelines



The World Health Organization and European Environment Agency have examined the uptake and impact of the WHO environmental noise guidelines for the European Region. Drawing on the experiences of member states the report finds that the guidelines have been well accepted by policymakers, promoting a unified approach to

estimate the health effects and disease burden associated with environmental noise. The brief highlights the strengths of the guidelines and identifies several challenges to implementation and possible solutions.

Read the full report here <https://tinyurl.com/who-solutions>

Expanding permitted development in England

The Department for Levelling up and Communities and Defra are consulting on proposals to expand permitted development for change of use to dwellings in England – including increasing volumes for shops, offices etc, expanding the right to some protected areas and allowing conversion of agricultural buildings for homes and specified business use.

The consultation closes 25 September 2023 <https://tinyurl.com/5ahk4t6z>

About the author:

Mary Stevens supports the IOA to bring acoustics to the attention of policy-makers.



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Extreme acoustics in the shooting range

Imagine this scene in a Hollywood action movie: Two police officers are chasing the bad guy in an industrial area surrounded by high concrete walls. A wild gunfight ensues for several minutes. In the end, the police capture the bad guy and all walk off unhurt.

By Gregor Schmidle, Product Manager, NTi Audio AG, Liechtenstein

Above:
Modern indoor-shooting range with eight lanes at 25m

What's wrong with this scene? In reality, if it had happened that way, all those involved would be temporarily deaf and might even have suffered permanent hearing damage.

As a manufacturer of sound level meters, we asked ourselves how loud gunfire really is and, to find out, we got in touch with the owner of a local indoor shooting range in Schaan, Liechtenstein. In addition to recreational use and competitions, security personnel often use the facility for professional training sessions.

This particular high-tech shooting range is located in the centre of an industrial area surrounded by several businesses, warehouses and manufacturing sites. The excellent sound insulation and

the powerful air ventilation as well as state-of-the-art technical equipment are all considered important features of this popular facility. An electronic target system allows for dynamic training sessions on stationary and moving targets.

We had exclusive access to the facility not only to measure the noise from various firearms, but also to assess the room acoustics. A low reverberation time is generally desired for shooting ranges.

Measuring the reverberation time

What is the ideal reverberation time in an indoor shooting range? The noise level is high even before the shooting starts, as the powerful air ventilation contributes significantly to the background noise.

We therefore evaluated the reverberation time with and without active air ventilation. Those measurements were performed with a dodecahedron, omni-directional loudspeaker. For this, the sound source was placed in the centre of the room, between the shooter's position and the target in order to get the full noise distribution throughout the room.

The background noise of the room without active air ventilation is 54.1 dBA. This was measured with a sound level meter at a distance of four metres from the omni-directional loudspeaker. The dodecahedron used provides 121 dB ref 1pW of sound energy and the sound level meter utilised a half-inch, low sensitivity (8mV/Pa) phantom powered microphone.

We also wanted to find out whether the laminar airflow of the ventilation system has a significant influence on any of the acoustic parameters. Therefore, we performed all our measurements with and without the active air ventilation system. [P42](#)

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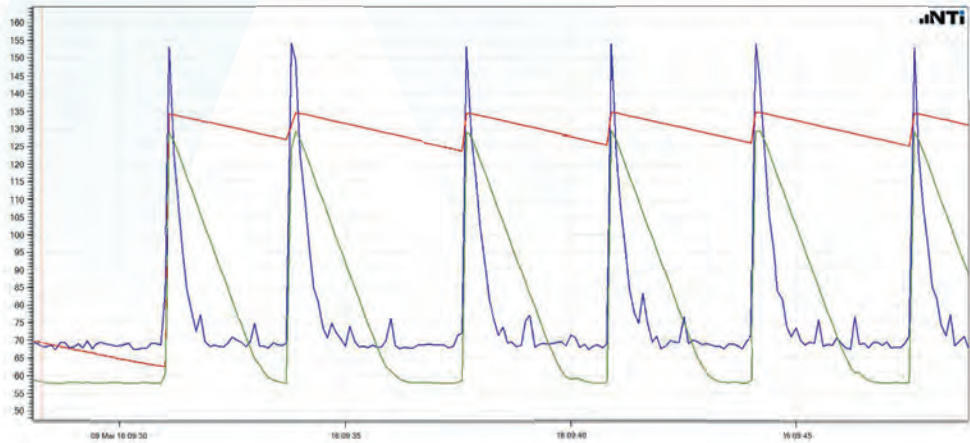
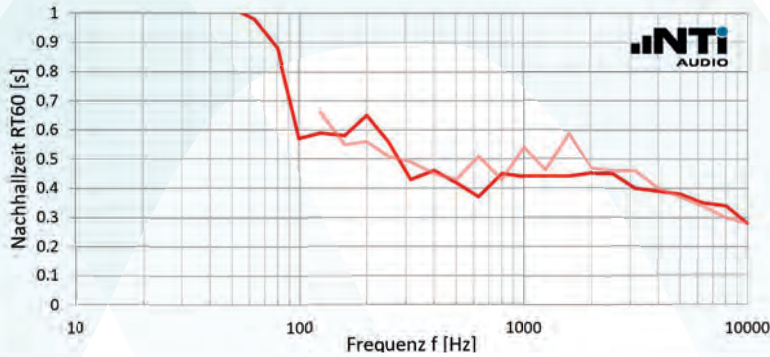
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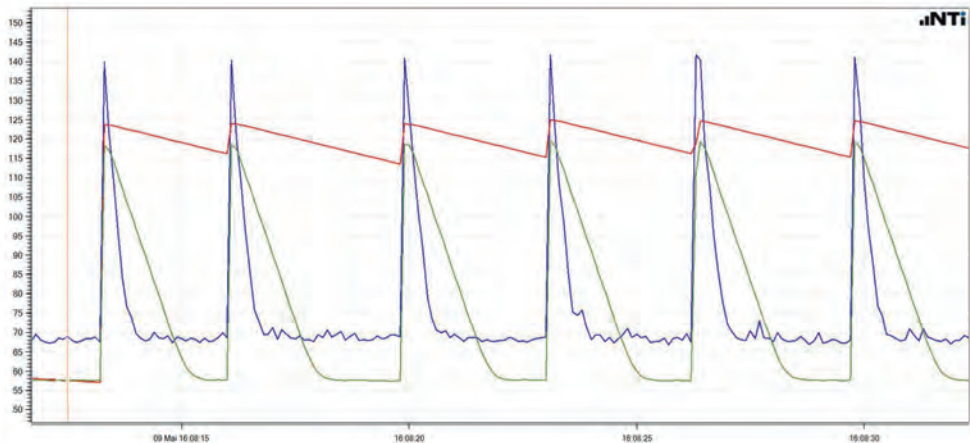
Jack Richardson, Hilson Moran Partnership Ltd

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Right:
Measurements of reverberation time with and without air ventilation



Above:
A series of six shots with LCpkMax (blue) LCIMax (red) and LAFMax (green) at a 2.5m distance



Above:
The same series of six shots at a distance of 8.5m

Measuring the reverberation time with no air ventilation (red curve) was plain sailing. After turning on the air ventilation (pink curve), the reverberation time at low frequencies seems to be lower. However, this is most likely caused by an increased measurement uncertainty, since the laminar airflow significantly increased the low frequency background noise.

How loud is shooting noise?

During initial orientation measurements, we found that a microphone positioned next to

the shooter, even a low sensitivity microphone, caused a significant over-range condition on the sound level meter. Therefore, we chose a position at a 30° angle and 2.5m distance from the shooter. This was the closest microphone position that did not lead to an over-range peak level of 154.1 dBC or higher.

When projecting that number to a distance of 0.7m (ear to pistol), the peak level at the ear reaches 165.2 dBC. At this level, the unprotected ear would most likely be permanently damaged by a blast trauma.

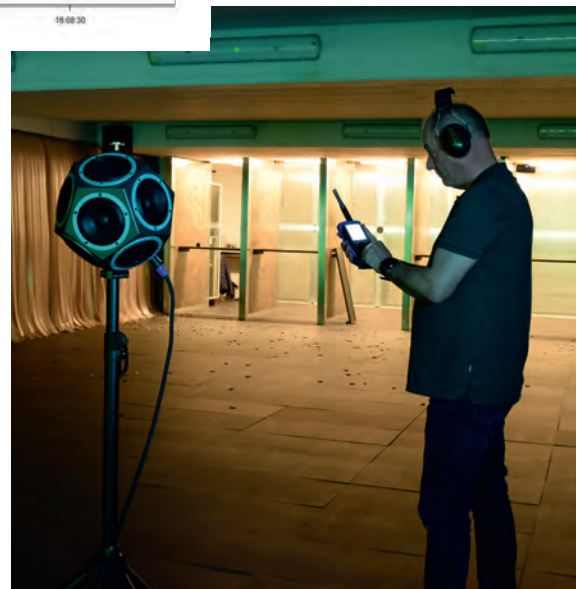
The same series of shots was measured simultaneously with a second device at a distance of 8.5m. At this position, the peak level LCpkMax still reached 143.8 dB.

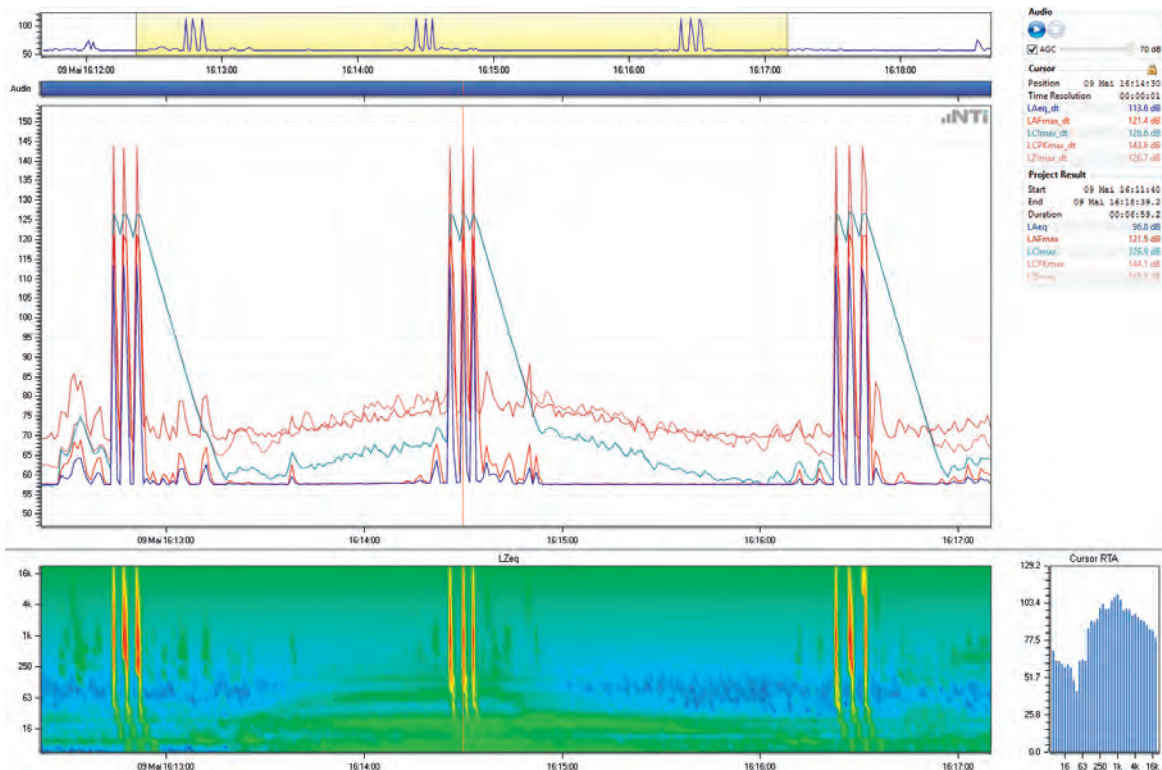
We knew that for a standard-compliant measurement of very short-term impulses, one should ideally measure with higher sampling rates of 192kHz as specified in the US MIL-STD 1474E standard, which specifies the maximum permissible noise levels produced by military systems and the test requirements for measuring these levels. In this measurement application the existing sampling rate of 48kHz for the sound level meter used allowed for a sufficient measurement and repeatable accuracy due to the spectral energy distribution of our measured shots. If the sampling of the meter was not sufficient, we would have seen large variations of the LCpkMax. We could then only conclude that the actual value was at least as high as our highest measurement with the sound level meter.

When projecting these measurement results to our initial action movie scene, it becomes highly likely that all participants would suffer from hearing damage after the first shot, no matter who fired first.

We also investigated whether the peak level changes with active air ventilation. The graph below shows that the background noise between the shots did indeed rise. The peak level however was not affected.

Below:
Dodecahedron loudspeaker in the shooting range





Left: Shooting sequence without / with / without air ventilation

Trained shooters know that hearing protection at a shooting range is mandatory. The attenuation of good hearing protection reaches 35-40 dB at mid and high frequencies, whereas lower frequencies below 500 Hz are only attenuated by 15-20 dB.

The main energy of a shot exists at frequencies above 1 kHz. Assuming a realistic attenuation of 35 dB, the peak level at the shooter's ears will still reach 130 dBC. For extra sensitive people or those who shoot frequently, it is recommended to combine the hearing protection with an extra earplug or earmold.

A public restaurant is located in the space next to the shooting range. Therefore, it was interesting to investigate the sound insulation of the shooting noise.

Based on the short-term Leq, the door to the foyer attenuates the sound by 44 dB, and in

the restaurant area, the noise is attenuated by 80 dB. At an attenuated level of 65 dB, the shots are barely audible when the air-conditioning and background music are off. The sound insulation measures are therefore highly effective.

Perfect ambience

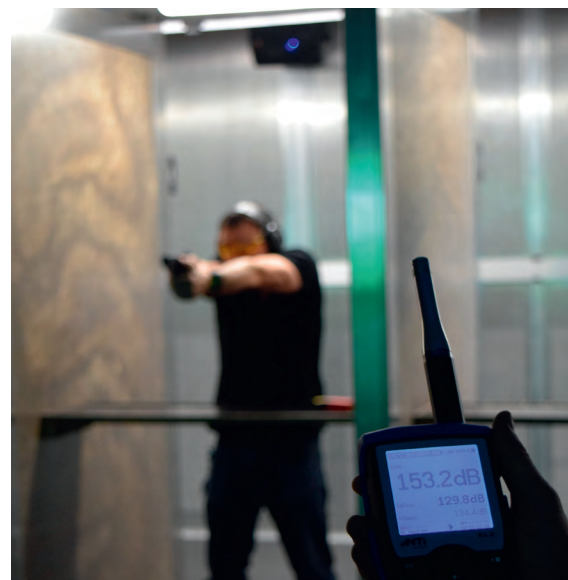
The measured reverberation time and sound insulation values confirmed the subjective look and feel of the shooting range. The acoustic conditions were as pleasant and functional in the reception area as they were throughout the rest of the range. Generally, there are no reference values for shooting ranges.

The director of the shooting range and the person responsible for safety said: "We took great care of the acoustics in the planning phase. The interior and materials were selected to get not only perfect

functional conditions, but also to provide a comfortable ambience for our shooters.

"It is my top priority that our customers get the best possible and individually arranged training at our facilities and that is only possible when everyone feels safe and comfortable." ☺

Below: Sound level measurements at a distance of 2.5m



Below: Shot noise measured at shooting range (left), foyer (centre) and restaurant (right)

Cursor	Cursor	Cursor
Position 09 Mai 16:15:46.2	Position 09 Mai 16:24:29.6	Position 09 Mai 16:25:21.6
Time Resolution 00:00:00.1	Time Resolution 00:00:00.1	Time Resolution 00:00:00.1
L _{Aeq} _dt 129.5 dB	L _{Aeq} _dt 85.3 dB	L _{Aeq} _dt 48.9 dB
L _{Afmax} _dt 127.7 dB	L _{Afmax} _dt 82.9 dB	L _{Afmax} _dt 47.8 dB
L _{Cimax} _dt 133.1 dB	L _{Cimax} _dt 86.2 dB	L _{Cimax} _dt 55.8 dB
L _{CPKmax} _dt 152.2 dB	L _{CPKmax} _dt 96.8 dB	L _{CPKmax} _dt 64.3 dB
L _{ZPKmax} _dt 152.5 dB	L _{ZPKmax} _dt 96.5 dB	L _{ZPKmax} _dt 67.9 dB

Physical phenomena of silica aerogels for vibro-acoustic applications

Mitigating noise emissions and transmission, combined with thermal insulation creates holistic and sustainable design for the construction of indoor and outdoor environments.

By Dr Hasina Begum, Research Fellow at the National Polymer Processing Centre, University of Warwick.

But there is a global need to reduce the energy consumption in Europe and 40% comes from the construction sector alone. Thermal insulation products often require good sound absorption and insulation properties to control noise, so noise control engineering is incredibly important to the quality of life in one's psychological and physical wellbeing and some applications are heavily regulated by standards and legislation.

Levels of acoustic noise are usually controlled by sound absorptive materials. The effectiveness of a sound absorber is measured by the sound absorption coefficient, which is the ratio of sound energy absorbed by the material surface to the sound energy incident upon the surface.

Porous materials are the most common class of acoustic absorbers used in noise control applications because they are lightweight, energy efficient alternatives to the heavy sound barriers and resonant absorbers.

The most common types of absorbers are

- mineral wool;
- fibreglass;
- foams, and
- non-wovens.

The acoustical properties of these materials have been studied extensively. A relatively new product on the acoustic absorption market is silica aerogels. Aerogels combine an outstanding thermal

insulation with high acoustic absorption across a broad frequency range. Silica aerogels are already commercially available and are produced in many different forms, e.g., powder/granulates, aerogel impregnated blankets, coatings and as hybrid spray-foam systems. Industries prefer not to use aerogels in their neat (monolithic) form because these are too brittle and have poor mechanical strength due to their complex dependence on bulk or envelope density.

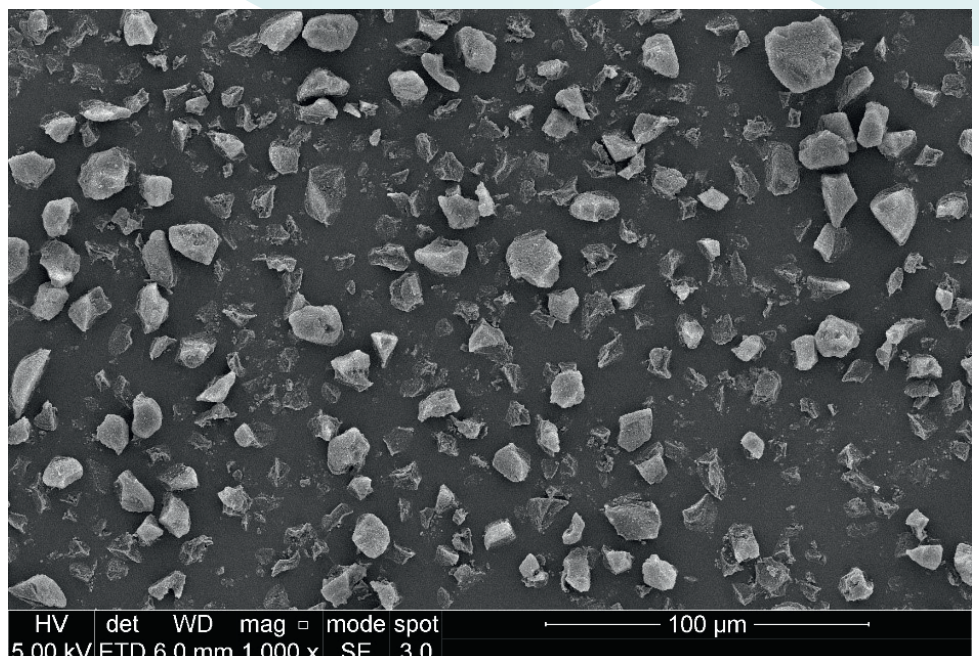
Researching the acoustical properties of silica aerogels

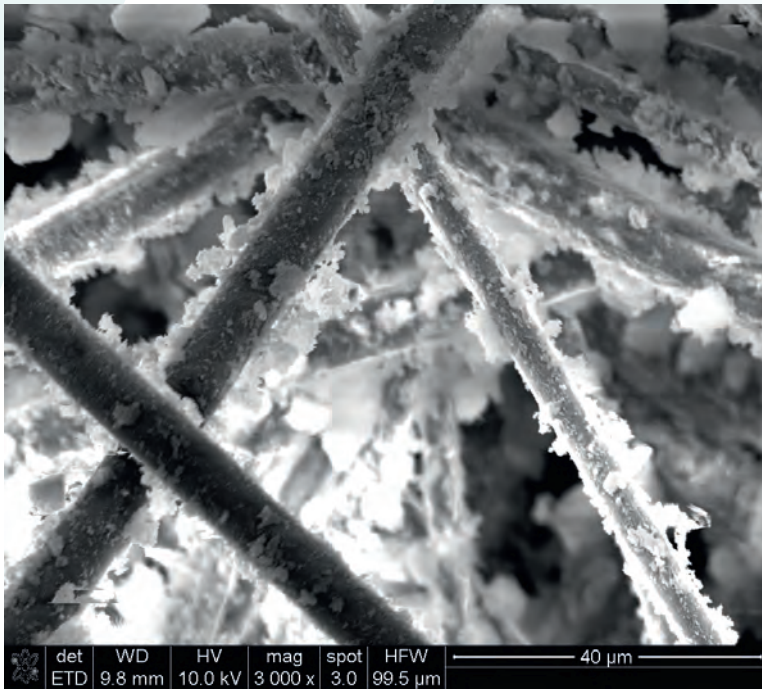
Although the thermal properties of silica aerogels are relatively well understood, the acoustical

properties of these materials have not been studied extensively. In response to this; a team of researchers at the University of Sheffield was assembled and led by the author of this article and Professor Kirill Horoshenkov. The team included Dr Wim Malfait, Dr Shanyu Zhao and Dr Matthias Koebel at Empa Swiss Federal Laboratories, Dr Yutong Xue and Professor Stuart Bolton at Purdue University (USA), Dr Paolo Bonfiglio at Materiacustica and Dr Rodolfo Venegas at Universidad Austral de Chile.

New evidence of the non-linear behaviour of the acoustical properties of aerogel powders with particle sizes below 50 microns

Below: Figure 1: New evidence of the non-linear behaviour of the acoustical properties of aerogel powders with particle sizes below 50 microns were found





Left:
Figure 2: The sound absorption coefficient of powder silica aerogels embedded into fiberglass mats depends strongly on the filling ratios

were found (see Figure 1 below). New experiments suggested that the non-linear behaviour of such small-sized powder aerogels was dependent on the amplitude of the incident sound pressure level used. A new non-linear loss mechanism different to classical friction damping was discovered and predicted by a valid theoretical model. This work was published in the Journal of the Acoustical Society of America (<https://doi.org/10.1121/10.0009635>).

Further studies demonstrated that the sound absorption coefficient of powder silica aerogels embedded into fiberglass mats (see Figure 2 above) depends strongly on the filling ratios. New data suggested that there was a progressive increase in sound absorption as the aerogel impregnation increased from 0 to 50%. When this reached 75% the effect of aerogel became less pronounced. A mathematical model was then applied to the complex reflection coefficient data measured in the impedance tube. It was found that a better model is needed to account for sorption and thermal diffusion effects rather than for the classical visco-thermal and inertia effects in the pores typical to traditional fibrous media and foams. This work was published in the Journal of Applied Sciences (<https://doi.org/10.3390/app1104593>).

Final research found that there were three scales of pore heterogeneities in the case of millimetre size granular aerogels

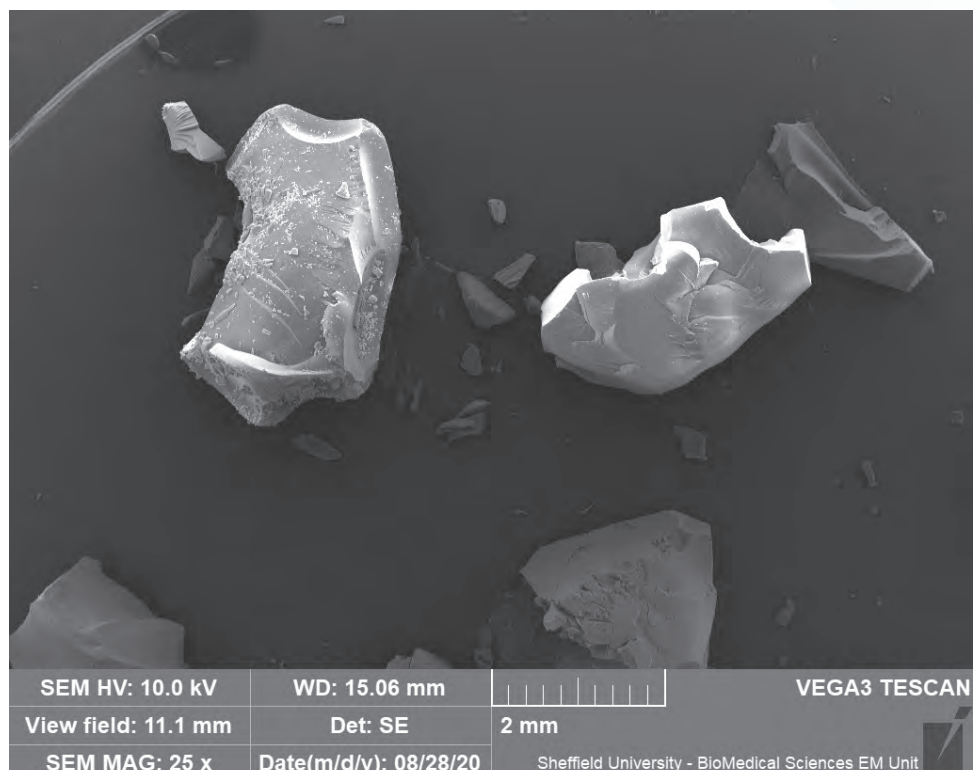
(see Figure 3 right). These pore heterogeneities cause different physical phenomena that affect sound propagation and absorption. While visco-thermal and inertia effects are important in classical granular materials such as glass beads, the rarefied gas flow and heat transfer in the inner-particle transport macropores, inter-scale (voids to/from inner-grain pores) pressure diffusion, and inter-scale (transport- to/from meso pores) mass diffusion needs to be accounted for to predict the

Below:
Figure 3: There are three scales of pore heterogeneities in the case of millimetre size granular aerogels, which cause different physical phenomena that affect sound propagation and absorption

acoustical properties of granular aerogels. It was important to understand that such effects were controlled by the presence of transport and mesopores in silica aerogels and perhaps only a proportion of the mesopore length in the direct vicinity of the transport pores or grain surface influence the acoustical properties. This work was published in the Journal of the Acoustical Society of America (<https://doi.org/10.1121/10.0005200>).

Future work

There remain many more areas to understand and refine the existing mathematical models used for modelling the acoustical properties of silica aerogels in vibro-acoustic applications. More work is required to systematically change the microstructure of silica aerogels and enhance its end use in acoustic applications – whether that is in powder or composite form. The physics of hierarchical pore structures and grain sizes of silica aerogels from micron size to sub-millimetre to millimetric size need to be fully captured. This would allow a better understanding of how the physical structures, layer thickness, and volume compaction affect the particle elastic frame. This would also provide better insight into the sound absorption properties at the quarter wavelength. ☺



John Connell Innovation Award 2023

It's time to be recognised for the important work that you are doing to cut noise and improve soundscapes and sustainability.

The John Connell Awards, launched in 2000, are held at the Palace of Westminster to recognise and promote innovative programmes, products and solutions from government, local government, industry, organisations, and individuals who have made a positive impact to reduce excessive noise and design better soundscapes to support health and wellbeing and improve the sound environment.

Innovation award

Sponsored by the IOA, the John Connell Innovation Award 2023, recognises and encourages the development of quiet(er) innovative solutions, programmes and technologies demonstrating sustainability to resolve noise problems.

- (a) new or enhanced product(s), programmes or solutions demonstrating significant technological, managerial and/or process advancement; and/or
- (b) organisations demonstrating a history of sustained innovation across product line(s) to resolve noise problems.

The deadline for submission of entries is **Friday 15 September 2023**.




The shortlist will be announced on **Tuesday 26 September 2023** and shortlisted entrants will be invited to the evening awards ceremony at the Palace of Westminster in London on **Wednesday 18 October 2023** where the winners will be announced.

On the judging panel for this year's award are:

- Russell Richardson, Director, RBA Acoustics, and Chair of the Innovation Award Judging Panel, on behalf of the Institute of Acoustics;
- Gloria Elliott, OBE, Chief Executive, Noise Abatement Society;
- Bridget Shield, Professor Emerita, The School of the Built Environment and Architecture, London South Bank University; and
- Daniel Goodhand, Director, Goodhand Acoustics, and IOA Council Member.

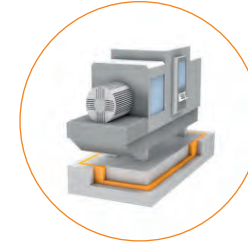
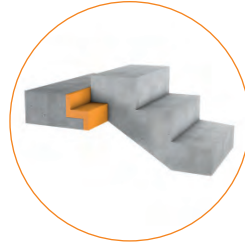
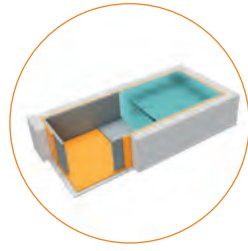
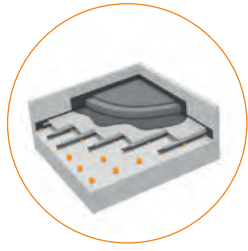
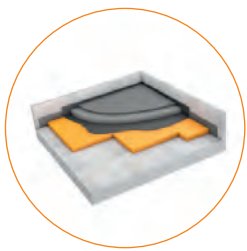
To request an award application please email johnconnellawards@noise-abatement-society.org

Commenting on the Innovation Award, Alastair Somerville, IOA President, said: "The IOA is delighted to sponsor the John Connell Innovation Award again.

"Taking the opportunity to encourage and recognise the extensive skills, innovation and excellence in our industry is paramount and this event offers a unique opportunity to encourage present and future generations of acousticians to continue to build and create an industry that we can all be proud of." 

For more information on the awards and previous winners visit <https://noiseabatement-society.org/campaigns/john-connell-awards/>





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Exploring the cultural heritage and restoration of Notre-Dame Cathedral through acoustic digital reconstructions

The acoustics of a place are ephemeral, but they are intrinsically connected to the physical environment. With acoustic measurements, acoustic models, and extensive archival research, acousticians are reconstructing the sounds of Notre-Dame through the ages after it was damaged by fire on 15 April 2019.

By Sarabeth S. Mullins, Elliot K. Canfield-Dafilou and Brian F.G. Katz

The modern experience of profound historical architectural achievements such as Etruscan tombs or Gothic cathedrals is strongly linked to each site's acoustic environment. The acoustics of an ephemeral heritage site are an intangible consequence of the tangible construction and furnishing of the space.

The echo of the cathedral

With the recent adoption of the UNESCO resolution on the importance of sound, in addition to the Convention for the Safeguarding of the Intangible Cultural Heritage, awareness is now growing of the importance of preserving, studying, and recreating the soundscapes and acoustics of historical sites. At the same time, the rapid development of available computing power has allowed for acoustic simulations capable of modelling vast and complex buildings in which acoustics often play a crucial role, such as theatres, concert halls and cathedrals.

While Notre-Dame has burned before, the 2019 fire is a reminder of the fragile nature of our cultural heritage. Fortunately, acoustic measurements, digital simulations, and digital reconstructions make it possible to recover, and to a certain

extent, preserve the sound of humanity's great architectural sites. What's more, the application of these measurements creates tools allowing archaeologists, historians, musicologists, and the general public to discover the lost acoustics of the damaged site. As part of the European Past Has Ears (PHE) and the French Past Has Ears at Notre-Dame (PHEND) research projects, and in conjunction with the acoustics working group of the Chantier Scientifique de Notre-Dame, we have been investigating the acoustic heritage of the cathedral over the centuries.

The contemporary acoustics of Notre-Dame

Despite the notoriety of the cathedral, there are few examples of published data on the acoustical parameters of this space. While some previous studies had been published in the early 21st century [Hamayon, 1996, Mercier, 2002], these reported varying reverberation times for the modern cathedral (e.g. 7.5 s and 6.5 s at 500 Hz, respectively), and did not fully explain the measurement protocols used. However, members of our laboratory carried out two previous measurement campaigns before the 2019 fire. After the fire, we were also able to make further measurements to document changes to the building's acoustic state. The

plans from these three measurement campaigns are shown in Figure 1. The first of these, from 1987, was recovered from an acoustic study conducted about a potential organ. While a variety of stimuli were employed, only a few balloon-burst sources were exploitable due to a lack of excitation stimuli details (e.g. anechoic signals, sweep stimuli parameters). While not an ideal omnidirectional source, balloon bursts are valuable in certain situations, offering a portable impulsive source [Pätynen et al., 2011]. The recorded bursts were digitised from the original analogue tape and analysed.

Later, as part of a French research project on Binaural Listening (BiLi), we made a series of acoustic measurements in 2015 almost four years to the day before the 2019 fire. These detailed measurements were made with the modern sine-sweep technique [Farina 2000], with multiple receiver positions spread over a large portion of the floor area, including binaural and ambisonic microphones at select positions (see Figure 2a).

After the 2019 fire, access was granted to the construction site for the third measurement campaign, carried out in June 2020. The spire had damaged the central part of the transept/altar marble floor as it fell. Due to the risk of further falling debris and structural instability, the central nave and transept were

off-limits to people, as highlighted in Figure 1c. The choir area was likewise cluttered with debris, and therefore inaccessible. Many of the side altars had been used to store objects. There was also scaffolding installed for the removal of the organ and a protection barrier (construction fencing and waist-height perforated metal panels) surrounding the central nave, as seen in Figure 2b. A short video documenting the measurement session is available online¹.

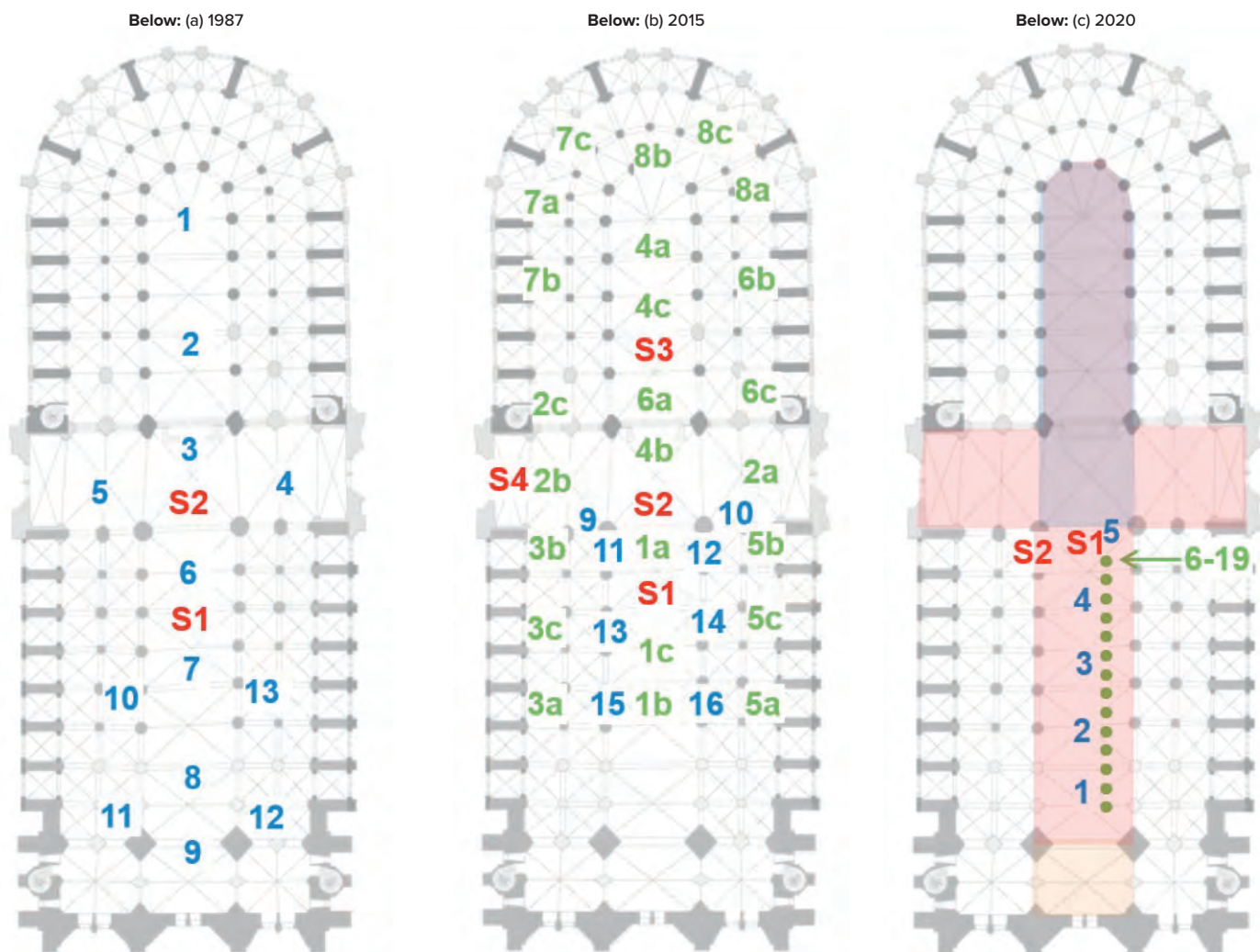
Comparisons between the results of the two pre-fire sessions (1987 and 2015) show a slight, but significant, reduction in reverberation time (8%), which is likely attributed to the installation of a carpet runner in the 1990s to reduce the footfall noise of circulating tourists. Compared with

the 2015 data, the reverberation time after the fire has decreased significantly (20%) [Katz and Weber, 2020].

We have examined the 2015 and 2020 results for comparable source and receiver positions using the marching line multiple slope analysis method [Luizard and Katz, 2014, Weber and Katz, 2019], in the 500 Hz octave band filtered RIRs (see Figure 3c). One can see the general decrease in reverberation times indicated in Figure 3a, while highlighting the problem of using the ISO3382 standard parameters when non-linear decays are present. Analysis results show a decrease in both Early and Late decay rates, indicating reductions in both the primary and secondary 'volumes'. In the case of Notre-Dame, the

delimitation of the different acoustic volumes is not as stark and evident as in coupled reverberation concert hall designs. However, the transept neatly separates the cathedral into two acoustically distinct zones, as its high ceiling and lack of subdividing walls creates a 34m wide by 14m deep by 33m tall zone of free-field propagation between the multilevel eastern and western portions of the cathedral. The reduction in decay rates in these volumes also decreases the bending point time and, to a lesser extent, level. It is noted that all of these parameters are linked to the acoustic coupling conditions. The variability in Late reverberation times for the 2015 condition could be attributed to the complexity of the space and the various acoustic zones, **P50**

Below: Figure 1: Measurement plans for the three sessions at the Cathédrale Notre-Dame de Paris



Positions are centred under numbered source (S# (red)) and microphone (# (blue and green)) labels or at points when the measured grid is too dense. The 2020 plan (c) also indicates in shaded regions the scaffolding (yellow), people exclusion (red), and encumbered/damaged ground (blue) exclusion zones where it was not possible to place measurement equipment

Footnotes

1. <https://youtu.be/YLi7ASosKww>

Figure 2: Images highlighting conditions for the (a) 2015 and (b) 2020 measurement sessions

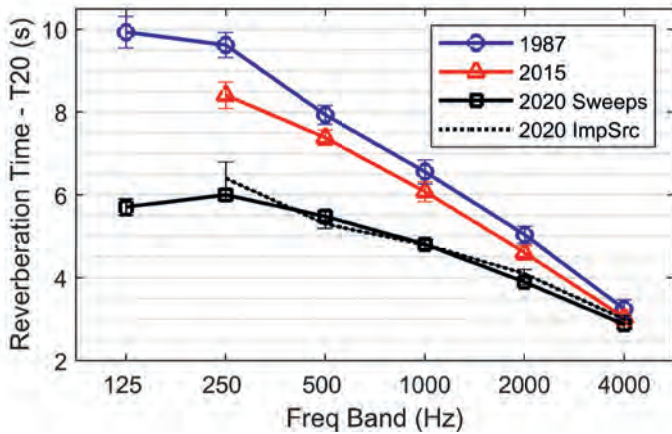


Above: Figure 2: (a) 2015, highlighting measurement equipment in the central aisle of the nave and carpet runner in a side aisle during the measurement session

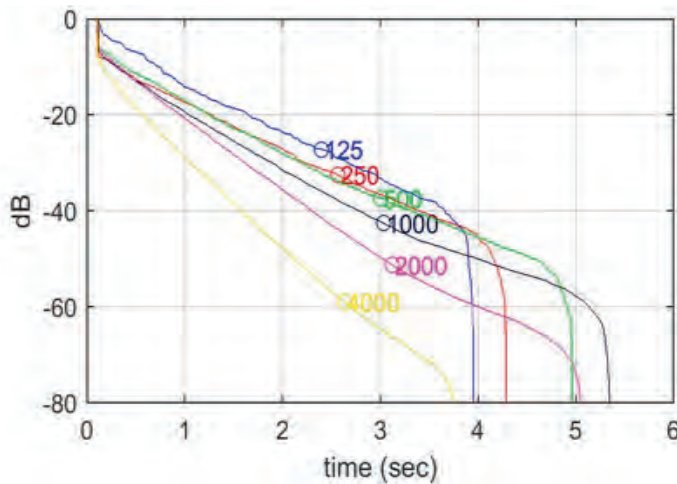


Above: Figure 2: (b) 2020, highlighting the remote-controlled robot-pulled microphone tripods and the general empty state of the nave during the measurements

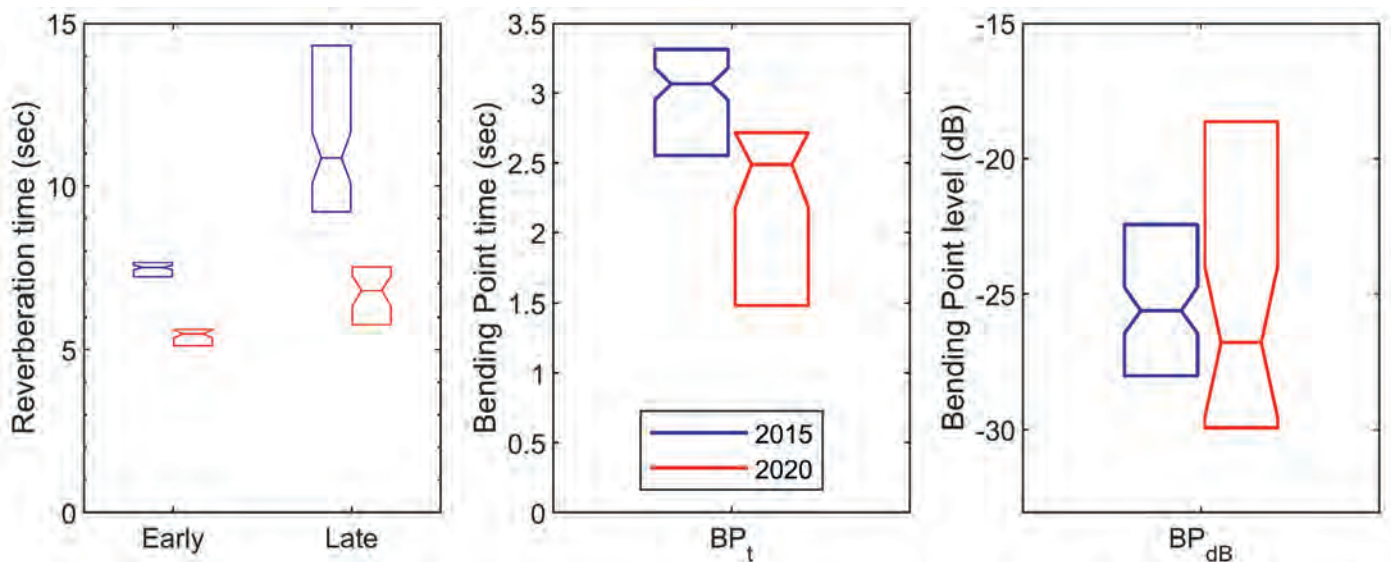
Figure 3: Summary of (a) mean reverberation time over receivers, (b) example RICs, and (c) coupled volume analysis



Above: (a) Mean reverberation time (T20) over omnidirectional microphones with standard error bars. 2020 results show those for sweep stimuli (S1) and impulse source gun-shots (S2, Rec positions 1-5)



Above: (b) Example of octave band filtered RIC decays, normalised, optimised SNR truncation, 2020 sweep stimuli data-set



Above: (c) Double-slope decay 500 Hz-octave band analysis distributions showing Early and Late reverberation times and the relative time (BP) of the identified bending point in the RIC decay curves ([Luizard et al., 2015] for parameter details). Notched boxplots show the median, 95% confidence interval, 25th and 75th percentiles of the data spread

leading to more than a simple double-slope decay with higher-order coupling.

When the reconstruction of the spire, roof, and vaulted ceiling are completed, and the interior scaffolding removed, we look forward to assessing the next iteration of this monumental building's acoustics.

Simulating the cathedral through the ages

There is a tendency among modern visitors to conceptualise a cathedral as a still and constant witness to history. However, the societies that maintained the building over centuries have all left their marks on the cathedral, from architectural renovations to politically-motivated redecorations, re-purposings, and damages. To modify the cathedral is to participate in a cultural legacy of continuous change.

While physical and digital simulations have been used for decades, digital approaches used in the 20th century were initially limited in their utility. As recent studies have shown the improved reliability of numerical simulations for studying complex, coupled acoustic conditions [Weber and Katz, 2019], we can expect such analytical efforts to be credible for Notre-Dame. We have shown in previous studies that geometrical acoustic simulations (CATT-Acoustic/TUCT) can be perceptually comparable to in-situ recordings [Postma and Katz, 2016b].

A geometric acoustic model of the cathedral was thus created and calibrated on the basis of measurements taken in 2015. Subsequent work on the historical acoustics of Notre-Dame [P52](#)

has refined this computer model, featuring alterations in interior geometry, closure of lateral chapels, inclusion of the clôture and rood screen, reshaping of choir stalls, and other details. Additional measurements of historical materials and supporting archival documentation are used to modify the simulations, adapting the model to the cathedral's historical or future states. To date, 13 acoustic models spanning the time period from before Notre-Dame was built in ca. 1163 CE to ca. 1712 CE have been created using this same software (CATT-Acoustic v9.1, TUCT v2.0, see Figure 5a).

The ca. 1163 model is a speculative one based on the foundations of a massive basilica found in archaeological digs in

1847 CE [Hubert, 1964, Barbier et al., 2019, Sandron, 2021]. Acoustic measurements and architectural plans of an extant and contemporaneous building of a similar architectural style [Cirillo and Martellotta, 2005] were used to create a calibrated model of the stand-in church, which was then modified to match the architecture of the ruins below Notre-Dame. All models after ca. 1163 CE are based on the GA model reported in Postma and Katz [2016a] and subsequently modified to match the historical states as discussed in Mullins et al. [2022], Canfield-Dafilou et al. [2022, 2023]. These models allow us to examine the acoustic evolution of the cathedral over generations, yielding insights into the experience of previous societies at the church.

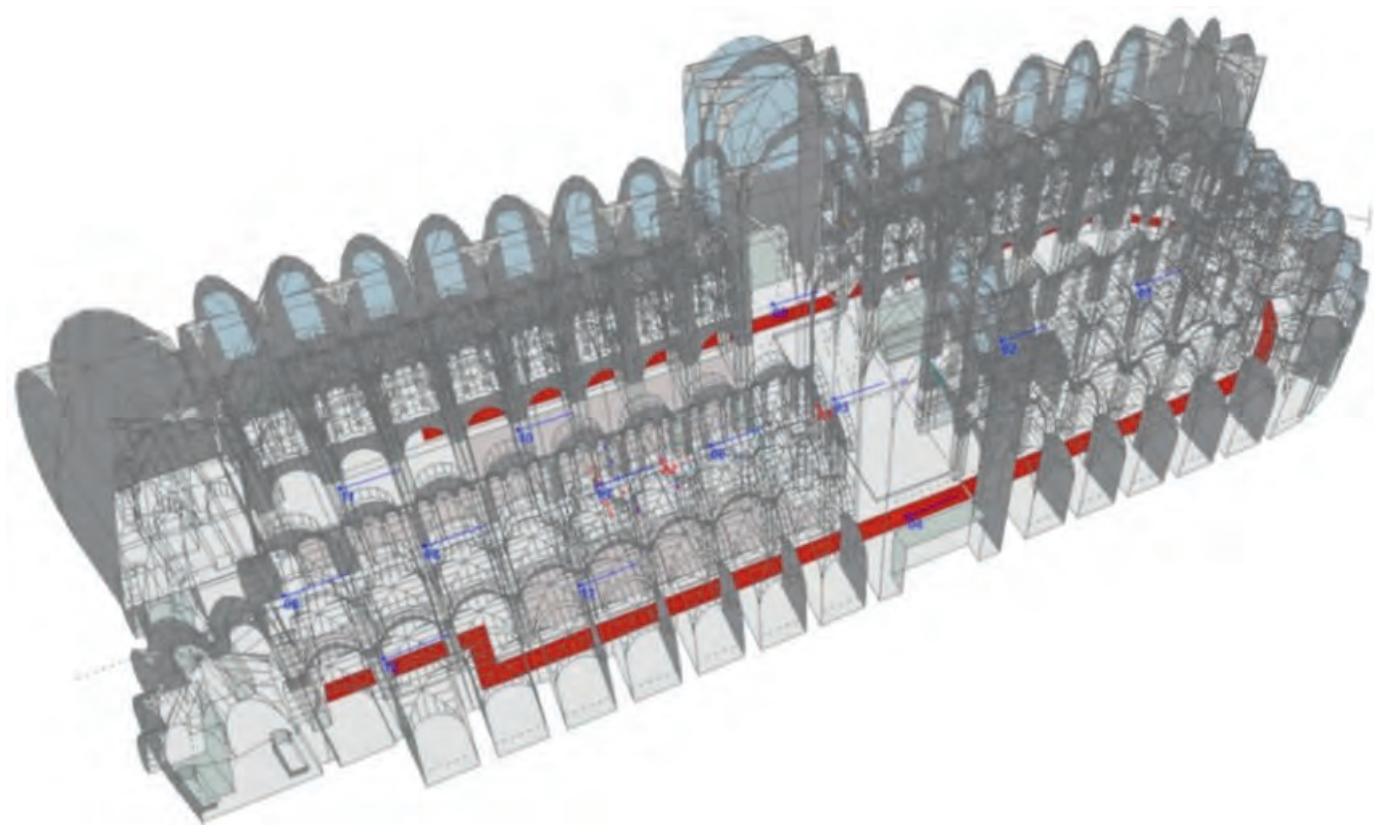
Listening to the past

This type of historically-informed simulation can be a powerful tool for historical studies, providing researchers with a sensory presentation of sound that was previously only available through description and supposition.

In parallel with the construction of the cathedral, a new genre of music developed among the musicians of Notre-Dame. Known as the School of Notre-Dame, these composers and musicians pioneered a virtuosic style of singing that embellished established melodies with prescribed and notated polyphonic ornamentation.

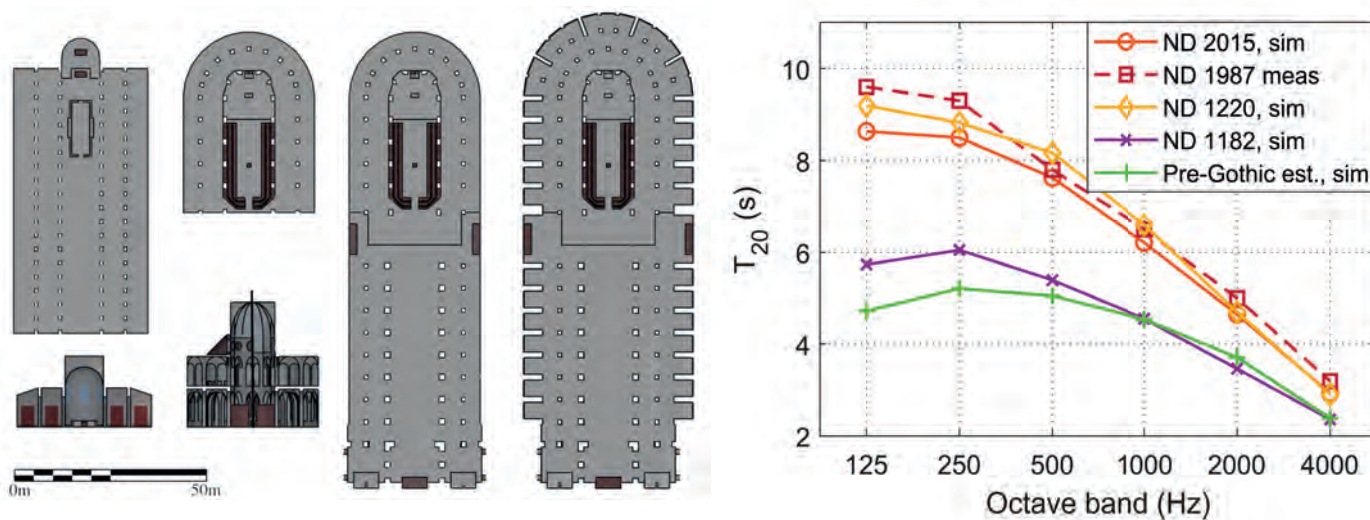
Working with musicologists, acoustic simulations are used to study the potential relationship between these musicians and the

Figure 4: Geometrical Acoustic simulation model of the state before the fire



Above: Geometrical acoustic model of Notre-Dame de Paris

Figure 5: Overview of several simulation models and associated reverberation time results



Above: (a) Plans and elevations of ca. 1163, ca. 1182, ca. 1225, and ca. 1350 states

Above: (b) Summary of mean reverberation time

reconstructed acoustics of Notre-Dame and its predecessor. These experiments use real-time, immersive virtual acoustic environments to allow singers to perform as an ensemble in the different simulated acoustic conditions. A choir specialising in medieval singing was studied as they sang *Organum Purum* and *Organum Notre-Dame* in the varying acoustics.

Analysis of musical parameters extracted from their recordings helps to examine what influence the different architectures may have had on musicians' performances. Listening tests with specialists focus on the differences in the suitability of music styles to the historical acoustic conditions. In this way, we hope to provide a new level of insight into the interconnected domains of culture and acoustics at the cathedral in the past.

In addition to the scientific aims, the acoustic model of Notre-Dame has been used to draw awareness to the cultural significance of the aural history of the cathedral. This

includes a virtual 'magic carpet' tour of the cathedral while listening to an extract from a performance of Massenet's oratorio *La Vierge*. The intention of this production (entitled 'Ghost Orchestra'²) was to capture the acoustics of the cathedral and how they vary according to the position of the sound source and the listener. An extended version, offering the entire concert from several fixed positions, was produced during the COVID lockdown in the form of a virtual sound-only experience³.

The selected piece of music, actually performed at Notre-Dame for its 850th anniversary, offers a unique experience with musicians positioned both in the transept and in the liturgical choir, in addition to several movements where soloists are positioned high up in the galleries, offering spatially variable sources and a truly immersive experience. These efforts have produced a four part audio-drama series, placing the efforts of the scientific team in an

easily accessible format. *Looking for Notre-Dame*⁴ plunges us into the mind of the young Victor Hugo as he begins work on his future 'cathedral novel' *Notre-Dame de Paris*. Another public work is the production of a geolocalised audio-guide, *Whispers of the Past at Notre-Dame*⁵, an immersive experience in the aural memories of the cathedral Notre-Dame de Paris.

Concluding remarks

Exploring acoustic cultural heritage through digital reconstruction brings an additional perspective and tool-set to researchers in the arts and humanities. Furthermore, it brings a powerful means of communicating and delivering memorable, meaningful, and most importantly, informed multi-sensory experiences. This is evident by the range of projects of this type across Europe. Despite its potential, auralisation is a static representation of how an environment sounds, a snapshot in time, and the final result [P54](#)

Footnotes

- <http://www.lam.jussieu.fr/Projets/GhostOrchestra>
- <http://lavierge2020.pasthasears.eu>
- <http://lookingfornotredame.pasthasears.eu>
- <http://whispersnd.pasthasears.eu/>

depends greatly on the limitations of the systems and techniques used to create it. When developing a model of any heritage space, the auralisation is only as good as the groundwork research into the source material documenting its history. Perhaps most importantly, our judgements on the auralisation reflect our selves, our experiences, and our expectations. As with many historical conceptualisations, the final results are created from and perceived through our modern state of mind. Despite these caveats, we believe that Notre-Dame is the perfect opportunity to showcase the opportunities of interdisciplinary partnerships. It is our hope that this work contributes to an appreciation of the cathedral's legacy as it moves towards full restoration.

Acknowledgements

The authors would like to thank the various researchers who have contributed to the measurements and acoustic modelling of the cathedral over the years: Bart N.J. Postma, Julie Meyer, Antoine Weber, and Michelle Castellengo. Funding has been provided by the European Union's Joint Programming Initiative on Cultural Heritage project PHE (The Past Has Ears, Grant No. 20-JPIC-0002-FS, phe.pasthasears.eu), the French project PHEND (The Past Has Ears at Notre-Dame, Grant No. ANR-20-CE38-0014, phend.pasthasears.eu), and the Chantier Scientifique CNRS/MC Notre-Dame. ©

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CASE STUDY

HOTEL WALDORF ASTORIA NY

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Manufacturing solutions
for architectural acoustics
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ACOUSTIC CHALLENGE



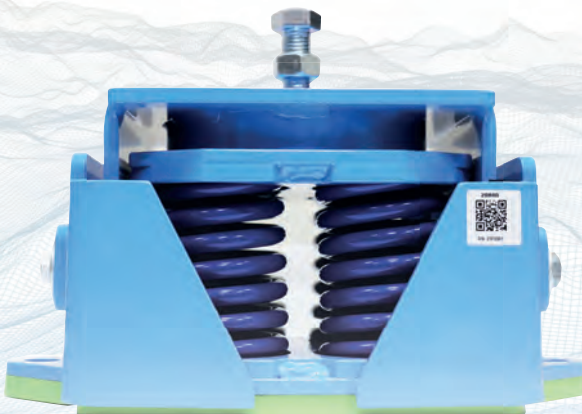
- 1 Isolation of 3 x Tedom M530 (530kWe) CHP cogeneration units.
- 2 Units located on the 6th floor.
- 3 Installation below the hotel ball room.
- 4 Extremely low height requirement.
- 5 High sound insulation.

SOLUTION



- 1 24 units of pre-compressed antiseismic spring mounts.
- 2 45mm of static deflection, providing 2.4Hz vertical natural frequency.
- 3 Each mount is individually tested, serial number with a QR code providing elastic properties.
- 4 On site assistance during the installation.
- 5 Measurement of deflections meeting the acoustic engineer requirements.

Cooperation with acoustic engineers



Lewis Metcalf
Applications Engineer – UK & Ireland

+44 (0)752 311 8007

Leicester, UK

lewis.metcalf@amcuk.co.uk

www.amcuk.co.uk
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CASE STUDY
VIDEO



The Rest is Just Noise podcast

The award-winning *The Rest is Just Noise* monthly podcast was set up by Doctors Andrew Mitchell, Francesco Aletta and Tin Oberman in the depths of the pandemic; simply to give them something new to work on and to keep in touch with the soundscape community.



Hosted by Andrew, Francesco and Tin, the podcast has grown and grown, reaching 30 episodes and more than 5,000 downloads. The listener base of predominantly researchers and practitioners, continues to expand and the podcast is gaining more attention. Released monthly, it explores the relationship between sound and cities and in each episode, the hosts are joined by an expert guest from fields including acoustics, architecture, and environmental psychology, to discuss their latest work and introduce listeners to the science, beauty, and noise of urban sound.

With deep knowledge and an engaging narrative, the co-hosts explore various acoustical phenomena and their impact on our lives. Through interviews with experts and immersive soundscapes, this podcast educates and entertains listeners, creating a space where the beauty and significance of acoustics are celebrated.

Andrew said: “Our focus is on the relationship between sound and cities, but we try to approach it from as many perspectives as we can. We’ve spoken to sound artists, architects, sociologists, psychologists, engineers, and many other experts.

Below:
Dr Hasina Begum, leads the ‘The Rest is Just Noise’ podcast special series on women in acoustics



“Recently, with Hasina Begum’s special series on women in acoustics, the topics have broadened outside of urban sound to cover the wider array of topics across acoustics.

“We also cover on-the-ground coverage of acoustic conferences, large and small, from the Acoustical Society of America to the Urban Sound Symposium to the Acoustics of Ancient Theatres Symposium.”

Recognition

The Rest is Just Noise was recently awarded the ASA’s 2023 Science Communication award in the ‘Acoustic Expert Multimedia’ category. The ASA judging



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Left:
Podcast recording with Angela Lamacraft

panel stated that: *“this podcast, stands out as a remarkable audio journey into the realm of acoustics. With deep knowledge and captivating storytelling, co-hosts Dr Andrew Mitchell, Dr Francesco Aletta, and Dr Tin Oberman explore various acoustical phenomena and their impact on our lives. Through interviews with experts and immersive soundscapes, this podcast educates and entertains listeners, creating a space where the beauty and significance of acoustics are celebrated.”*

Special series on women in acoustics,

To celebrate International Women in Engineering Day in June, Dr Hasina Begum, EDI Champion for the UK Acoustics Network (UKAN+), led the first episode of a special series of The Rest is Just Noise podcast, which features exceptional women doing some incredibly exciting work with acoustics.

The Professor Eleanor Stride episode

Hasina interviewed Professor Eleanor Stride, the Statutory Professor of Biomaterials in the Departments of Engineering Science and the Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences. Their conversation about bubble acoustics delved into Eleanor’s journey into acoustics, how and why it happened, what particularly interested her and the challenges that she has faced.

Hasina explains that: “This podcast was set up after conversations we had at a UKAN+

EDI meeting when we realised that very few women working in acoustics are championed enough for the great work that they do. I wanted to interview a series of women in the style of an informal chat and understand why there aren’t many women pursuing careers in acoustics.

“Professor Eleanor Stride was chosen as the first guest because I wanted someone who was very well established in their career and who had gone through the higher education and academic system (In Eleanor’s case, all the way to professorship).

“I wanted to discuss her experiences of having a successful career and ask her if there were any secrets to having such a strong work ethic while still being able to balance family life.”

Initially this was only supposed to be a very short, trial series of three or four women talking about their careers in acoustics and some of the challenges they might have encountered, but with such positive feedback from the first episode the team may extend this and interview more women.

Hasina said: “Future guests lined up include a mix from industry and academia. We want to target those that are quite established in their careers, how they have become so successful and what advice they would give to younger women that have ambitions to emulate that success.”

Challenges

Although this project has been quite time intensive for Hasina, travelling back and forth to UCL where

the recordings take place, while juggling her responsibilities and commitments as a research fellow at Warwick, she said that it has been an incredibly rewarding and insightful experience for her.

However, it hasn’t been without challenges, she said: “I have found that a lot of the women that have agreed to take part in the podcast come from a particular background; white and middle class and this leaves me slightly conflicted as the whole reason I started this process was to promote equity, diversity, and inclusion.

“It’s made me realise that there is not enough diversity among the women that are currently working in acoustics.

“We hope to address this by expanding our pool of invitations to guest speakers that are at international institutions as we aim to raise awareness and encourage women from all (and under represented) backgrounds to pursue a career in acoustics.

Listen to the podcast here: <https://www.justnoisepod.com/>
Listen to Hasina’s episode with Professor Eleanor Stride here: <https://www.justnoisepod.com/1438372/13064708-wia-special-series-bubbles-everywhere-with-eleanor-stride> @



Above:
Professor Eleanor Stride

@JustNoisePod



Below:
Podcast recording with Helen Sheldon



Approved Membership Applications

The Membership Committee reviewed 63 application forms on 27 July 2023 at their third Committee meeting of the year, held at AECOM offices in London. 27 corporate applications have recently been approved by the Council following the recommendations of the Membership Committee. The Committee saw 35 new candidates joining the IOA, the remaining applications came from members upgrading.

MIOA

Badruddin Abdul Khadar	Duygu Ozel Guney
Bilal Ahmed	Andre Rebello
Charlotte Birch	Sophie Reyland
Peter Brooks	Cameron Salisbury
Paul Couper	Ozgun Sinal
Benny Cryan	Aikaterini Stogiannou
Richard Daniels	Daniel Stuart
Samuel Ellwood	Arun Sulkunte Iyengar
Wai Tung Ho	Kaelyn Tan
Stephen Howells	Eoghan Tyrrell
Kar Houu Hui	Thomas Watkin
Hywel Jenkins	Ryan Webb
Richard Jovic	George Zelenovic
Jo Lacy	

AMIOA

Wisdom Adza	Leanne Leonard
John Barker	Ben Lyons
Sarah Barnes	Jonathan MacNevin
Gary Brzezinski	Jack Miller
Richard Burrows	Max Radivan
Thomas Corbisley	Tom Rusby
Zachary Francis-Cox	Alex Sharp
Courtney Jacob	Freya Tewnton
Hoi Yuet Lam	Luis Vargas Crespo
Benjamin Lee	Ruben Vazquez Amos

TechIOA

Liam Boles	Calvin Hanks
Chloe Glenn	Luke Jarvis
Tom Greatorex	Jayan Mistry

Affiliate

Mark Metcalfe	Travis Smith
Mathew Robinson	Tom Suddaby

ACOUSTICS 2023

16-17 October 2023 at The Guildhall, Winchester, UK

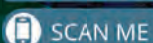
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Or you can find further information online at <https://www.ioa.org.uk/events>



We look forward to seeing you there.



Temple welcomes Phil McIlwain



Phil McIlwain has just joined Temple

Specialist environment, planning and sustainability consultancy, Temple, is pleased to announce that Phil McIlwain has joined the acoustics team in London.

Phil has considerable experience as a Local Authority Environmental Health Practitioner and was Technical Lead on Acoustics at Westminster City Council since 2007. He is also a senior visiting lecturer at Westminster University and operated his own acoustic consultancy from 2011 to 2019. Prior to joining Temple, Phil set up and managed the construction noise, vibration, and dust assessment and monitoring service with his last employer.

Made in Britain

Founded in 1914, IOA sponsor member, Christie & Grey Limited, has been manufacturing vibration, noise and shock control solutions for more than one hundred years, and they have just qualified as a member of the 'Made in Britain' organisation.

'Made in Britain' is a not-for-profit organisation that supports British manufacturers and works with UK trade bodies, government departments, and media channels to support skilled jobs, responsible business and sustainable growth.

Christie & Grey's Technical Director, Daniel Hall, said: "We became a member of the organisation to promote us as a British manufacturer to customers and to other companies within the British manufacturing community.

"We currently have a circa 98% British supply chain for our component parts and feel it is important in terms of both sustainability and reassurance on product quality when promoting our products worldwide and in the UK.

"As members of Made in Britain we can draw upon the knowledge and experience of other members in promoting ourselves to new markets and work collectively with other like-minded British companies. Made in Britain sits on the All-Party Parliamentary Manufacturing Group to help increase influence across relevant public policy."

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SuperPhon provides reverberation control at Coventry's TWO FRIARGATE

CMS Danskin Acoustics' SuperPhon panel is to contribute to reverberation control in the full height reception area of Coventry's prestigious new, Grade A office address, TWO FRIARGATE.

The 12-storey TWO FRIARGATE is part of Coventry's first dedicated business district, Friargate, and when complete in the coming months, it will be the city's most sustainable building and premier office address. TWO FRIARGATE has achieved BREEAM Excellent accreditation and is targeting A AirScore rating and EPC A.

Specified by the architects for the reception, which incorporates a business lounge, the SuperPhon panels were manufactured by CMS Danskin Acoustics in Warrington.

SuperPhon is an acoustically absorbent ceiling and wall panel of composite construction for reducing sound reverberation, providing up to Class 'A' acoustic performance. It is designed for use in many applications, including recording/rehearsal studios, audiology rooms, cinemas and theatres, schools, call centres and conference rooms.

The TWO FRIARGATE project involved a tight order-to-delivery timescale of just nine days and several different sized panels all with a Cara Glass finish.

SuperPhon is available in a range of standard sizes and thicknesses. Bespoke panels and absorbers size, thickness, shape or fabric-facing and high impact performance options



TWO FRIARGATE Coventry reception interior

can be readily manufactured. A flexible solution, SuperPhon can provide complete or partial wall coverage and its wide range of colour finishes provides aesthetically pleasing reverberation control.



Acoustic isolation for Sadler's Wells

Inserting the floating floor springs before commencing jacking, to within 5mm across the whole area

The East Bank development, part of the London 2012 legacy, includes a new site for Sadler's Wells, dance theatre. Bringing the vision for the new building to life has involved significant engineering, including ensuring the building's occupants won't be disturbed by noise and vibration from freight trains passing nearby. To help overcome this, vibration control specialist Mason UK designed and manufactured a system of bespoke bearings to isolate against sources of vibration.

The building was designed and created by architects O'Donnell and Tuomey, and dance practitioners were consulted in the early phase of the design process to ensure the finished building caters to their needs. However, for the building to function as intended, sophisticated acoustic engineering was required.

The challenge facing the contractor was the proximity of the site to a major trainline. With freight trucks passing right across the front of the site, there would be plenty of low frequency vibration generated and without the correct isolation methods in place, this vibration would manifest as low frequency noise in the dance studios.

Studio One

The biggest challenge came from Studio One, a particularly large venue constructed on a steel frame. Five main trusses, spanning approximately 25 meters and weighing around 20 tonnes each were installed and to isolate effectively against the vibration emanating from the trainline, a bespoke solution was required.

Acoustic floating floors are often the most effective solution for isolating dance studios. However, due to the vast size of Studio One, large rubber bearings were a better option to isolate the vast steel trusses from the concrete structure.

A bespoke solution

With an area this size, it made more sense to position point loads of large bearings spread out around the perimeter and 11 support locations were needed to support

the trusses at intersections. Having lots of isolators spread out over a floor this size (as would be the case with a floating floor) would be less cost effective and the use of large bearings also had the benefit of keeping contact points to a minimum — offering superior acoustic performance.

Rubber bearings can be designed to provide low natural frequencies, as low as four to five Hertz if necessary. The low dynamic stiffness of Mason proprietary rubber formula makes it a highly effective material choice for an isolator, even for the low frequency vibrations that would be generated by freight trains. The kind of bearings used for Sadler's Wells East were the type usually used when isolating entire buildings and each bearing had to be specifically designed to handle the loads it must face.

Bespoke shear keys

Although the bearings provide the ideal acoustic solution, they also introduced a further engineering challenge — handling lateral forces. Structural engineers need to ensure the building is designed to withstand the impact of these forces, such as wind loads from hurricanes or even terrorist activity. In the case of Sadler's Wells, significant collapse forces had to be supported.

Mason UK therefore designed a system of bespoke shear keys to accompany the bearings. Because the forces were so large, Mason UK proposed separating into 'working' day-to-day forces to be handled with acoustic bearings placed laterally, and 'emergency' load conditions for which large steel bump stops were incorporated. This approach greatly reduced cost and prevented the need for bearings which for day-to-day forces would be far too stiff.

Acoustic bearings were also used to isolate the entire plant area on roof level — unique steel-to-steel connections were developed as a simple way to reduce uncertainty of noise and vibration generated by air handling and water heating systems.

Meet the Rion NL-53

After around a decade, the Rion NL-53 is replacing the ubiquitous NL-52. Factors which fuelled the Rion NL-52's popularity included the intuitive simplicity of the user interface, data stored as text files on a memory card, reliability and quality. Low power consumption and the availability of the Rion WS-15 outdoor windshield made the NL-52 ideal for long-term unattended monitoring.

All these features have been retained in the new Rion NL-53. The biggest change is the user interface. With only three physical keys (start/stop, pause/continue and power), all settings are selected using the instrument's 3.5" LCD touch screen, which allows a lot of information to be shown simultaneously without the screen appearing cluttered.

Power consumption of the NL-53 is low. With the screen at full brightness the NL-53 consumes around 1.2W. For long-term surveys, using the LCD 'Auto Off' function can reduce power consumption to around 0.7W, giving at least 10 days from an external 12V 12Ah battery and around 60 days on an external 12V 100 Ah battery.

NL-52 customers will be able to use their existing WS-15s, microphone extensions and outdoor kits (using a power adapter). Alternatively, ANV's new outdoor kits incorporate LiFePO4 batteries which are the safest type of lithium battery. The LiFePO4 cycle life is also around four times greater than other lithium battery types. Replacing the valve regulated lead acid (VRLA) 12V 12Ah with the equivalent LiFePO4 battery in a standard NL-53/52 long-term kit reduces the weight from 7.5 to 4.7 kg. ANV can now provide a weather-protected 100Ah LiFePO4 which weighs only 13.5 kg (23.2 kg lighter than its VRLA counterpart).

ANV have integrated the NL-53 into LivEnviro offering immediate live-to-web access to data. If you have, or want to develop your own remote system, or just connect the NL-53 to a computer or Raspberry Pi, the instrument has Ethernet, USB and serial communications and an onboard web server.



P62

Type approval for NTi's XL3 Class 1 sound level meter

NTi Audio's XL3 Class 1 sound level meter has now been Type Approved by LNE in France. LNE, the French National Laboratory of Metrology and Testing, ensures that instruments meet strict accuracy and reliability standards, namely IEC 61672 sound level meter standard and IEC 61260 octave-band and fractional-octave-band filters standard, through rigorous testing over several weeks.

The XL3 has been independently confirmed as fully compliant with these standards therefore offers the highest level of instrument integrity and accuracy for field-based measurements.



SRS is 40!



Sound Reduction Systems Ltd, manufacturer of innovative acoustic solutions, is celebrating its 40th anniversary. Since its inception in 1982, (then known as Hartnell & Rose) the company has constantly adapted and diversified to where it is today, delivering high-quality products and services to clients worldwide.

Managing Director, Alex Docherty, said: "Reaching 40 years in the acoustic industry is a testament to our dedication to providing innovative solutions that enhance people's quality of life. We are immensely proud of our products and service and the trust our clients have placed in us over the years."

As Sound Reduction Systems Ltd celebrates this significant milestone, it also looks forward to the future with excitement and optimism and remains dedicated to providing performance and quality with its products backup up with the very highest levels of customer service, ensuring that it stays at the forefront of the industry for many years to come.

ViBRIDGE: Holistic testing of in-ear headsets with bone conduction sensors

HEAD acoustics enables realistic testing of in-ear headsets with bone conduction sensors in the transmitting direction. For this purpose, they use their artificial head HMS II.3 ViBRIDGE and excite the artificial ears HEL/HER 4.4 ViBRIDGE with a vibration generator – comparable to the average bone sound excitation in humans.

Bone conduction sensors in in-ear headset replicas allow measurements of how bone conduction 'sounds.' These measurements give a good overview of the individual differences for each talker and allow HEAD to determine the average bone sound transfer function. This is reproduced with an actuator in the artificial ear of the artificial head to obtain a perfect simulation that corresponds to the results of the test measurements. This means that with HEAD acoustic's ViBRIDGE, manufacturers can test their in-ear headsets with structure-borne sound sensors holistically, correctly, reliably, and reproducibly in the lab.



New acoustics forum

IOA member, Dan FitzGerald, owner of Irish Acoustics, a consultancy for studios, venues and home listening, has been involved in the musical side of sound since the 1980s. His film and TV work included working with international stars such as Tom Waits, Emmylou Harris, and Amy Winehouse, and during the 90s Dan developed an interest in the behind the scenes aspects of music and recording. He has set up Pro Acoustics Forum to encourage discussion, learning and the sharing of knowledge between acousticians worldwide.

Dip in at <https://www.irishacoustics.com/forum/noticeboard/introduction> @

Quick QR code event finder

11th International Conference on Auditorium Acoustics

28-30 September 2023
SNFCC, Athens, Greece

<https://auditorium2023.org>



Acoustics 2023

16-17 October 2023
Institute of Acoustics
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Enhance your career prospects in acoustics

The IOA runs a range of certificated short courses nationwide, assessing competence in the areas shown. The courses run twice a year at accredited training centres across the UK (courses are held prior to exam dates and usually run for around five days).

To find out more about any of these courses consult the list of centres at: <https://www.ioa.org.uk/education-training> and contact the appropriate centre directly.

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Environmental Noise Measurement



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Anti-Social Behaviour (Scotland) Act 2004 - Noise Measurements



Courtesy of Luis Gomez-Agustina

BRANCH NEWS

Central Branch

By Matt Torjussen, Central Branch Secretary

The Central Branch held its last meeting before the summer recess in June with a talk by Professor Alex Rogers from the University of Oxford on the development and use of the AudioMoth, a low-cost open-source hardware device for recording audio.

The project started as a smartphone app to record the song of the New Forest Cicada, so called because in the UK it is only found in the New Forest. Between the months of May and July this large insect (3cm long!) sings with a very characteristic high-pitched sound between 14 and 15 kHz. Due to this high pitch, there had been no reports of anyone hearing its song in the last 20 years. During the 'Great Cicada Hunt', members of the public were encouraged to go out into the New Forest and record audio onto their smartphones, which would be analysed to detect the distinctive cicada song. While this project failed to detect cicadas in the UK, the same app was successfully used to detect them in Slovenia.

After the success of this project, a compact and purpose-built audio recorder was developed, which became the AudioMoth. Designed specifically to be cheap and have low power consumption, the aim of the device was to automatically detect the song of the New Forest Cicada by recording a short 200ms sound sample, analyse it, and store a further 30 second recording if the song was detected.

The low cost of the AudioMoth allows the device to be deployed in vast numbers, typically in arrays of 20-30. It has been successfully used to look at the spatial distribution of species by using a GPS signal to keep the clocks on the individual devices synchronised, which allows the arrival time of wildlife sounds to be used for triangulation. This same AI engine can be trained to identify the sounds produced by certain species, allowing ecologists to set up the device quickly for their specific needs.

The success of this device has led to its use around the world for detecting rare species. It has also been developed into the HydroMoth, for monitoring the underwater sound produced by shoals of fish, and the MicroMoth, for mounting onto birds.

While Central Branch meetings are hybrid events, we encourage all members to attend in-person meetings whenever possible. These meetings offer a unique opportunity to learn from and network with peers. As always, this event was recorded and is now hosted on the IOA's website within the members' area. If you missed this great talk, make sure you check it out online.

Below: The New Forest Cicada (Image © Jaroslav Maly/Buglife)



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Midlands Branch

By Matt Torjussen, Midlands Branch Secretary and Aglaia Foteinou

We were delighted to host Professor Mariana López of the University of York for an online talk for the Midlands Branch in June on *Enhanced audio description: a new accessibility paradigm*. Aglaia Foteinou reports.

Mariana's work, as part of the AHRC-funded project *Enhancing Audio Description II*, challenges the over-reliance on words and voice of the traditional method of audio description. Examples of new production films in collaboration with film and TV industries were presented with this enhanced method which acknowledges diversity in accessibility. Mariana played excerpts of films that are just about to be released and which make use of this method and it was fascinating to listen/experience the films through sound effects and spatial information of the scenery, including binaural audio and first person narration. The method is currently being evaluated by visually impaired audiences aiming to offer guidelines and workflows to professional productions. Mariana talked about the challenges in the production and post-production process, and discussed ways that the team overcome them.

Noisy ICUs



Above: Footsteps became an unexpected dominant noise source in ICUs during the pandemic because of disposable shoe covers worn by staff

On 23 July the Midlands Branch hosted Dr Young-Jik Lee, Senior Lecturer at The University of Liverpool, for a hybrid meeting at Birmingham City University on *Acoustic Environments of Intensive Care Units During the COVID-19 Pandemic*. Matt Torjussen reports.

The talk focused on a study in which continuous monitoring was carried out in wards and nurse stations in four Chinese hospitals where the L_{Aeq} and L_{AFmax} were recorded over three different time periods: day, evening, and night. It was found that World Health Organization guideline values were generally exceeded throughout the 24-hour period, ranging from 51.1 to 60.3 dB L_{Aeq} .

The sound was dominated by talking/voices, door-closing, and footsteps. It was particularly noted that footsteps became an unexpected dominant noise source during the pandemic because of disposable shoe covers worn by staff, which made footsteps noisier. Long-term monitoring carried out at the Royal Liverpool Hospital showed levels like this to be relatively stable over time.

Future work is planned that will include:

- sound level detection using convolutional neural networks operating on Raspberry Pis;
- soundscape analysis using an eight adjective semantic scale based on ISO 12913-2; and
- analysis of the contribution of the room acoustics of healthcare environments to the recorded noise levels.

Southern Branch

By Jack Richardson

On Wednesday 28 June 2023 our Southern Branch members were treated to a fascinating presentation by Paul Reynolds, the CEO of FSD Active Ltd, on a relatively rare technology: active mass damping. Paul gave a detailed overview of their product, CALMFLOOR which utilises active mass damping to provide an adaptable and controllable solution to vibration problems in buildings. Think of noise cancellation for structural vibration!

You may or may not have met tuned mass dampers at some point during your career, but they are often immense and seen as an unfeasible 'bolt-on' to buildings. Consequently, these are exceptionally rare and fast becoming extinct in a world where the squeeze of embodied carbon targets and building regeneration aspirations are being felt by everyone in the industry. Paul opened proceedings not only by highlighting these challenges but naming them as the primary drivers for creating the product.

Paul described how the 'first digital solution to vibrations in floors' works, in principle to reduce dynamic resonances in building structures, and was keen to corroborate his claims with real-life measurement data comparing the performance of the system with that of a bare building structure and conventional passive tuned mass dampers. The results seemed impressive, particularly when considering each unit weighs only 67kg and is small enough to be hidden above a standard ceiling.

The presentation was concluded with a discussion about the practical steps consultants can take in specifying CALMFLOOR on their projects, after which a lively Q&A followed. With their interests peaked, several members quizzed Paul to better understand the potential limitations of the product asking probing technical questions. Although the virtual format didn't allow a live demonstration of the product, it was clear the attendees were engaged with the presentation and excited about the potential for this technology – I know I was!

We'd like to thank Paul for taking the time to present to our members.



SPECIALIST GROUPS

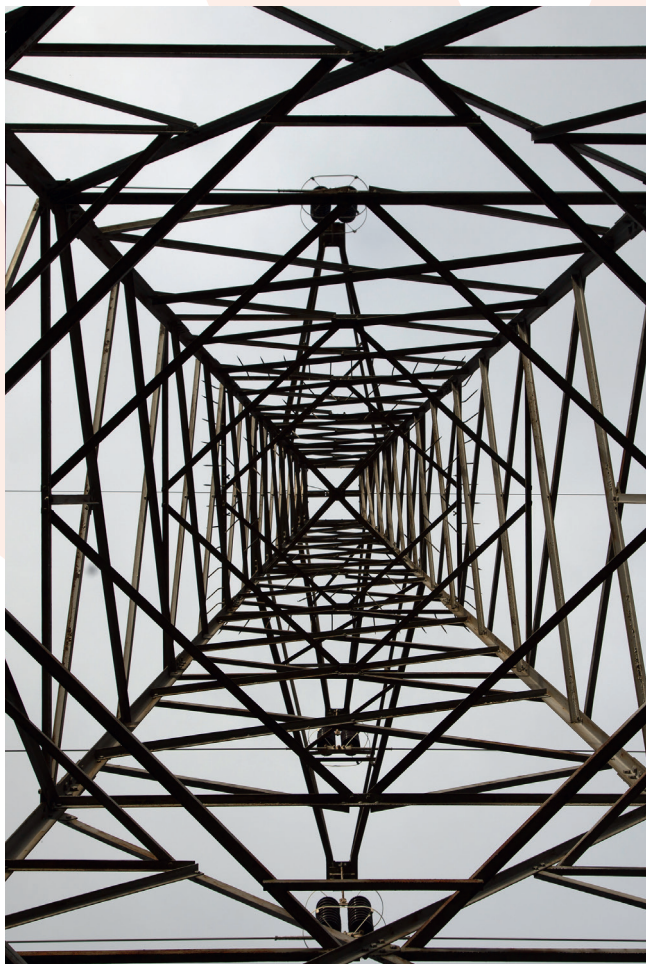
Noise and Vibration Engineering Group news

On Wednesday 20 September 2023, the Noise and Vibration Engineering Group will be hosting Richard S. Morris from National Grid for a talk entitled 'Managing Environmental Noise on the High Voltage Electricity Transmission System'.

National Grid is the largest electricity transmission and distribution business in the UK. Richard will talk through the key issues that his team faces in managing noise from the high voltage electricity transmission system which comprises around 330 substations and over 7,200 kilometres of high voltage

overhead lines across England and Wales. Richard will describe the principal noise sources which include transformers and shunt reactors and also cover issues specific to overhead lines in the context of the 'the great grid upgrade' which is the largest overhaul of the electricity grid in generations. 📍

For more information and to sign-up for the event, please visit the events page on the IOA's website at ioa.org.uk/events



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NEWS

Volunteering at the Big Bang Fair

Phil Hainsworth, associate at Atkins (a member of the SNC-Lavalin Group), is a STEM ambassador and has been volunteering at this year's Big Bang Fair.

The Big Bang Fair is the largest STEM event in the UK. Running annually over three days at the NEC in Birmingham. The event welcomes thousands of school children from across the UK to engage in STEM activities, games and career discussions. It also provides exposure to some of the UK's leading STEM employers to find out more about the exciting range of STEM careers available.

Phil said: "It is always great to visit the Big Bang Fair as the scale of the event is breath-taking, with so many interesting companies to really engage and inspire young people into a fantastic range of STEM careers.

"I am fortunate to have been to previous events where I've volunteered on careers panels, discussing what I do for my day job in acoustic consultancy and the academic routes to take.

"This year I volunteered as a robotics challenge judge, scoring the 40 finalist teams from a national school competition to build, programme and control autonomous robots using LEGO robotics sets. The competition was great as it also required an element of team work, research, presentation skills and consideration of sustainability."

The Big Bang Fair is always looking for volunteers, and you don't need to be a STEM ambassador to join in, so do keep an eye on the Big Bang Fair website where you can sign up for the newsletter to get details of next year's event as soon as they are released.

<https://www.thebigbang.org.uk/>



THE BIG BANG

Free to a good home — some acoustic equipment now of historical interest

In 1973, after Pc Bird left the British Aircraft Company where he had been using Bruel & Kjaer sound measuring equipment, analysing recordings made on Nagra tape recorders, he joined the London Borough of Hounslow's Architects' department.

Here the only acoustic measuring equipment was a Dawe 1419C sound level meter. But it did have an electronic calibrator rather than the standard falling ball calibrator of the time. It wasn't particularly useful for measuring and analysing the aircraft and traffic noise which formed the main part of the noise work, so he immediately requested a rather more sophisticated set of equipment. The response was the offer to buy just one item on the list, the calibrator.

When the GLC was closed in 1986 with it went the acoustic services of the GLC Scientific Branch and the opportunity arose for Hounslow to buy some of its own sound measuring and analysing equipment. Part of this included a CEL 393 SLM in its own case, c/w a CEL 160 trace recorder and an Epson HX-20 portable computer for long term storage and analysis of data – state-of-the-art equipment.

It was in this same year that Bird Acoustics was formed with Sue Bird as the main partner while Pc was still working for Hounslow Council. Pc Finally Joined Sue in the business late in 1993 and because the London Borough of Hounslow's Property Services Department no longer had an acoustics engineer, he was able to buy their noise equipment and bring it to Bird Acoustics.

By this time the older equipment had long passed its use by date so this equipment went into storage where it has remained until there was a need to use the storage space for something better.

Equipment list

1. Dawe 1419C SLM c/w

- Windshield
- Calibrator type 1418A (isn't that a step up from the falling balls?)
- Manual
- hv

2. CEL 393 integrating SLM c/w

- ½" mic 186/3F
- Calibrator type 172
- Accelerometer
- Box for connecting to Epson HX20 (see below)
- Carrying case with various cables

3. Epson HX-20 laptop computer (see above) for calculations and long-term storage of data

- a. Reference manual
- b. Paper and ink cartridge (probably dry) for inbuilt printer
- c. Tape cartridges

4. CEL 160 c/w

- a. Paper for printer
- b. Power supply

This old, now historic, acoustic measuring equipment is freely available to anyone to start or add to their museum collection. If you can use it, get in touch with Sue and Pc Bird by email sue@hemleyhill.me.uk or phone 01844 2775331. ☺

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Committee meetings 2023

DAY	DATE	TIME	MEETING
Thursday	7 September	10.30	Executive
Wednesday	13 September	10.30	Council
Tuesday	26 September	11.00	CPD Committee
Wednesday	11 October	10.30	Engineering
Thursday	12 October	10.30	Engineering
Thursday	12 October	11.00	Publications
Tuesday	31 October	10.30	Research Co-ordination
Thursday	2 November	10.30	Meetings
Tuesday	7 November	10.30	CCWPNA Examiners
Tuesday	7 November	13.30	CCWPNA Committee
Wednesday	8 November	09.30	CCBAM Examiners
Wednesday	8 November	10.30	CCENM Examiners
Wednesday	8 November	13.30	CCENM Committee
Thursday	9 November	10.30	Diploma Tutors & Examiners
Thursday	9 November	13.30	Education
Tuesday	21 November	10.30	ASBA Examiners (Edinburgh)
Tuesday	21 November	13.30	ASBA Committee (Edinburgh)
Thursday	23 November	10.30	Membership
Thursday	30 November	10.30	Executive
Wednesday	6 December	10.30	Council

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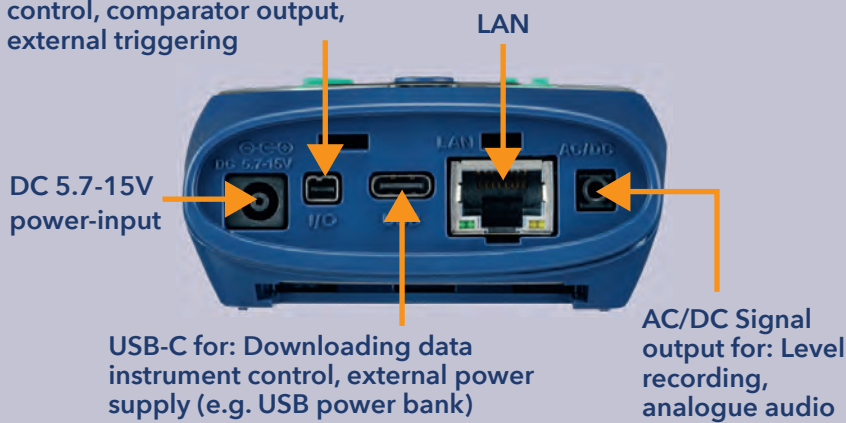


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