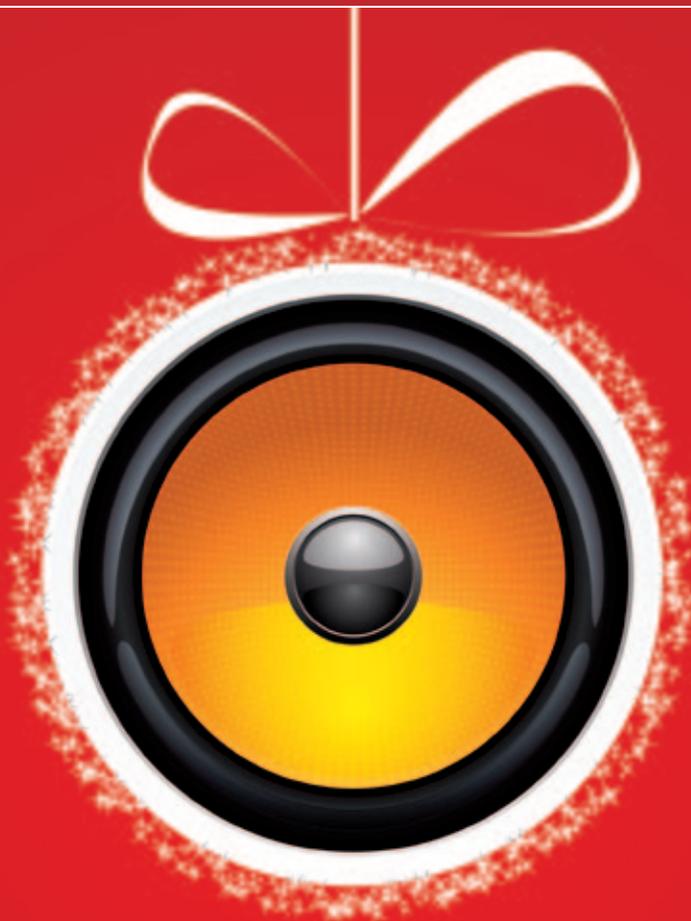




The magazine of the  
Institute of Sound and  
Communications Engineers

**December 2013**

# ISCE



**We're off to ISE, Amsterdam 4–6 February 2014**  
**Visit us on stand 7-H230**

## **Inside this issue**

**1** Introduction from our President · **1** Events diary · **2** Why are PA systems often so poor? I<sup>2</sup>M!  
**4** Institute Day 2013 · **6** ISCEx2014 · **8** Auction · **9** Canford ramp up production capabilities  
**10** Manchester Royal Exchange Theatre visit · **14** Line-array microphones  
**16** Farewell to industry greats · **17** Steve Jones FInstSCE 1952 to 2013 · **18** Standards updates  
**20** New Members December 2013 · **20** Insurance scheme · **20** Job opportunities · **21** Supporting Members

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4 - 6 February 2014  
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# Introduction from our President

Anthony Smith *MInstSCE*



**W**elcome to the December issue of "the mag" – this takes me back to when I edited it between 2004 and 2006, with the same problem of what to write!

Institute day was an interesting affair, both taking the reins from Terry, while

in another part of the south, a friend and colleague was being buried. One thing Steve Jones was passionate about was sound, and unlike many people he decided to do something about it, representing PLASA and ISCE on standards committees. While we didn't always agree on all points, we always had the consensus that things needed changing.

One of the things I will be pursuing in my three year tenure as President, is the training and monitoring of the standards we, as a learned society, are involved in; over the last six years all the standards relevant to the Institute require certificates for design, installation, commissioning and maintenance and I want the ISCE to provide training so our members can sign and issue these with confidence. The ISCE will police this, removing cover from those who complete the course and still carry on with bad practice.

I am currently drafting a plan for this to be done and will announce it at ISCEEx in March, and while it will take money to set up, it should be revenue generating and a valuable service for our members.

Enjoy the rest of the magazine, I wish you all a merry Christmas and look forward to seeing as many of you as possible at ISCEEx in March.

**Anthony** ♦

We welcome your contribution to the magazine with editorial and advertising. Please send news or articles to Ros

## Events diary

### 4–6 February 2014

Integrated Systems Europe  
Amsterdam, Netherlands

### 5 March 2014

ISCEEx Exhibition and  
Seminar Day  
Birmingham, UK

### 19 March 2014

Design & installation of  
induction loop systems  
ISCE training course  
Watford, UK

### 20 March 2014

Measurement & certification  
of induction loop systems  
ISCE training course  
Watford, UK

### 17–19 June 2014

Firex  
EXCEL, London, UK

### 13–15 September 2014

BPM/PRO  
NEC, Birmingham, UK

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Comments on articles and letters are invited.

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## Why are PA systems often so poor?

### I<sup>5</sup>M!

Peter Mapp *FInstSCE*

**W**hat is I<sup>5</sup>M you ask? Well it's shorthand for I1111M and is the reason that so many public address and emergency sound systems often fail to achieve their desired performance goals and expectations. I1111M can actually be summed up in a single word – IGNORANCE! But ignorance on so many levels and by so many people – here are some examples based on 30 years experience in this business.

**Ignorance by the client** as to what they actually want, why they want it, what is possible and what it is likely to cost. To be fair, why should most clients know what is technically achievable and what the cost implications are? Sometimes however, expectations/requirements are well beyond reality and require solutions that defy the laws of physics. On the other hand I have come across situations where the expectations were so low, that meeting them still resulted in an unhappy client as the system didn't actually serve their needs. While most clients cannot technically define what they need, most should be able to define or list what they want a sound system to do and any restrictions that may need to be imposed.

**Ignorance on behalf of the consultant, specifier or system designer.** There are some very good consultants and designers out there but far too many systems are 'designed' or specified by people operating well out of their area of expertise. Mechanical and engineering consultants would be a good example of this. Simply quoting a bunch of standards and codes that a system has to meet is not a system design – though such a document can be made to look quite impressive to the uninitiated. Alternatively there is the tried and tested 'cut and paste' approach whereby parts of a spec that has been put together by a competent designer are copied into a new 'amateur' document – which might explain why one 'spec' I saw recently required there to be a microphone socket in the middle of a swimming pool (the wet bit). But ignorance of electro-acoustic design is not limited to those outside this industry. On far too many occasions have I witnessed the result of a so called 'audio engineer's' ignorance and the mystified expression on his face wondering why a system didn't sound right/wasn't intelligible. The first

thing normally to blame are the acoustics, then the loudspeakers, the amplifiers, the microphone and finally the budget – never the ability of the engineer himself. Yes room acoustics can (and do) play a significant part in the overall result. It is why it's called electro-acoustics. If the effects that the acoustics of a space can have on a system and how to take this into account are not understood, then the person designing or specifying the system shouldn't be. That doesn't mean to say that every installer/designer needs to be an acoustic expert – but they need to know the basics and the effect that acoustics can have on a system's performance. The point here is knowing what you don't know and thereby knowing when to ask for more expert help.

**Ignorance by the architect.** This is an easy one to claim (and I often have). But is it reasonable to expect an architect to understand the effect of their building's design might have on the sound system and acoustics? I would like to think that they should have an inkling and at least be prepared to listen to reason or an expert view. Indeed some do. Unfortunately when the 'expert' that they are listening to is the uninformed electrical consultant, then a recipe for disaster is in the brewing. Furthermore, there are a remarkable number of ignorant acoustical consultants out there who think they understand sound system design – but demonstrably do not, but that's another story.

There is, of course, a breed of architects who do not want to listen to anybody. The task is to make them. Agreed, that's easier said than done, but architects are not stupid (well most aren't) but are intelligent design professionals. The problem needs to be set out in a logical and understandable fashion. Forget trying to bamboozle them with technical terms and rhetoric – that won't work but a well-reasoned and logical explanation of the problem often will – though I have to admit – not always. This is then the time to resort to reminding them that there are standards and codes to be met if the building is to achieve its license from building control/the fire officer etc. You have to stand up to architects – all too often they get their own way to the detriment of the acoustic environment/

sound system performance. Why? because they have not fully understood or been made aware of the implications of their design. The problem is often one of trust and communication. You have to learn how to communicate with an architect and they have to learn to trust you and your ability/expertise.

**Ignorance by the user.** The users/operators of many sound systems really do not understand the system they have and how to properly operate it. Folklore and myth abound which can result in a far from optimal performance. Then there is the "I know better" mindset, often belonging to the local audio 'expert'. (Rewiring the loudspeakers in a space with a 2-second reverberation time with oxygen free cable is unlikely to resolve a speech intelligibility issue). Using the microphone correctly would also sort out many sound system problems – as would optimising the gain structure.

**Ignorance by the bean counters insisting on taking the lowest quote or demanding a cheaper price.** Whereas you do not always get what you pay for, when a bid is submitted that is half the other three,

then common sense says don't believe it – what have they missed out? What corners are being cut? Unfortunately bean counters rarely think like this.

**Maintenance.** Many perfectly reasonable systems don't work correctly because they have not been maintained. These days, systems rarely go wrong on their own accord – particularly, if correctly designed so that they are not working at the limits of their intended range. Human intervention or interference is more often than not the root cause. Building maintenance crews accessing ceiling voids and disturbing cables is probably the most common problem but failure to maintain appropriate cooling of equipment rooms or spaces causing amplifiers to overheat is another common issue. Not maintaining or checking batteries is also a regular cause of system failure. Electronic systems/processors and components can and do fail but with regular maintenance and checks, such problems can be minimised – though not eliminated. So next time you hear a poor sounding sound system – **just think I<sup>5</sup>M.** ♦



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# INSTITUTE DAY 2013

Thursday 24 October 2013 · Park Inn Hotel, Watford



Our guest speakers for this year's Warren-Barnett Memorial Lecture were Peter Mapp, Gordon Morris and Doug Edworthy, who gave a lively lecture on 'Assistive Listening and then some' – focussing on the design, effectiveness and end user requirements of assistive listening systems.

Terry Baldwin *HonCompInstSCE* introduced the AGM and after serving as President for the last four years, handed over to the new President, Anthony Smith. Anthony's term of office will be for a further three years, and he will be assisted by the newly appointed Vice President, Phil Price.





An engraved cut glass beer tankard was presented to Terry Baldwin and an engraved pen case to Bryan Robinson, for their exceptional services to the ISCE. Bryan will now be stepping down as a Council member, but will continue as a Director and heading up the Finance Committee.

Our thanks also go to Cunnings Recording for helping out with the PA and recording on the day.

The 2013 AGM minutes can be found on the members' area of the ISCE website.



# ISCEx2014

## Networking Dinner

Tue 4 March 2014 · 7pm

ISCE will be hosting a networking dinner on the eve of the exhibition and we would like you to join us.

Why not book a table and invite your customers along, to give them a chance to preview the exhibition in an informal setting. Guests can mingle with the good company of industry friends and colleagues.

Pre-dinner drinks from 7pm.



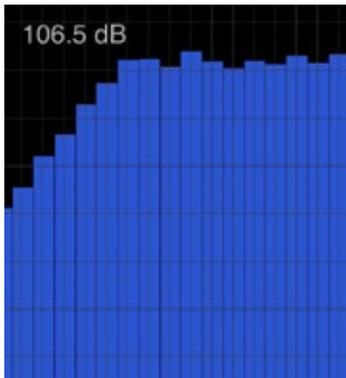
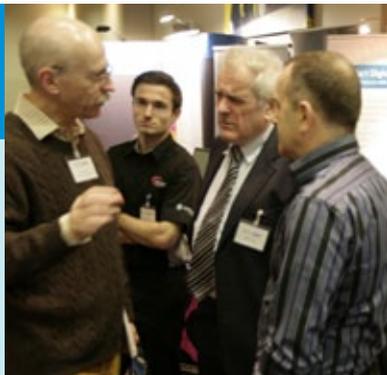
## Exhibition and Seminar Day

Wed 5 March 2014 · 9.30am–5pm

### Mix with the best in the business

At the most relevant event in the sound industry calendar, you will meet the people that matter most to your business, with informative seminars led by industry experts, running alongside the exhibition.

Free entrance to the exhibition and seminars.



# ISCE

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## Seminar programme

10am

### **Signal to amplifier to loudspeaker – I thought it would be louder**

**Tony Stacey · Acoustic Consultant, AMS Acoustics**

Usually the signal you want to amplify in the real world is not the same as the signal used to rate an amplifier's power output capability.

Different bandwidths, frequency response and crest factors all have to be taken into account.

This presentation takes a look at some real world signals and the sound pressure levels you should expect at the output of loudspeakers.

11am

### **Increasing the intelligibility of computer-generated text-to-speech**

**Cassia Valentini Botinhao · Research fellow, The Centre for Speech Technology Research, University of Edinburgh**

Text-to-speech (TTS) systems provide speech output for dialogue, announcement, and reading applications as well as personalised voices for people that have lost the use of their own. TTS systems are built to produce synthetic voices that should sound as natural, expressive and intelligible as possible and, if necessary, be similar to a particular speaker. Although naturalness is an important requirement, providing the correct information in adverse conditions is probably even more important in certain applications.

This presentation will show a variety of strategies that increase the intelligibility of TTS voices in additive noise. These include using recordings of natural speech produced in noise to train the system, or exploiting what is known about the auditory processing of speech in noise to generate speech that is easier to understand for the listener. It will also cover how each strategy works, their effect on subjective intelligibility and how they can be combined to create a synthetic voice that is highly intelligible in a wide range of noisy conditions.

**The special rate of £80 B&B at the Holiday Inn is only held until 11 January, so ensure you book early to avoid disappointment. Please book by telephoning central reservations 0121 634 6200, quoting ISCE**

2.15pm

### **Design and supply of loudspeakers for the Royal Navy and Army – not quite your home environment**

**John Moore · Director, Secomak Ltd**

The Company, Vitavox was started in the 1930s by Leonard Young an ex Merchant Navy Seaman who also ran a radio repair shop. Len knew that naval loudspeakers of that time were inadequate for the job and on-board ship 'the pipes' are critical.

Vitavox still supply loudspeakers, microphones, handsets and headsets used by the Royal Navy and have recently started supplying equipment to the Army as well.

This presentation will cover the compact submarine loudspeaker which is set on the bridge fin of a submarine that is outside the pressure hull and so has to withstand immersion in water down to 700 metres (69 atmospheres – half a ton per square inch) and still operate when it returns to the surface. After a recent major redesign, the new unit, still using the same basic principles, is now on the Astute class submarines.

This presentation will also cover the concept for supplying a military grade public address system to the latest class of armoured vehicles due to go into service with the Army in 2016 and how we became contract award winners. Our strap line was 'shout before you shoot'.

3.30pm

### **Is two-dimensional beam steering the best audio solution for difficult acoustical environments?**

**Jan Leerschool · International Sales Manager, Pan Acoustics GmbH**

Very often it is shown that a digitally beam steerable loudspeaker system can solve many problems for speech intelligibility in acoustically difficult areas.

Some systems offer a single beam-technology, some offer a multiple beam-technology.

Today, there are some manufacturers having two-dimensional beam steered systems in the market. Can these systems offer an all-round solution or are they specifically designed for special applications?

This presentation will look a bit deeper into this technology; what is behind it and what do they have to offer.

---

# For sale at ISCEEx2014 by auction

5 years of *Public Address* magazine from 1977 to 1981

**Ron Walker** Trustee and Charity administrator

The auction is in aid of the two registered charities, Public Address Engineers Benevolent Fund and the Alex J Walker Memorial Fund.

## What's being offered?

Five A4 bound volumes of *Public Address* magazines, which make an excellent reference for the period. It includes many Technical Matters reports by Haydon Warren, thought by many to be the best writer/reporter our industry has ever had. It also has reports by Frank Poperwell, who was with GEC then Reslo and later Deritron. Many of his samples are now with the PA Museum at Norwich. John Weed wrote about the Association in many editions. The Volumes include many new product reports, and advertisements, which give a great sense of history.

## A brief review of each volume

This is just a flavour of the articles within the volumes. There is so much more to read.

### Volume 20 – 1977

- The office was at Windsor Road, Slough and the Secretariat was Douglas Joyce
- The President was Bernard Skinner
- The Sound 77 exhibition was held at Wembley
- Herb Jaffe of Atlas Sound wrote about hearing above the roar of the crowd
- A New BBC Outside Broadcast Van was reviewed for BBC Radio
- An article about Loudspeakers, screens and projectors

### Volume 21 – 1978

- Harold Smart was President
- The 29th Annual Report & Accounts
- A profile of John Goodwin, who was with STC then ITT and later with PYE
- Articles; The cats whiskers and domestic radio in 1920s
- Health & Safety, – new regulations!
- AES 59th convention report by Percy Gander
- TOA's first year in UK

### Volume 22 – 1979

- John Mordaunt of PYE became President
- The Exhibition "Sound 79" moved to the Cunard Hotel, Hammersmith, London
- The best sound system by –Elecrovoice
- An ASCE joint venture to New York
- The human ear by Frank Poperwell
- Voice internal systems in submarines from Plessey Communications

### Volume 23 – 1980

- Phil Page is President
- A report on the Inaugural meeting of the ISCE by Ken Walker
- Measuring Microphone by Percy Gander
- Audio at Rock Concerts by Ken Dibble
- 100 Volt Line systems by Percy Gander
- Speech Equalisation by Hugh Brittain
- A Sound Invention by John Goodwin
- Loudspeaker measuring by Percy Gander

### Volume 24 – 1981

- Douglas Joyce dies in office and Ken Walker takes over
- President holds a reception for the Charities
- Induction loops in public places
- Opto electronics by R Nightingale
- York Minster – sound system by Hugh Brittain
- PA for 1.25 million by Haydon Warren
- Radio frequency interference by Ron Glaisher
- Wakefield Cathedral by RB Dunbar
- National Wireless Museum

## Information

Viewing will take place on the evening before and during the morning of the exhibition. The auction will be conducted by Terry Baldwin, ISCE's immediate Past President and trustee of the charity and will take place after the lunch break and before the afternoon seminar session.

If you wish to bid and are unable to attend ISCEEx2014 at Birmingham on 5 March, you can make a sealed bid offer to the ISCE office, please mark the envelope 'sealed bid' and it must arrive by 3 March.

Gift Aid can be recovered if the highest bidder is a UK tax payer.

Payment by cheque or cash (sorry no cards). ♦

## Canford ramp up production capabilities



**C**anford's order book has gone from strength to strength, particularly with a growing demand for bespoke cables and other own brand manufactured products such as MDUs, Tecpro, EMO and Panamic boom poles. In order to maintain the outstanding quality and reliability of their products, Canford have made significant improvements within its manufacturing facility.

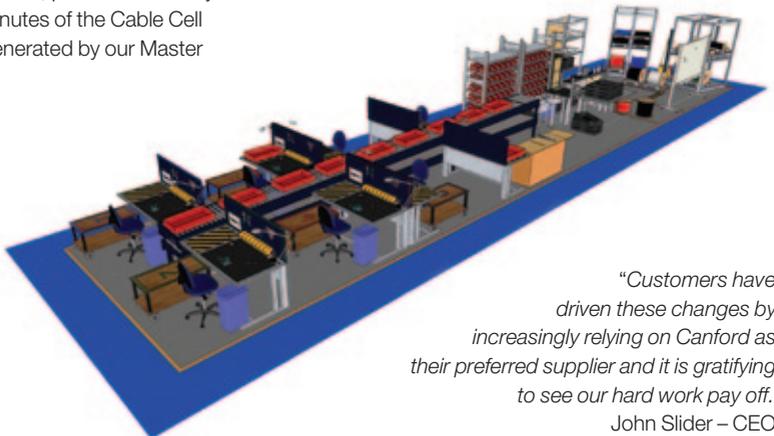
The first major change was to create a Rapid Response Cable Cell which was developed to allow both custom and non-stock cable assemblies to be quickly produced, reducing customer waiting times. To do this a Kanban scheduling system of 'just in time' production was implemented, which means that the top 80% of most commonly used components are always available. To further aid production, the work areas adhere to the 5S methodologies (sorting, straightening, systematic cleaning, standardisation and sustaining) which is monitored and scored on a daily basis. Depending on cable type, cable assemblies can be produced, packed and ready for shipping within 20 minutes of the Cable Cell receiving a picking list generated by our Master Scheduling Team.

Building on the success of this Rapid Cable line, similar cells have now been introduced for other product lines, which have benefited from increased output and reliability. The MDU (main distribution unit) cell has increased average unit production from 21 units to 38 units per cell, per day. Other cells include Tecpro and EMO with further cells currently in the planning phase.

Canford has an enviable reputation for the excellence of its manufactured goods, which is reflected in the standard 2-year warranty on all Canford made products. Improvements in output must not impact on reputation. To ensure quality is maintained, a Production Support Team has been created consisting of qualified engineers who can help train production staff if they encounter any issues, production operators are IPC qualified and two of the production team leaders are fully qualified IPC trainers.

*"We pride ourselves in offering our operators a structured and consistent working environment, with production support readily available at all times"*  
Kerry Storey – Production Manager

Other initiatives include the creation of a Looming Station, where all internal wiring components are prepared and tested in advance of build-up, an upgrade to the planning system and the introduction of a Master Scheduling department. The combined effect of all these changes and hard work has not only increased production capacity while maintaining quality standards, but has seen our production scheduling maintain a 100% completion rate for over 4 months. ♦



*"Customers have driven these changes by increasingly relying on Canford as their preferred supplier and it is gratifying to see our hard work pay off."*  
John Slider – CEO

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# Manchester Royal Exchange Theatre Visit

15 November 2013

Jim Smith *MInstSCE*

**A** tour of the Manchester Exchange Theatre on Friday 15 November rounded off a fantastic week for electro-acoustic indulgence. The tour marked the finale of the Institute of Acoustics Reproduced Sound Conference 2013. The Conference 'delivered', proving yet again to be a truly stimulating and informative experience with the usual exceptional standard of papers and with the added bonus of tours of BBC and Salford University facilities at MediaCityUK.

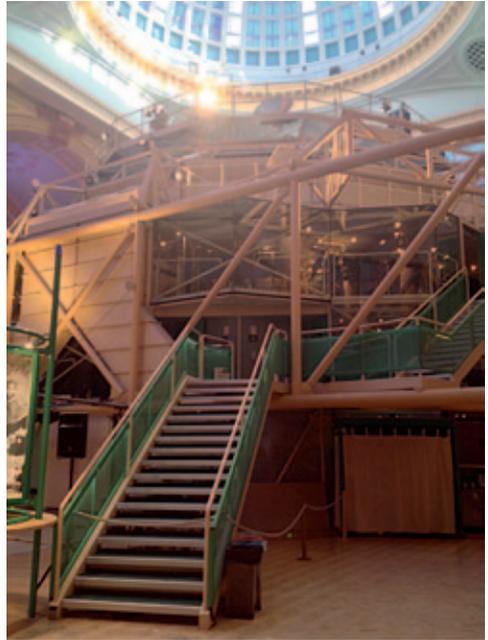
Perhaps most importantly for the ISCE a joint venture to the Manchester Royal Exchange Theatre marked what is to be the fore-runner to future regional events. This is something which ISCE Council has been discussing for some time now and hopefully this will inspire members throughout the UK to take the initiative and suggest opportunities for future regional events.

The Royal Exchange Theatre Company was established in 1976. Its home, the Manchester Royal Exchange Theatre is housed within a third of the Great Hall of the Victorian Cotton Exchange. This was reputedly the largest trading hall in England at the time, trading primarily in cotton and textiles and earning it the name of 'Cottonopolis'.

The building has been severely damaged on two separate occasions. The first was caused by a direct hit during an air raid at Christmas 1940, whilst more recently it was damaged in 1996 when an IRA bomb exploded less than 50 yards away. The building was repaired at a cost of £32M of which £1M was set aside for a state of the art audio system.

The Theatre structure is unique in that it is a steel and glass module sitting within the Grade II listed building. Owing to load restrictions (250kg/m<sup>2</sup>) the module is suspended from four structural columns and only the stage floor and lowest seating are supported by the structural floor.

To many, the structure is reminiscent of the lunar landing module and with a seating capacity of around 700 – 750 it is the UK's largest theatre in the round. It has operable panels in the walls and roof to allow direct coupling of the theatre to the larger acoustic volume of the trading hall in which it sits.



**The Theatre is reminiscent of the Apollo lunar landing module**

This feature is used to good effect to provide ambient sound effects either from the two permanent install Electrovoice full range cabinets mounted high up in the dome and/or through strategically located temporary installations in the 'atrium' which also capitalise on the space's natural reverberation. However, this also means that extraneous noise from bar staff, technical equipment and stage crew needs to be carefully managed or accepted as an integral part of the Theatre's operations. Indeed the original design ethos was that the theatre be honest and transparent, so much so that patrons are treated to glimpses of what would typically be behind the scenes at other venues. In fact the front of house and back of house areas at MRE are the same architectural space.



**Props used in the production of Sweeney Todd assembled in the atrium space**

Props, scenery and technical equipment are located in the atrium with props and scenery brought in and out on a moving floor/track operated by draw cables. Furthermore, ushers double as stage crew and open and close doors to the theatre space to allow actors to enter and exit stage when prompted by cue lights and in line with the script. Certain doors are fitted with magnets which trigger attenuation/muting of the show relay system so as to avoid confusing the audience.

Owing to its heptagonal geometry, the theatre favours immersive audio and the install certainly delivers this.

The house system is a fully analogue system comprising around 70 MeyerSound cabinets in combination with a number of JBL Control 1 and Control 23 loudspeakers and a correspondingly impressive number of patch points located both within the module and trading hall (apparently a patch-box is never more than 9 feet away).

A Cadac J-Type mixing console coupled with Labgruppen Quad amplifiers and Meyer P1, M1A, B-2 and S-1 processors provide an extremely flexible and configurable processing and routing system.



**Cadac J-Type mixing console in the main control position**

Loudspeakers are generally driven in groups of 6–8 corresponding to the seating blocks at each of the three levels. Where required this grouping facilitates stereo imaging (eg notional 'L' and 'R' channels are formed through alternate blocks eg 1 & 3 and 2 & 4). Individual loudspeakers can also be isolated to provide locations for 'spot' effects.

The Theatre is currently showing Sweeney Todd and our resident hosts, Deputy Head of Sound Sorcha and Sound Technician Dave were joined by Owen Lewis, Sound Engineer for the show who explained some of the concepts developed by the show's Sound Designer Richard Brooker and how these had been adapted for theatre in the round.

The show previously played at the West Yorkshire Playhouse where the performers had to project and where the band was relatively 'remote' from the stage. Performers aren't normally miked at the MRE. However, the intimate nature of the MRE and the proximity of the band located to one side of the theatre at Level 1 warrant the use of close miking. The central 'basket' suspended above the stage floor accommodates seven MeyerSound UPA cabinets and the whole rig can be set at three height positions. Sound absorbing baffles have been installed to the rear of the UPAs which it is claimed improve headroom/gain before feedback.

The 'band' is reinforced with two Meyersound UPJ cabinets each side of the balcony front. Additional fills are provided around the theatre and whilst these are the same UPM model as those used for vocals, they are aimed and time aligned to ensure that the audience perceives an accurate sense of localisation relative to the band position.

Owing to the seating layout fills are also required for those stage level seats closest the stage which are off axis of the basket UPAs and which aren't covered by the smaller UP1s. For Sweeney Todd small time aligned Meyer MM4 loudspeakers are installed behind grilles set into the stage floor. ▶



**Front fill loudspeaker mounted behind grille in floor cut-out**

Lack of opportunity for traditional scenery means that audio plays an even bigger role in setting the scene or 'delivering the experience' (the main theme behind RS2013). This often requires novel approaches to the sound design. Often this includes subtle, almost innocuous ambience but also more prominent sounds from what are known as 'practicals'. These are understood to be props used by the performers (or more accurately 'perceived' to be used by the performers in some cases).

A number of examples included:

A 1970s upright organ which appears to be played by an actress but is actually played real-time by a musician. The organ has been retrofitted with a 12V car amplifier and batteries. The amplifier receives a signal from an in ear monitor transceiver and is wired to the organ's original loudspeakers.

Similar hardware is used to drive a Tannoy loudspeaker in the engine bay of a Reliant Robin to recreate engine noise.

A gramophone with remotely controlled motor driven turntable, artificial stylus and small drivers installed in the throat of the original horn is linked to an in ear monitoring system.



**Inside the organ showing the 12v amplifier/battery set-up**

In addition to the ambience created by the EV dome loudspeakers, supplemented as and when by temporary installations in the atrium, a series of JBL Control 1 cabinets aimed at the outer glazing provide additional reflected ambient sound.



**There are obvious restrictions regarding fuel and fumes etc so the engine is replaced by an in-situ amplifier and loudspeaker which receive audio input from a wireless in ear monitoring device**

Overall, the technical systems at the MRE are extremely versatile, employing novel and innovative features and techniques developed by a clearly talented and knowledgeable technical staff.

The Theatre and staff pride themselves in sharing knowledge and experience and offer public and private tours in addition to ongoing community liaison and educational programmes. More information can be found at [www.royalexchange.co.uk](http://www.royalexchange.co.uk)

Hopefully, this review will act as a stimulus for future regional events. The ISCE has a few ideas for events in the North West but would welcome suggestions from members around the UK for future visits, tours, presentations, discussion workshops etc in your region.

Please get in touch with Ros Wigmore or Jim Smith ([jim.smith@aecom.com](mailto:jim.smith@aecom.com)) if you have any suggestions or would like to take an active role in organising events in your region.

Thanks to: Sorcha, Dave and Owen at the Royal Exchange Theatre, John Taylor of IOA and Jim Gilroy of ISCE who both liaised with the Theatre to organise this event. ♦



## VSA 2050

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  - **20 x 50W CLASS D AMPLIFIERS**
- DRIVEN BY DSP HIGH CAPACITY POWER SUPPLY



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SPEAKERS**  
WITH FULL CONTROL

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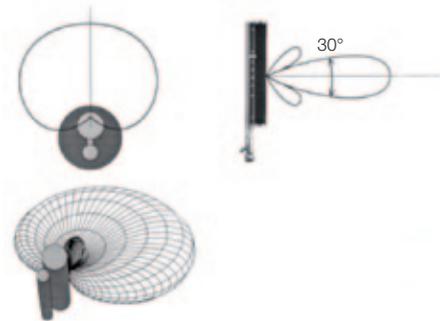
# Line-array microphones – their applications & improving their low frequency directivity

John Willett *MInstSCE* Sound-Link ProAudio Ltd

Based on original research by: Sebastian Goossens – Institut für Rundfunktechnik GmbH, Munich, Germany

The line-array microphone has been used successfully in many applications where greater control of the directivity is required.

In order to separate the wanted sound from the unwanted, a pronounced directional characteristic is needed. In many cases, the standard microphone patterns: cardioid, hyper-cardioid, figure eight, etc., are not really suitable as they pick up as much in the vertical plane as they do in the horizontal plane. Line-array microphones have a non-rotationally symmetrical directivity characteristic (see diagram 1), which can be very advantageous in such cases. In the horizontal plane, line-array microphones have a cardioid polar pattern. In the vertical plane they have a narrow 30° acceptance angle for better rejection of off-axis sound. This means that the microphone is insensitive to reflections from the ceiling or table and is an ideal tool in acoustically awkward situations. For several years, a line-array microphone called “KEM” (Cardioid Plane Microphone – in German: “Kardioid-Ebenen-Mikrofon”) has been used successfully.



**Figure 1** Directivity of the KEM microphone  
Top left: plan view – cardioid polar-pattern  
Top right: side view – 30° acceptance angle  
Bottom left: 3D illustrative diagram

As a speaker’s microphone at a lectern, the KEM has proven itself over many years; for example there is a pair in the plenary assembly hall of the German Bundestag. Here they supply the sound for parliamentary television broadcasts as well as for the public address system in the chamber. The orators

have freedom of movement in the horizontal plane, without the fear of sound fluctuations in level or tone. In the vertical plane, annoying reflections from the room and possible feedback from the PA system can effectively be suppressed.

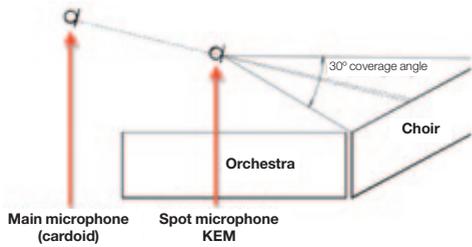
A recent use has also been to place the microphone horizontally on the desk of, for example, the Mayor in a council chamber. This use means that they can be heard clearly whether sitting or standing, but can speak to someone sitting next to them in confidence without being picked up. In this case the directivity would be cardioid in the vertical plane with a very narrow horizontal plane.

In high-quality video conferencing systems, all the conference participants can be picked up by a single line-array microphone. All the delegates round the table are equally covered, even those at the extreme ends. Speech intelligibility is excellent because the unwanted reflections in the vertical plane (ie: from the table and ceiling) are rejected. Overall, a very natural dialogue is achieved; with the added advantage that, because individual microphones are not needed, the delegates forget the microphone is there and just converse naturally. This application does away with the need for an expensive delegate microphone system, where the delegates are always aware of the microphone in front of them (sometimes with the need to press a button to speak) and results in a more natural conversation and a more effective discussion. These are already in use in prestigious organisations in the UK, Europe and further afield.

Another use is as a theatre microphone; the KEM line-array microphone can be used to pick up the action on stage. For example, in a classical gala on ZDF in Germany, line-array microphones were placed along the edge of the stage, so as to pick up the singing of the many performers who freely moved about the stage while singing. The directivity of the line-array meant that floor noises and reflections are rejected by the microphone.

The KEM line-array microphone can also be used as a spot microphone for recording live performances. For example, a pair can be used for a choir who are

above and behind the orchestra. The line-array, with its narrow vertical angle, can pick up the choir while rejecting the sound of the orchestra (diagram 2).



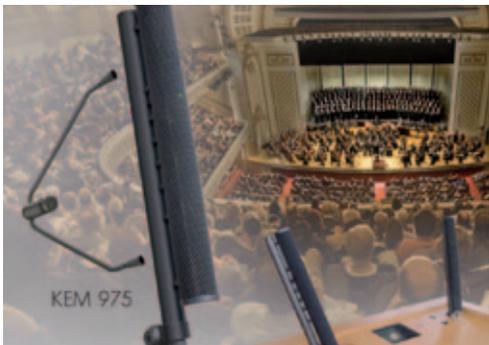
**Figure 2**

It is in this situation where the deficiencies of the standard line-array can be heard. The 30° acceptance angle holds very well down to about 630Hz, but below this frequency it opens out into a normal cardioid pattern and can be susceptible to the bleeding through of the low frequencies from the orchestra. This is due to the length of the microphone – the KEM 970 has a 28cm spacing for the capsules that are used for the bass end which limits the low frequency directivity. A much longer length would enable the directivity to be maintained down to lower frequencies (for example, a length of 170cm is needed to keep the directivity down to 100Hz), but this would make the microphone unwieldy and impractical.

So, another solution had to be found....

Research done by Sebastian Goossens at the Institut für Rundfunktechnik in Munich in Germany has come up with a novel solution that keeps the length of the microphone the same, but narrows the directivity at low frequencies.

The solution is to add a 'Delta capsule' behind the microphone. This is filtered and polarity reversed and added to the main array. This vastly improves the directivity at low frequencies and makes the KEM far



more suitable for choir and orchestral work.

This 'Delta capsule' is an option that can be fitted or removed as required. So, for normal speech use (For example, on a lectern or in video conferencing) it is not needed, but can easily be attached for musical work.

Microtech Gefell's new KEM 975 incorporates this new 'Delta capsule' and further improvements in the microphone have also lowered the noise floor.

Of necessity, this article has been kept to a reasonable length and has not gone into too many technical details. However, a more detailed explanation can be found in the paper I presented at the Institute of Acoustics in November 2013. A PDF of this paper is available on the Sound-Link website, together with a Powerpoint slide with embedded sound files that demonstrate the directivity of the microphone with and without the 'Delta capsule'. These can be downloaded by typing this link into your browser: <http://tinyurl.com/kem975>

This takes you to the KEM 975 page on the Sound-Link website, which also includes more photographs and a detailed description. ♦



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## Farewell in 2013 to sound industry greats

### Amar Bose

November 1929 – July 2013

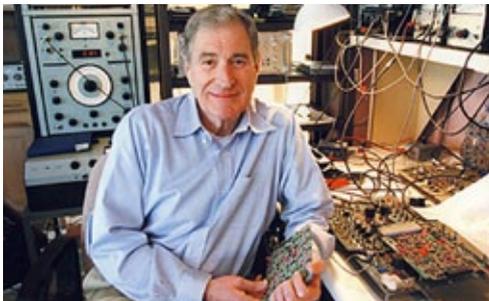
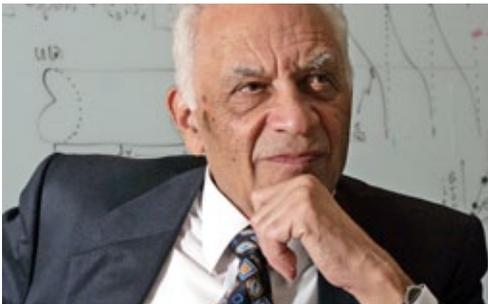
Founder of Bose Corporation

**A**mar Gopal Bose, born in Philadelphia, was the son of an Indian immigrant who ran an import business.

Enrolling at the Massachusetts Institute of Technology (MIT) in Boston, Bose earned three degrees in Electrical Engineering, including a doctorate. In 1956, invited to join the teaching staff, he accepted with the intention of staying for two years at most. In the event he remained a faculty member until 2001.

He had begun his studies of audio quality in the 1950s with a research programme into physical acoustics and psychoacoustics – the way in which we perceive sound. The work ultimately led to a technical revolution in acoustics and electronics, which eventually saw his firm, Bose Corporation (founded in 1964), grow into America's largest loudspeaker manufacturer, with more than 8,000 staff and annual revenues of more than £1.1 billion.

Bose's awards and honours included a Fulbright postdoctoral scholarship, membership of the National Academy of Engineering and the American Academy of Arts and Sciences, and a fellowship of the Institute of Electrical and Electronics Engineers.



### Ray Dolby OBE

January 1933 – September 2013

American engineer and inventor of the noise reduction system known as Dolby NR

**R**ay Milton Dolby, born in Portland, Oregon, was the son of a real estate salesman.

Dolby grew up tinkering with mechanical things, and developed an interest in film-making that changed his life. Alex Poniatoff, founder of the video and audio-recording firm Ampex, asked Dolby's high school for a projectionist for a talk he was giving, and Dolby volunteered. The 16-year-old wanted to be a cameraman and had put together his own rig. Poniatoff recognised his talent and invited him to work for Ampex, which had developed the first commercial audio tape recorder and was now working on a video version.

He made major contributions, and filed his first patent at the age of 19. Eventually he held more than 50. Dolby left Ampex when he graduated from Stanford University in 1957. He took a Marshall scholarship to study for his PhD at Cambridge, sailing for Britain on the Queen Elizabeth.

In 1965 he set up a firm in London to sell Dolby equipment to recording studios. Success came with Decca Records, which ordered the first nine Dolby A-301 professional noise-reduction units at £700 each.

Dolby transformed the film industry by improving sound quality with his Dolby A noise-reduction system, widely installed following the popularity of Star Wars and other films by George Lucas. He also had a huge impact on the tape-cassette business thanks to the almost universal adoption of the consumer version, Dolby B.

Public recognition for Dolby's work included a US National Medal of Technology, two Oscars for scientific and technical achievement, several Emmys, a Grammy, an honorary OBE and a star on Hollywood's Walk of Fame. ♦

**Top**  
Amar Bose

**Left**  
Ray Dolby OBE

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## Steve Jones *FInstSCE* 1952 to 2013

Roland Hemming and Jim Griffiths



It was with great sadness to report that Steve Jones died in October, after a short illness.

Steve was an internationally renowned audio

consultant working on projects such as Millennium Dome, Wembley Stadium, Millennium Stadium, Ascot Racecourse and Tel-Aviv opera house.

In addition to project work, he was also very active in helping with Standards. He was instrumental in creating BS7827 sound systems at sports grounds. He also worked on BS5839-8 the code of practice for voice alarm. More recently he was working on revisions to the EN54 standards.

His 45-year career started at EMI, initially working on defence projects. Steve helped build the sound mixers for Abbey Road including the TG12345 – the first transistorised mixer. He also worked with Peter Dix, measuring reverberation time. This was for the design of the (successful) mushrooms at the Royal Albert Hall.

He was asked to deliver some parametric equalisers to Abbey Road and was about to leave when the engineer told him to wait 'until John was happy'. He applied for a job there and worked as a tape editor. Since he could read music, he was assigned classical work which he found 'boring'.

After EMI he worked for Ferrograph selling multitrack tape recorders and then from there to Hayden Laboratories selling Telefunken (maker of the first 48 track) Sendor, and Sennheiser.

After that worked he for Electrosonic, for seven years. Steve was the only pure audio person they have ever employed. With significant funding from the arts council he did many theatre projects for them, looking after the sound and communications. This work then took him all over Europe.

Starting up on his own his first job was for Cable and Wireless and found himself bidding against Electrosonic for a job in the Middle East. With his BBC Model B computer he used C&W's 'Easy Link',

one of the first ever email systems. Because he could respond much more quickly he won the job.

Whilst working in Hong Kong he can boast of being arrested more than 20 times in one day. He was conducting sound tests at the Hong Kong Stadium and each time he did a test he was arrested for making too much noise, taken to a side room where, each time, he subsequently proved he was below any limits.

At the IOA reproduced sound conference in the late 80s, he met Jim Griffiths. Steve was armed with the half-written spec for Tel Aviv Opera House. Jim asked if Steve could design the system for Wembley Stadium.

Through the 1990s, he worked with Jim at Travers Morgan, who became Symonds Travers Morgan then Capita, eventually becoming an employee. The alias 'Griff and Jones' trick worked on many projects – Millennium Stadium Cardiff, Twickenham Stadium, Ascot Racecourse, the Millennium Dome and many more.

In recent years he worked for himself again.

Always willing to speak his mind he recently reiterated some of his thoughts on the industry. 'People get the standards they deserve' he said. Commenting that many companies complain about standards like EN54, but did not try to get on the committee. He also said that 'attendance from audio people at committee meetings was often poor. The reason why we get fire orientated standards is because fire people attend.'

He also said that it was possible that 'every UK stadium is possibly illegal', referencing the fact that none of the standards set a tolerance for load monitoring of loudspeaker circuits. 'If you follow the rules of the current standards you risk losing too many loudspeakers but still thinking your system is ok.'

Those of us lucky enough to know him got to know a kind, intelligent man who truly cared about the people he worked with and the projects he worked on.

RIP Steve. ♦

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## Standards updates

CEN TC 72 WG3 has started preliminary work on the revision of EN 54-16 and -24. This work is intended to include 'active' loudspeakers such as steerable line arrays.

Anyone who is interested in contributing should contact Andy Scott via [info@isceorg.uk](mailto:info@isceorg.uk) and he will send you the official comment form.

Public drafts will be made available via BSI in due course (1 to 2 years) and this will provide another opportunity for anyone with an interest to comment.

### Relevant Standards for the sound industry are:

#### AFILS

##### **BS 7594:2011**

*Code of practice for audio-frequency induction-loop systems*

Go to <http://shop.bsigroup.com> and enter 7594 to get the current status.

ISCE Members on committee:

Andy Scott, Doug Edworthy, John Woodgate, Peter Mapp, Anthony Smith, John Rawlins and Russell Simpson

##### **IEC 60118-4:2008**

*Electroacoustics  
Hearing aids.  
Induction loop systems for hearing aid purposes.  
Magnetic field strength.*

New version currently in final committee drafting.

Go to <http://shop.bsigroup.com> and enter 60118-4 to get the current status.

ISCE Members on committee:

Doug Edworthy, John Woodgate, Russell Simpson and Richard Dungan

##### **IEC 62489-1:2010**

*Electroacoustics – Audio-frequency induction loop systems for assisted hearing  
Part 1: Methods of measuring and specifying the performance of system components*

Being amended to include recent new technologies used in association with hearing aids for assistive listening.

ISCE Members on committee:

Doug Edworthy, John Woodgate and Richard Dungan

##### **IEC 62489-2:2011**

*Electroacoustics – Audio-frequency induction loop systems for assisted hearing  
Part 2: Methods of calculating and measuring the low-frequency magnetic field emissions from the loop for assessing conformity with guidelines on limits for human exposure*

Being revised to take into account new international recommended exposure levels.

ISCE Members on committee:

Doug Edworthy, John Woodgate, Richard Dungan

#### Voice alarm

##### **BS 5839-8:2013**

*Fire detection and fire alarm systems for buildings  
Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.*

##### **BS EN 54-16:2008**

*Fire detection and fire alarm systems  
Voice alarm control and indicating equipment.*

##### **BS EN 54-24:2008**

*Fire detection and fire alarm systems  
Components of voice alarm systems.  
Loudspeakers.*

## Sound systems

### BS 7827

*Code of practice for designing, specifying, maintaining and operating emergency sound systems at sports venues.*

### BS 6259

*Sound Systems*

Due out later this year.

ISCE Members on committee:

Anthony Smith, Andy Scott, Bryan Robinson, Doug Edworthy, John Woodgate, Peter Mapp, Majid Siadat, Ray Gatehouse, Tony Stacey

### BS 8590

*Code of practice for the installation of audio visual equipment*

Due out 2014.

ISCE Members on committee:

Doug Edworthy, John Woodgate

### EN 50849

*Sound Systems for Emergency Purposes not including fire*

Due to be published for vote December 2013.

### BS EN 60849

*Sound Systems for Emergency Purposes including fire*

To be replaced by EN 50849 but still in force and has precedence over BS 5839 Part 8.

### BS 6840-1:1987, IEC 60268-1:1985

*Sound system equipment.*

*Methods for specifying and measuring general characteristics used for equipment performance*

### BS 6840-2:1993, IEC 60268-2:1987

*Sound system equipment*

Glossary of general terms and calculation methods – work in hand.

### BS EN 60268-3:2013

*Sound system equipment*

*Amplifiers*

ISCE Members on committee:

Doug Edworthy

### BS EN 60268-4:2010

*Sound system equipment*

*Microphones*

### BS EN 60268-5:2003+A1:2009

*Sound system equipment*

*Loudspeakers*

### BS EN 60268-7:2011

*Sound system equipment*

*Headphones and earphones*

### BS 6840-10:1991, IEC 60268-10:1991

*Sound system equipment.*

*Methods for specifying and measuring the characteristics of peak programme level meters*

### BS 6840-11:1994, IEC 60268-11:1987

*Sound system equipment.*

*Specification for application of connectors for the interconnection of sound system components*

continued overleaf... ▶

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**BS EN 60268-12:1995, BS 6840-12:1995,  
IEC 60268-12:1987**

*Sound system equipment  
Application of connectors for  
broadcast and similar use*

**BS 6840-13:1998, IEC 60268-13:1998**

*Sound system equipment  
Listening tests on loudspeakers*

**BS EN 60268-16:2011**

*Sound system equipment  
Objective rating of speech intelligibility by  
speech transmission index*

**BS 6840-17:1991, IEC 60268-17:1990**

*Sound system equipment  
Methods of specifying and measuring the  
characteristics of standard volume indicators*

**BS 6840-18:1996, IEC 60268-18:1995**

*Sound system equipment  
Peak programme level meters.  
Guide for digital audio level meter*

**BS EN 61603-3 :1998**

*Transmission of audio and/ or video using  
infra-red radiation – translation systems*

**BS EN 61603-3 :1997**

*Transmission of audio and/ or video using  
infra-red radiation – wide band audio including  
Assistive listening*

**BS EN 61603-1 :1997**

*Transmission of audio and/or video using  
infra-red radiation – general ♦*

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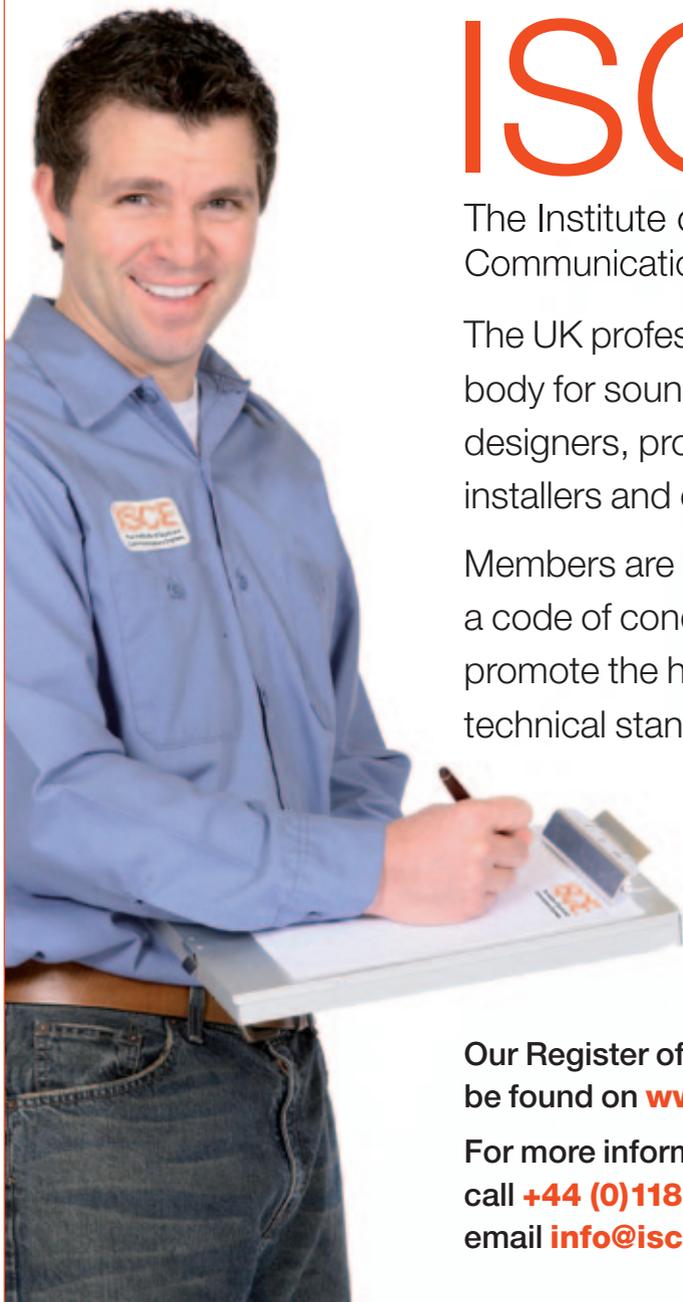
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