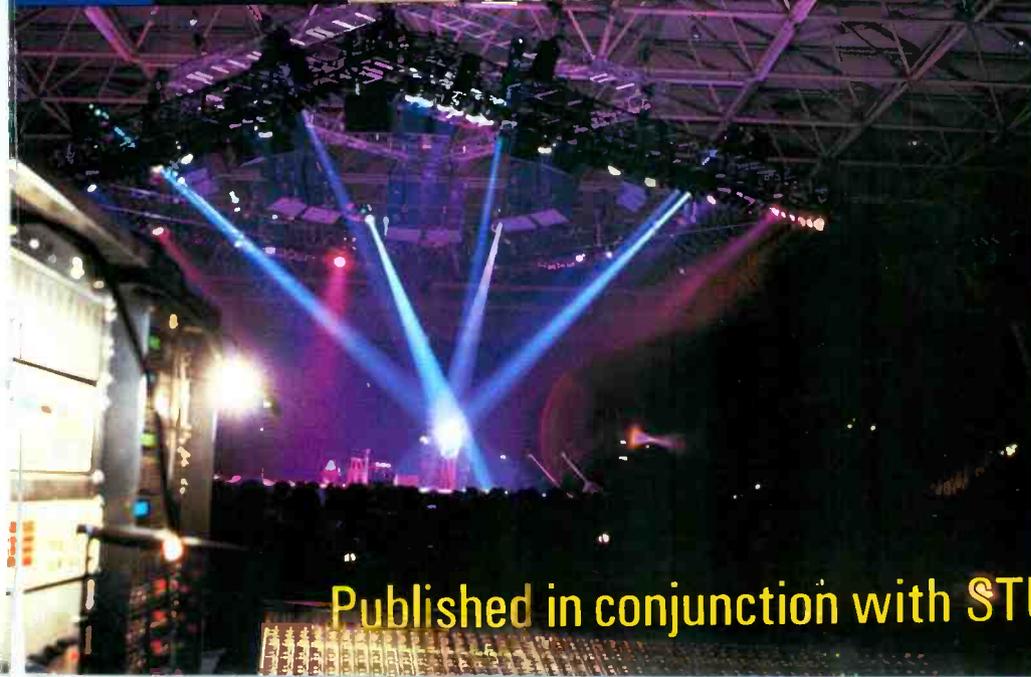
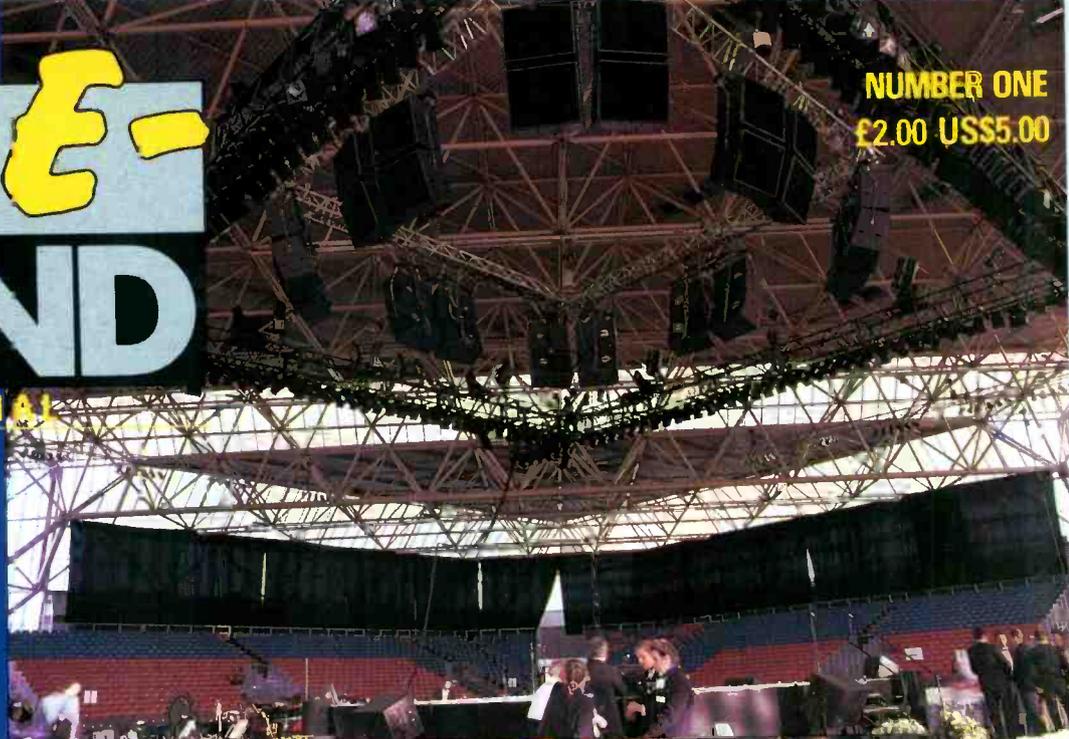


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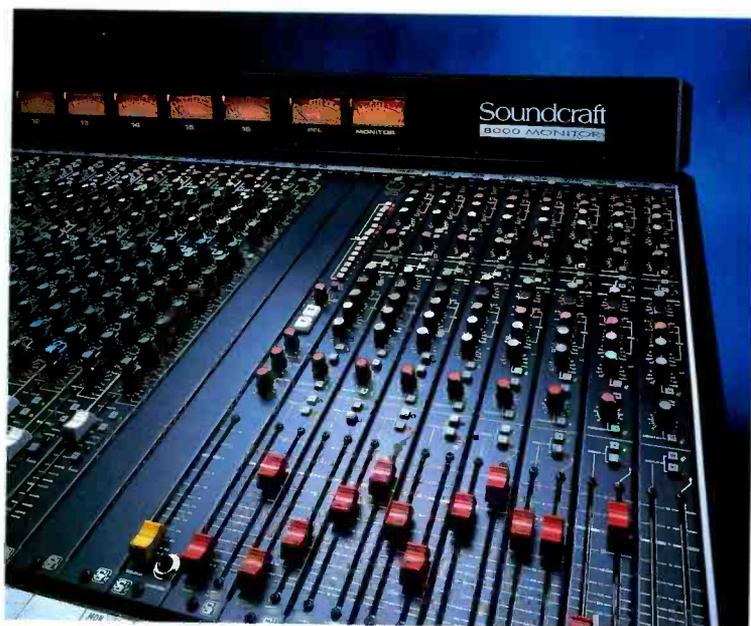
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NEWS
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Soundcraft
8000 MONITOR

contents

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LIVE SOUND is published in conjunction
with **STUDIO SOUND**

**Cover: Scenes from the recent Frank,
Liza and Sammy tour in Amsterdam and
London. Photographed by Mike Lethby.**

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WELCOME TO LIVE SOUND

Live Sound is just that – a look at all aspects of entertainment orientated live sound. It comes from the same people who bring you *Studio Sound* and there will therefore be many similarities. There may also be many who will read both titles but this is just the nature of pro-audio.

Live Sound is a recognition of the fact that with the growing sophistication of professional audio in all its facets it is no longer possible for a single magazine to address all relevant areas between the same covers to the kind of depth that the subject deserves. In this issue we have mainly addressed stage sound but we do not

see ourselves in anyway restricted to this specific area. Future issues will develop into the field of fixed sound installation as long as the motivation is entertainment. **Live Sound** is a move into areas that *Studio Sound* only addresses as a sideline.

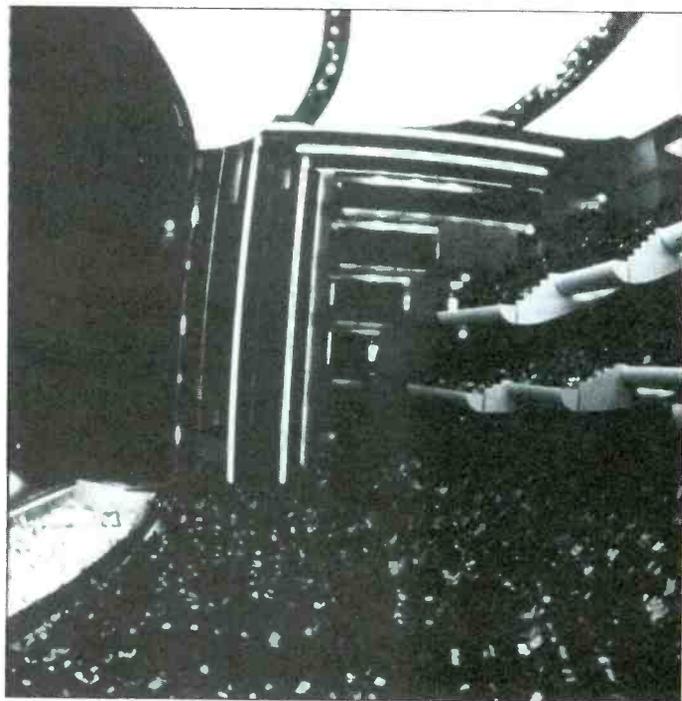
Your comments on this introductory issue would be most welcome as would suggestions for future areas of development and coverage.

We hope that with this publication we will be able to serve the live sound side of the entertainments industry in a way that parallels the relationship that *Studio Sound* has with the recording industry.

CONTRACTS

Real World, Box, UK, have supplied a 16-input, 8-output version of their *Automated Send Matrix (ASM)* system to Sunsound Audio Inc of Northampton, MA, USA. The ASM System is currently being used by 10,000 Maniacs on their US and Canadian tour . . . French speaker manufacturer **Nexo** have recently supplied UK hire company Wigwam Acoustics with an *S1200* system; they've also provided overflow systems for the recent Billy Graham dates; systems for West End theatre shows through Delta Sound Inc; and a large order of speakers for the new Bastille Opera House in Paris . . . For Who's 25th anniversary tour bass player John Entwistle installed a **Soundcraft** series 600 recording console in his home studio to prepare new material . . . **CB Electronics**, Berks, UK, have recently supplied *Video Streamers* to be used to provide cueing systems at the

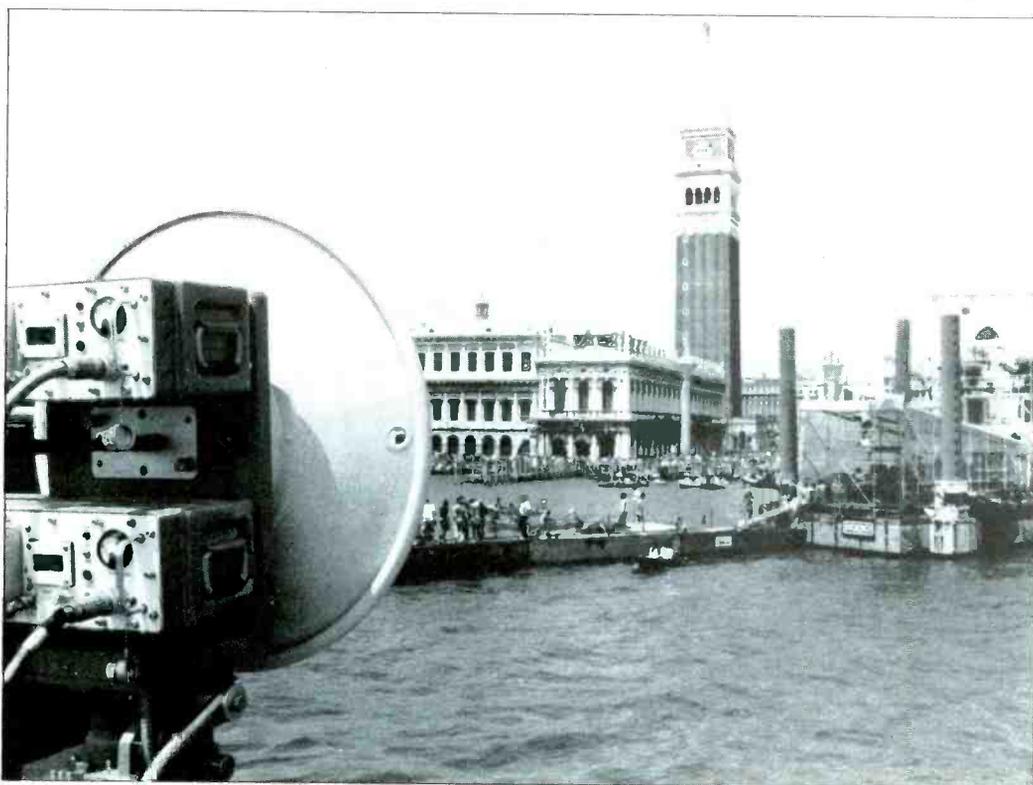
Louvre open air concert in France. The concert required that orchestral performers on four sides of a pyramid should be able to receive tempo and performance cues from the conductor. The solution was to program bar and tempo information plus alpha-numeric text cues into the *Video Streamer*. The information was then relayed, in realtime, to a number of video monitors enabling the conductor and all the performers to maintain perfect time . . . **Cadac** have supplied a 40-input E-type console to the Royal Shakespeare Company for use in the main theatre at the Barbican Centre, London . . . Alhambra Theatre, Bradford, UK, have chosen an **Allen and Heath** *Saber* PA as their new mixing console . . . The **Meyer Sound** *SIM* equalisation process has recently been used at the Tony awards in New York; and the Montreux Jazz Festival and Eurovision Song Contest in Switzerland. The *SIM* system



Nexo loudspeakers at the Bastille Opera House in Paris

analyses and calibrates sound systems . . . One of Australia's largest Theatre Restaurants, The Swagman, Melbourne, has recently bought four **ARX 912s**; two **ARX 303s**; and six *SS1200VC* power amplifiers and associated signal processors . . . Anderson, Bruford, Wakeman, Howe are touring America using four **Celestion** *SR* series sound reinforcement systems . . .

Pink Floyd's infamous free concert in Venice saw **British Telecom** providing radio microwave links in Europe for the first time. BT's outside broadcast division supplied radio microwave links for two camera positions, in a bell tower and for a roving camera . . . For Simple Minds' recent world tour they have chosen a variety of **BSS Audio** equipment including two customised 5-/6-way active crossover systems configured from a hybrid of *MCS-200* and *FDS-360* units; 80 channels of *MSR-604* active mic splitters; 16 channels of the *AR-416* 4-channel active DI units; 14 *DPR-502* MIDI noise gates and six *DPR-402* compressors/de-essers . . . **Beyerdynamic's** *TourGroup* microphones have recently been used on tour by Robert Cray, Bryan Ferry, Bobby McFerrin, Kim Wilson, Phil Collins and Peter Gabriel . . . **Soundcraft** have supplied the first series 8000 monitor console to PA company Encore Entertainments, London, for use on the company's tours with Steve Harley and Dogs D'Amour . . . **Adamson Acoustic Design**, Corporation have recently supplied their Advanced Concert Systems to Snow Sound in Connecticut, Sound Associates in New York and Terry Hanley in Massachusetts.



British Telecom provided radio microwave links for Pink Floyd in Venice

“No one can repeal the laws of physics. The challenge is to make them work for you.”

KENTON FORSYTHE
Director of Engineering; Co-Founder



Case in point: The KF600, EAW's newest system for performance applications. It measures just 33" high and 19 3/4" on a side. Yet KF600s produce 130 dB, averaged from 65 Hz — 20 kHz.

A principal factor behind that small miracle is our unique Transverse Geometr™ low frequency

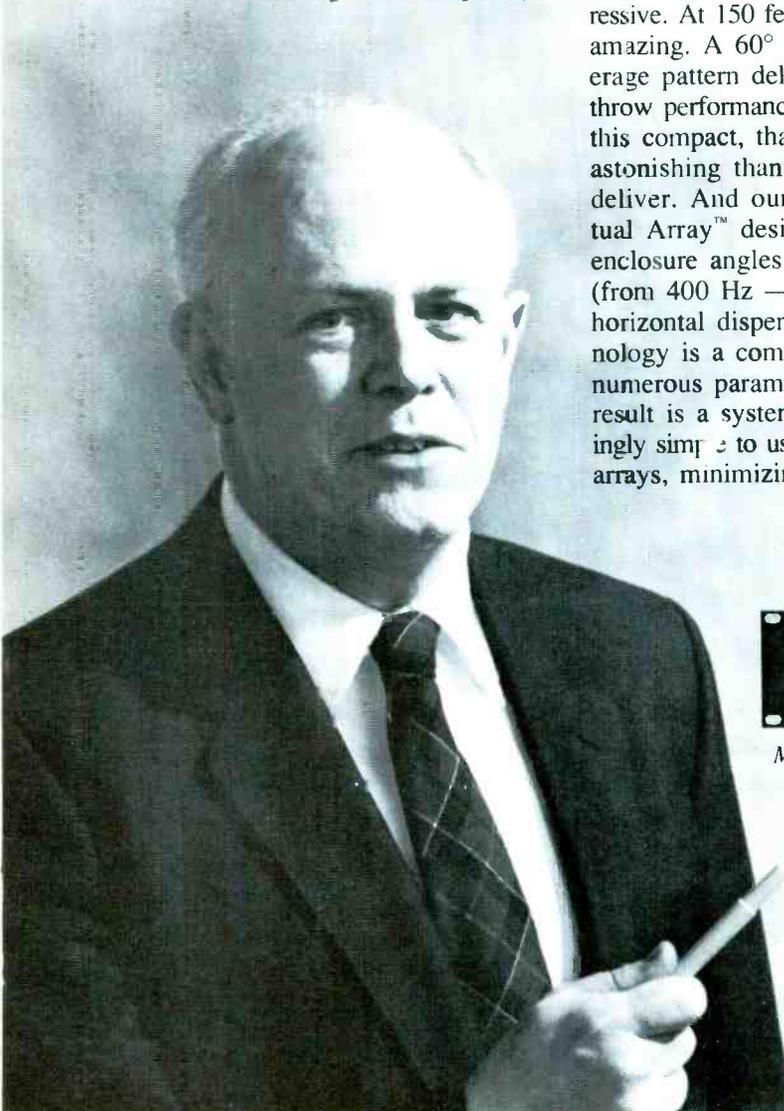
subsection. In this ingenious example of physics at work, the woofer faces *sideways*. Yet its entire output is frontally focused. The design uses dual chambers (one tuned, the other acoustically open) to accomplish this acoustic rotation while maintaining high woofer efficiency.

At 15 feet, KF600s sound impressive. At 150 feet, they're simply amazing. A 60° horizontal coverage pattern delivers true long throw performance. From speakers this compact, that's even more astonishing than the SPLs they deliver. And our exclusive Virtual Array™ design matches the enclosure angles to that constant (from 400 Hz — 20 kHz) 60° horizontal dispersion. VA™ technology is a complex balance of numerous parameters. But the result is a system that's amazingly simple to use. With KF600 arrays, minimizing interference

and eliminating lobing or hot spots is virtually automatic.

We're known for innovative enclosures, but we also know the value of electronics. So we've developed KF600 modules for our MX800 Closely Coupled Electronic Processor™. The MX800 provides four-way asymmetrical crossovers, time/phase compensation, individual driver protection and high frequency power response equalization, along with LF excursion control and equalization. All functions are precisely adjusted — through TEF™ analysis and real world testing — for optimum effectiveness.

If you have an application that demands unlimited sonic performance while providing limited space and setup time, audition KF600s. You may have a little trouble believing your own ears — most people do. But what you'll hear is real: No magic, just the laws of physics, artfully applied.



MX800 CCE Processor — an integral part of the KF600 system.



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IN-BRIEF

Audio cable specialists **Klotz** have opened a new office and warehouse near Amersham, Bucks, UK. Large cable orders will no longer have to be supplied from Germany, but will be dealt with from UK stocks, greatly reducing delivery times. The division will be headed by managing director Brian Latham. Klotz UK Ltd, Unit 9, Penn Street Works, nr Amersham, Bucks HP7 9PT UK. Tel: 0494 716891. Fax: 0494 713787 . . . **BSI** have announced the publication of *BS 6840: Part 16: 1989: Sound System equipment*. Part 16 describes the 'Rasti' method for the objective rating of speech transmission in auditoria with respect to intelligibility, with or without sound systems . . . Birmingham based **SSE Hire**

Ltd have announced the formation of a new company, SSE Ireland, in a move to offer an improved service for acts working in Eire and Northern Ireland. SSE have supplied a large amount of PA equipment already to Ireland and see this new venture making touring in Ireland more economically viable for bands. SSE Ireland is being equipped with a full specification duplicate concert system. SSE Ireland, The Factory, Dublin. Tel: (0001) 684966 . . . **Electro-Voice**, Michigan, USA, have expanded their research and development effort with the construction of new engineering facilities. The three-storey research centre has over 28,000 sq ft of space and houses over 50 engineers, technical assistants and support staff. The new facilities

allow complete designing, testing and evaluation of prototypes, as well as offering suitable conditions for Fast Fourier Transform (FFT) and Time-Energy-Frequency (TEF) testing via a specifically designed listening room and anechoic chamber. Other capabilities include CAD, holography and laser-based analysis.

AGENCIES

Cue Systems, UK, have been appointed by HW International to distribute the complete range of **Carver** power amps in the UK. Cue Systems, London N16 7UT. Tel: 01-960 2144. Fax: 01-960 1160 . . . Autograph Sales have become exclusive UK distributors for the **Saje** range of consoles. Saje see Autograph's work in live sound as an important factor in the decision. Autograph Sales, 102 Grafton Road, London NW5 4BA. Tel: 01-485 3749. Fax: 01-485 0681 . . . **Turbosound** and **Crest Audio** have chosen First Audio as their UK distributor. First

Audio was formed by ex-Turbosound marketing manager Tim Chapman. First Audio Ltd, 95 Ditchling Road, Brighton, Sussex BN1 4SB. Tel: 0273 693610. Fax: 0273 693620 . . . US loudspeaker manufacturer **Gauss** have appointed concert sound company Shuttlesound as their UK distributor. Shuttlesound Ltd, Unit 15, Osiers Estate, Osiers Road, London SW18 1EJ. Tel: 01-871 0966. Fax: 01-870 9300.

PEOPLE

UK PA company **Martin Audio** have appointed Rob Peck marketing manager and Lynn Chappell sales manager . . . **Bose UK** have appointed Colin Cartwright as general manager. Cartwright was formerly the sales & marketing director of Cimex International . . . **Electro-Voice**, MI, USA, have appointed John Murray marketing development manager for professional sound reinforcement. Murray comes from Panacom Corp, Ohio.



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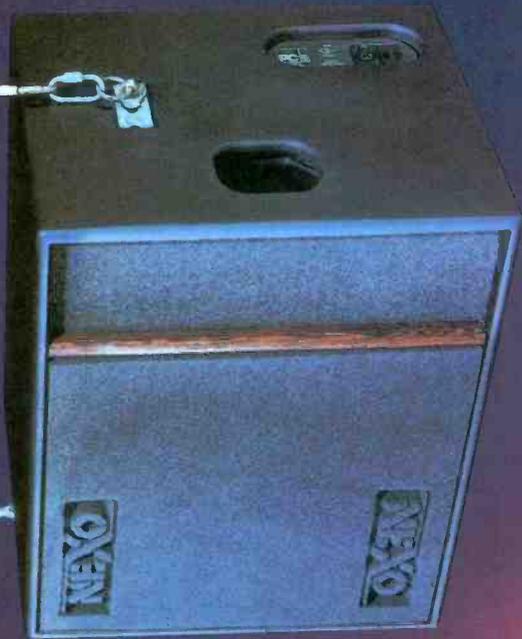
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CELESTION EXPAND SR SERIES

Celestion have expanded their SR series of loudspeakers, with the SR3 PA cabinet, the SRC3 loudspeaker processor and the SR Compact. The SR3, 10.3 x

12.8 x 9.4 ins. contains a single 8 in driver with 60 Hz to 20 kHz frequency response. The SRC3 loudspeaker processor provides a minimum amount of active and fixed equalisation to maximise the studio response of the SR3. This 2-channel unit is installed between the preamp and power amp of a system. The SR Compact uses the same driver design as the larger SR series speaker, its single 5 in concentric dome radiator can handle 100 W with an 80 Hz to 20 kHz frequency response and maximum SPL of 111 dB.

Celestion Industries, 89 Doug Brown Way, Holliston, MA 01746, USA. Tel: (508) 429-6706.

UK: Celestion International Ltd, Foxhall Road, Ipswich, Suffolk IP3 8JP. Tel: 0473 723131.



VITAVOX PRESSURE DRIVER

Vitavox have developed a high sensitivity pressure driver suitable for use in musical instrument amplification, disco and live sound speaker systems. The S6 has a claimed power rating of 100 W but it can be used with systems with an overall rating of over 100 W.

The drivers feature lightweight, corrosion resistant diaphragm assemblies and high flux barium ferrite magnets.

Vitavox Division, Secomak Ltd, Honeypot Lane, Stanmore, Middlesex HA7 1BE, UK. Tel: 01-952 5566. Fax: 01-952 6983.

NEXO INTEGRATED SYSTEMS

Nexo have released the SI 1000 and SI 2000 integrated systems together with the SI TD controller. These new systems represent evolved versions of the SI system and both use two cabinets: a bass enclosure and a mid/high assembly.

The SI 1000 features two 12 inch (30 cm) bass drivers, two Nexo midrange drivers coupled to a Nexo horn and a 1 inch compression driver coupled to a Nexo CD horn. The SI 2000 uses two 15 inch (38 cm) bass drivers, a lower impedance midrange assembly and two 1 inch high frequency drivers coupled to a single CD horn via a sophisticated system that features a directivity control reflector and interference control waveguide.

The SI TD controller is

designed to improve system response and allows real time control of voice coil temperature and cone displacement of each loudspeaker by introducing selective frequency filtering and amplitude control, when required, to prevent damage. A feature of the SI TD is a 'stack' control, which compensates for the response changes caused by stacking or arraying enclosures.

Nexo Distribution, 154 Allee des Erables, ZAC de Paris Nord II, BP 50107, 95950 Roissy, Charles de Gaulle Cedex, France. Tel: 1 48 63 23 01. Fax: 1 48 63 24 61.

UK: Farrahs (UK), Unit 7, St Georges Industrial Estate, Richmond Road, Ham, Surrey. Tel: 01-549 1787.

CARLSBRO ALPHA SERIES ENCLOSURES

Carlsbro Electronics have introduced the Alpha series enclosures. The Alpha series A110 is a 65 W cabinet powered by a 10 in Celestion loudspeaker and high frequency horn. The A112 is a 100 W enclosure containing a 12 in Celestion driver and high frequency horn. The A115 is a

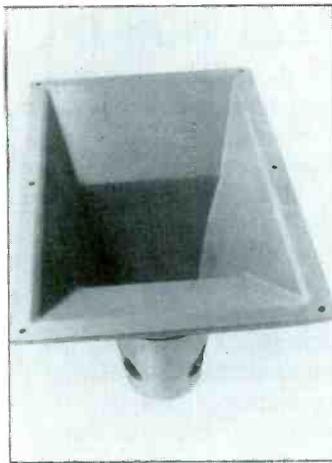
150 W cabinet with a 15 in driver and pair of HF tweeters. Also new is the PM65-100, 100 W, self-powered monitor aimed at semi-pro use.

Carlsbro Electronics, Cross Drive, Kirby-in-Ashfield, Notts NG17 7LD, UK. Tel: 0623 753902. Fax: 0623 755436.



ALTEC LANSING CONSTANT DIRECTIVITY HORN

The heavy duty injection moulded Altec Lansing *MR944A Mantaray* horn is a mid/high frequency unit delivering low frequency loading down to 500 Hz, and directivity control of the full frequency range to 20 Hz. Altec recommend the *Mantaray* in conjunction with its own compression drivers, the *900-8A* or the *909-16A*. As part of a small or medium full range system, these units can be used for speech and music in auditoriums, cinemas, and churches.



Altec Lansing Corp, PO Box 26105, Oklahoma City, OK 73126, USA. Tel: (405) 324 5311.

UK: UK Sound, Osiers Estate, Osiers Road, London. Tel: 01-874 2050. Fax: 01-870 9300.

APOGEE AE-4 SPEAKER

Apogee Sound have introduced a new single-amped, electronically coupled loudspeaker system, the *AE-4* comprises of a 12 in cone driver and a 1 in throat compression driver coupled with a moulded uralite high

frequency horn. The high frequency driver is fluid-cooled for low distortion and increased power handling. **Apogee Sound Inc, 1150 Industrial Ave, Suite C, Petaluma, CA 94952, USA.**

JBL ADD TO SOUNDPOWER SERIES

JBL have added to the *Sound Power* series by introducing a 'passive' version of the *4726* Bi-Radial system and *4728* Bi-Radial Stage Monitor. The *4726P/4728P* are equipped with internal crossovers for situations where bi-amping is

impractical.

JBL Professional, 8500 Balboa Boulevard, Northridge, CA 91329, USA. Tel: (818) 893 8411.

UK: Harman UK, Mill Street, Slough, Berks SL2 5DD. Tel: 0753 76911. Fax: 0753 35306.

SOUNDCRAFT SERIES 8000 MONITOR CONSOLE

Soundcraft have launched the series *8000* monitor console based on the series *8000* house desk.

The new console provides 16 independent output groups, each with 3-band fully parametric EQ and VU metering. Input channels have a switchable 80 Hz highpass filter and 4-band parametric EQ. The 16-channel sends are presented on eight dual concentric controls, each pair having pre/off/post selection.

Other features include

talkback sends to any output bus and 2-way communication with a series *8000* house console.

Soundcraft Electronics Ltd, Unit 2, Borehamwood Industrial Park, Rowley Lane, Borehamwood, Herts WD6 5PZ, UK. Tel: 01-207 5050. Fax: 01-207 0194.

USA: Soundcraft Electronics USA, PO Box 2200, 8500 Balboa Boulevard, Northridge, CA 91329. Tel: (818) 893-4351.

TRANTEC RADIO MIC RECEIVER AND DISTRIBUTION

Trantec Systems Ltd have introduced the *S2* autodiversity radio microphone receiver, which has been specially designed for professional applications such as broadcast. Features include 19 inch rackmounting, DTI approval, true diversity operation using two antennae and two independent receivers, balanced audio output, audio mute switch, RF and audio level indicators and exclusive noise blanking and RF signal strength muting.

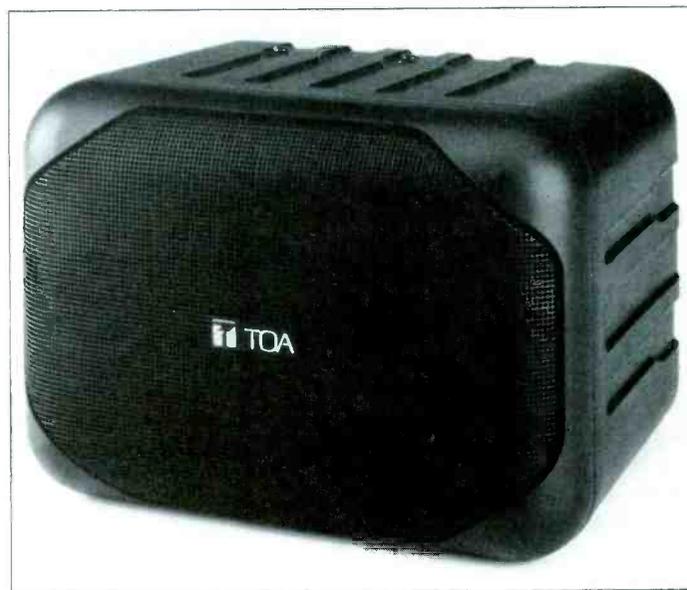
Also new is the *ADU-VHF* antenna distribution unit, which allows four *S2* receivers to be fed from two common antennae, as well as improving system performance by providing +6 dB of RF gain. The *ADU-VHF* features a common power supply, and accessories include a rackmount front panel and a pair of remote Dipole antennae.

Trantec Ltd, 119-121 Charlmont Road, London SW17 9AB, UK.

IN BRIEF

The **Stage Radio Company** have introduced a Radio Transmission system specifically designed to transmit MIDI. The system will work on legal UK UHF frequencies. Hardware House (Sound) Ltd. Tel: 01-986 6111. Fax: 01-986 8127 . . . **JBL** have introduced two new loudspeakers for the installation market, the *S3* and *S4*. Both units are designed for wall or ceiling mounting . . . **Michael Stevens & Partners** have announced the addition

of the KEF *CR160R* and *CR160S* ceiling/in-wall speakers to their *Custom* series range . . . **Toa Electronics** have launched the *F-5* fashion speaker. Designed for wall mounting the *F-5* is a bass reflex speaker with 10 W of band limited pink noise handling capacity . . . A new polar response plotting project by **Apogee Sound**, CA, USA, charts accurate, measured polar response graphs for large scale loudspeaker arrays and clusters.



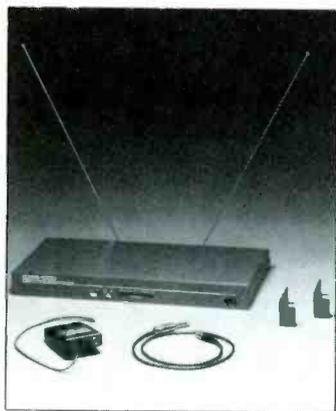
equipment

NEW PRODUCTS FROM ELECTRO-VOICE

Electro-Voice have introduced a variety of new products including the *GS-1000* wireless guitar system, the *MS-1000* wireless vocal mic, additions to the *Extender* speaker range, the *DH1Amt-16* compression driver and the *FS-212* wedge monitor.

The *GS-1000* wireless vocal microphone with the E-V *ND757* capsule is a dual-receiver true-diversity system with two separate receivers on the front end. To avoid drop-outs the receiver with the strongest signal is automatically chosen. The system has a switchable mic/line *XLR* output, line level $\frac{1}{4}$ in output, detachable antenna and an internal power supply.

The *Extender* Speaker range now features the *S-1202ER* 2-way, and the *SH-1810ER* 3-way systems. The *S-1202ER* features the *DH2010A* compression driver with a constant-directivity horn and a 300 W Pro-line woofer producing a maximum SPL of 125.5 dB. The *SH-1810ER* features the *DH3* compression drive; and the *DL10X* midrange driver. The *DH1Amt-16* is a high-frequency compression driver. Two drivers mount on an *MTA-22* Manifold Technology Adaptor to create the *DH1A/2MT* acoustic summation system.



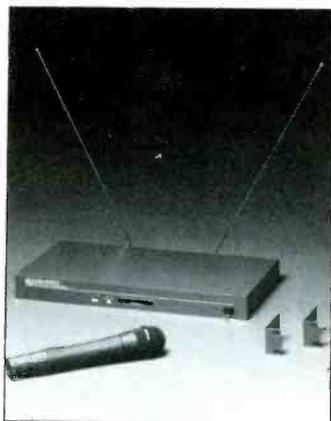
Electro-Voice GS-1000

The *FS-212* is a 2-way biamped system incorporating both high frequency horn and 2 in throat compression driver with a pair of 12 in woofers. SPL at 1 W is 101-113 dB at 1 m. Frequency response is 50 Hz to 20 kHz.

Electro-Voice, 600 Cecil Street, Buchanan, MI 49107, USA. Tel: (616) 695-6831.

UK: Shuttlesound. Tel: 01-876 0966. Fax: 01-870 9300.

Europe: Electro-Voice SA, Switzerland. Tel: (032) 51 68 33.



Electro-Voice MS-1000

SOUNDCRAFT 8000 SERIES EXTENDER UNIT

Soundcraft have launched a new option for the series 8000 PA console, for use within both fixed and touring installations. The 16-input *Extender* unit works alongside the series 8000 and can be configured with any choice of input modules. The *Extender* has

been developed by Soundcraft dealer LMC in conjunction with Star Hire.

Soundcraft, Unit 2, Borehamwood Ind Park, Rowley Lane, Borehamwood, Herts WD6 SPZ, UK. Tel: 01-207 5050. Fax: 01-207 0194.

REAL WORLD LIVE ASM SYSTEM

Real World's Automated Matrix system has recently been used on tour. The *ASM* gives computer recall of effects sends and returns. For live use, line level feeds are derived from each mixing console channel to feed into the *ASM* inputs. Up to 96 inputs (in multiples of 16) can be accommodated, which then feed separate level controls and mute switches that route the signal to any one of up to eight extra mix buses. From

there the signal passes to the effects devices as normal, via the master output section of the *ASM*. In the studio the *ASM* would normally be driven from a MIDI sequencer locked to timecode. For the tour Real World developed a manually cued MIDI remote system based around an Atari *ST* computer.

Real World, Box, Wiltshire SN14 9PL, UK. Tel: 0225 743188. Fax: 0225 743787.

CARLSBRO STEREO POWERED MIXER

Carlsbro Electronics have launched a range of stereo powered mixers featuring digital reverb. The *DX* range of 600 W powered mixers are available in 8-, 12- and 16-channel formats. The inbuilt reverb offers 128 programmes,

including delay, gated reverb and a misc section.

Carlsbro Electronics Ltd, Cross Drive, Low Moor Road Industrial Estate, Kirkby-in-Ashfield, Notts NG17 7LD. UK. Tel: 0623 753902.

ALTEC LANSING A700 LOUDSPEAKER SYSTEM

The *A700* speaker system has been produced to celebrate the 40th anniversary of the *A-7* 'Voice of the theatre' loudspeaker system. The *A700* includes the *A700XLF* accessory subwoofer systems, the *1632A* electronic crossover/system protector, the *9442A* and *9444A* power amps and the *A700SK* accessory suspension kit. Also new are

the *938-8AD* and *938-8AE* loudspeaker systems for use as foldback monitors or in a small portable sound system.

Altec Lansing, PO Box 26105, Oklahoma City, OK 73126, USA. Tel: (405) 324-5311.

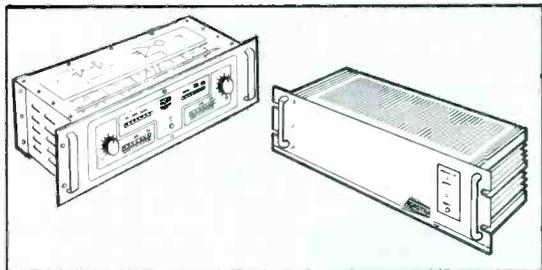
UK: UK Sound, Osiers Estate, Osiers Road, London. Tel: 01-874 2050. Fax: 01-870 9300.

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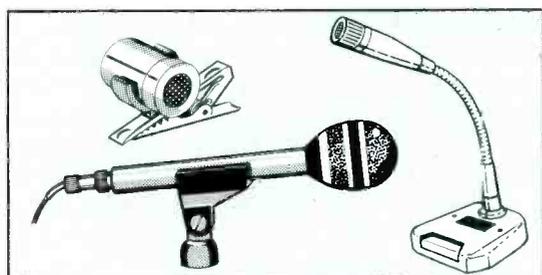
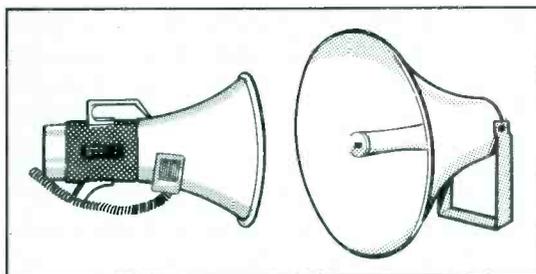
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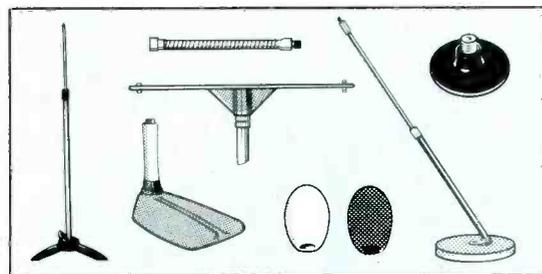
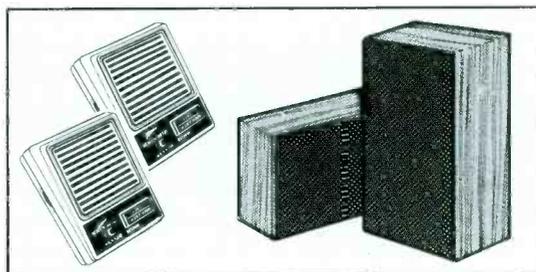
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NAMM, Anaheim, California, USA. January 19th to 21st.
88th AES Convention, Centre de Congres, Montreux,

Switzerland. March 13th to 16th.
ABTT Scottish Conference & Exhibition Centre, Glasgow, Scotland. March 14th to 16th.
Musikmesse, Frankfurt, West Germany. March 21st to 26th.

ON THE ROAD

Late summer is traditionally a quiet time for PA hire companies and this year proved no exception.

With their major summer tours and festivals out of the way, most operators were gearing up for a UK and European autumn touring season, which looks like being busier than ever. A few notable exceptions aside, the order of the day was 'call us next month when it starts to happen'.

This is a brief summary in alphabetical order of the August/September touring scene.

- Audiorelease had a September tour with Texas using a Meyer *MSL-3* system, and say that more contracts are in the pipeline.
- Britannia Row emerged from a hectic July with some unusual events in August, starting with a water-borne PA (throwing up to 800 metres) for Europe's largest firework spectacular at the Festival du Lac near Geneva, Switzerland, and finishing in Paris, France with a 250 kw Turbosound system, which provided musical accompaniment for an 800 metre tightrope walk across the River Seine to a platform half way up the Eiffel Tower. BRP also staged Bon Jovi at Milton Keynes Bowl, UK, and have Jethro Tull's autumn tour on their books.
- Canegreen's Meyer systems were scattered around the world: one in Spain; another in the US with The Outfield; and a complete 28-cabinet system plus Midas *PRO-40* desks on Rick Astley's world tour, with engineers Chris Lindop (FOH) and Robin Fox (monitors).

Canegreen will also be servicing Pat Metheny's 11-week UK/Europe tour which runs up to Christmas.

• Clair Brothers in the UK provided *S4* systems for Julio Iglesias' Spain dates and the Bros shows at Wembley – and their US counterparts also have a packed line-up of major tours.

• Concert Sound's recent efforts took them to Swaziland and beyond for a series of Eric Clapton shows using a Martin system.

• Creative Sound Systems is providing a Meyer/Bose system for a performance at St Paul's Cathedral on September 6th of 'The Plague and the Moonflower' – an orchestral event for 1,500 heads of state and their companions, the highlight of an international conference

• Farrahs have a lengthy series of trade dates for the CEGB, and installations in numerous West End shows including *Woman in Black* at the Fortune Theatre, *Sherlock Holmes* at the Windmill and a tour with *Royal Hunt of the Sun*. Four more major musicals are on the company's books for September.

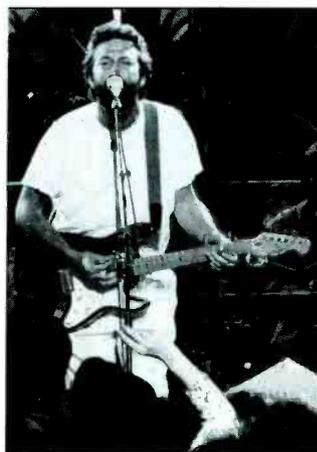
• SSE have had a busy time with Electro-Voice *M74* systems out on FM's UK tour.

THE STAGE RADIO STATION

The *Stage Radio Station* from Personal Radio Systems relays a live stereo mix to the artist without the need for stage monitors. The system comprises a dual-channel transmitter, antenna, backpack and personally moulded-ear-piece. The stereo mix from desk can be transmitted up to 70 m via the antenna. Input

sensitivity is monitored on the transmitters LED bargraph indicating the optimum signal-to-noise ratio operating area and potential overload. The backpack is only 11 x 7 x 3.5 cms and houses the receiver, amplifier, stereo de-coder and integral antenna.

Personal Radio Systems, Unit 2, 12-48 Northumberland Park, London N17, UK. Tel: 01-801 8133.



Metallica's US dates, the Reading Festival and a September show with Wet Wet Wet at Irox Park – which also saw the debut of Tasco's Starlite Lighting Voice Activator system. SSE's HB systems also served The Pogues' Irish dates and the 1989 Skill Olympics in Birmingham. Their *MB3* monitor systems were used throughout.

• The PA Company, like many other firms, has balanced its summer books with numerous 'dry hires'. It's also supplied PA to the BBC and a large Meyer *MSL3/Bose 802* system for the Lord Mayor of London's 800th Anniversary show at Tower Bridge.

• Over at Tasco, Joe Brown has spent the summer re-assessing his UK strategy. The result, he

says, is a fusion of Harwell's packaging philosophy with Turbosound's speaker technology.

Accordingly, Tasco UK has developed a FOH system consisting of Soundcraft series 4 desks, C-Audio *PA 2000/3000* amplifiers, active stage boxes and Turbosound *TMS-3s*, with Harwell monitors powered by Carver *PM1.5* and Microtech amps. The fruits of these efforts, Brown says, won Tasco the contract for George Michael's summer show in Spain and the autumn Climie Fisher tour.

Tasco's stateside 'hard rock' reputation – which accounts for most of the company's business with Martin and Harwell systems currently out with Whitesnake, Judas Priest and Guns 'n' Roses – is a tag Joe Brown aims to broaden this side of the Atlantic.

• Star Hire staged a series of jazz and classical concerts at various stately homes – sponsored by Baileys on behalf of the National Trust – using a Turbosound PA and (on most occasions) their own *Contain-A-Stage*, a truck-mounted stage set-up, which includes generators, PA, lights and a choice of stage background colour.

Over the August Bank Holiday weekend they also provided Court and Turbo systems for London's Notting Hill Carnival and a 60 kW Turbo rig for a Hindu festival at Milton Keynes bowl.

• Wigwam provided Bose and Nexo PAs for a Blackpool gig by Stone Roses, summer seasons by Canon and Ball and Freddie Star, plus West End shows including 42nd Street, South Pacific and Wayne Sleep.



Sound Science. Sound Art. SIM™ Equalization from Meyer.

“Noise and light are not music.” John Meyer

Dynamic sound behaves differently in each spatial context. And while schematic arrangement helps dramatically in predicting sound quality, only through live use and exhaustive testing can an installation be tuned for specific desired characteristics.

Some sound designers still use noise, swept tones and light to set up a soundstage, as if projecting sightlines and frequency response in an empty room delivered the pure experience of music.

Meyer Sound recognizes the importance of both frequency response and phase response alignment and maintaining the *order* of the signal throughout a space. (For example, playing a tape backwards doesn't change frequency response, but changes phase response.) And the only way to gauge phase properly is through measurement.



Bob McCarthy
Senior SIM Engineer
at the 1988 Grammys

SIM Measures Music.

SIM™ equalization, a sophisticated acoustical analysis and correction technique using proprietary Meyer Sound technology, is performed non-intrusively, and with real-world accuracy, because it uses real-world program material (either voice or music) as the test signal. The technique may be used during actual performance, when the audience presents its true effects on the sound reinforcement.

Interactive Process.

SIM equalization involves the sound designer, consultant, mixer and SIM engineer in an interactive process of establishing the subjective sound dynamics of a space. When used with a properly aligned Meyer Sound system, it creates an environment in which both frequency response and phase response are dramatically improved, resulting in superior sound clarity for every member of the audience.

Results-Oriented Measurement.

A SIM engineer from Meyer operates the system, implementing the sound designer's desired effects.

SIM enhances the mixing function, making the spatial sound dynamics visible to the SIM engineer. Placing SIM microphones strategically throughout a space, the engineer first ensures all areas are covered, and then adjusts each area to attain a uniform sound experience through SIM's straightforward system of resolving complex measurement.

SIM equalization even has the ability to erase a room. The sound designer thus can bring back in the room's ambience or enhance it, to whatever degree deemed appropriate. SIM gives the designer qualitative, as well as quantitative, control of a space.

Clarity for the New Sophistication.

The audience is the true beneficiary of SIM equalization, enjoying better intelligibility and a more intimate relationship with the performers.

With SIM, Meyer is helping redefine the parameters of live performance sound quality.

Meyer Sound's CP-10 Complementary-Phase Parametric Equalizers, designed to correct the types of acoustical problems found in actual concert halls, are an integral component of the SIM equalization process.



Meyer originally intended to be solely a manufacturer of high-quality, rugged and reliable loudspeakers, but finding testing equipment which could meet Meyer's exacting standards proved impossible. To accurately measure the performance of Meyer Sound components individually and in arrays, and to make sound work in spaces, Meyer Sound Laboratories developed by necessity its own testing technology and methods.

SIM equalization grew out of Meyer's uncompromising production philosophy, and as such, SIM is applied only to Meyer Sound equipment installations. Instead of attempting to second-guess the tastes of the market, Meyer produces sound systems that most truly represent the character of the signal they receive, leaving artistic control to the artist. With SIM, Meyer offers an equalization tool that leaves complete control of spatial sound dynamics where it belongs — with sound designers, consultants, and mixers.

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Budoken Hall, Tokyo
Stevie Wonder tour, Wembley Arena, London
Luciano Pavarotti, several tours
Les Miserables, New York, Boston, Los Angeles, London
Lily Tomlin, The Search for Signs of Intelligent Life in the Universe, San Francisco, Washington D.C., Chicago
Jubilee Auditorium, Calgary, permanent installation
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M E Y E R S O U N D



THE LONDON ARENA britain's newest venue

Mike Lethby visits the London Arena on the occasion of a recent Duranduran gig

Duranduran's sell-out showpiece concert in London on April 20th, 1989, marked the official launch of Britain's newest large venue – the 11,600 seat London Arena. It was Duranduran's sole London date on their 1988/89 Electric Theatre World Tour, the band's first major outing for some years.

With sound production by Clair Brothers, the year-long tour averaged five shows a week, playing venues ranging from theatres to large outdoor arenas.

Since the London Arena is clearly intended to take a significant slice of the capital's touring market, I took this opportunity to evaluate it in the context of its first major rock show – and to ask Clair Brothers' sound engineers about their company's latest developments.

BRITAIN'S LATEST VENUE

During the 1980s the Rainbow, the Venue, Lyceum Ballroom and Hammersmith Palais have all disappeared from London's regular theatre circuit. Further up the scale, Wembley Arena, Earls Court and

Wembley Stadium have retained their dreary monopoly on larger shows. Each was conceived long before the age of amplified music – and it shows.

Harvey Goldsmith and boxing supremo Frank Warren headed the original consortium which brought the London Arena to life. They aimed to use their collective experience to get the new venue right first time – from both performers' and audiences' points of view.

This remarkably sensible (and, of course, potentially very lucrative) idea offered promoters a fresh alternative to staging multiple theatre shows or a one-off at Wembley, as well as setting a new standard for major live venues into the bargain. All in all, adding up to a stiff challenge to the average UK arena – no mean feat in theory – but how does it shape up in practice?

ARENA DESIGN, 1989-STYLE

From the outside there is little to gladden Prince Charles's eye. The Arena is simply a huge corrugated steel shed, squatting between sleek offices and the futuristic overhead railway with all the charm of a multi-storey car park in Snowdonia. Inside, however, there's a thoroughly modern multipurpose venue, well

equipped and versatile.

To accommodate anything from large rock and opera shows and trade exhibitions to tennis tournaments and local community sports events, banks of seating tiers on either side can be automatically brought into position on powered tracks at the touch of a button, while arena seating blocks can be configured in numerous ways.

TV-standard lighting and six hanging points of up to 2.2 tonnes capacity apiece are provided. The northern end offers a large stage construction area with direct load-in access.

'Up in the gods' a suite of administration offices houses a police control centre and the Arena's external communications facilities, which include provisions for satellite link-ups.

So, however you want your show to be staged, the London Arena appears to have most of its options covered.

At ground level there's a fully-equipped first aid centre and a walk-through Wembley-style arcade of bar/fast food/merchandise areas running around the front and both sides of the Arena. In this respect it compares poorly with Wembley since punters hoping to find a less congested bar on the opposite side – unlikely – are routed through the already-busy main foyer.

The only other major drawback, paradoxically, is its Docklands Development Zone location. Currently served from the City by one painfully congested road and a rail link of limited capacity, access will only improve when new roads and extra rail facilities come on-stream early in the 1990s.

ARENA SOUND REVISED

Now for the good news: London Arena's designers have implemented some fairly serious acoustic measures for live music. For while it may look like an aircraft hanger it thankfully doesn't sound like one.

Chris Bracey, of architects Stewart

Left: Outside, the London Arena is simply a corrugated steel shed squatting between sleek offices and an overhead railway. Right: A giant octopus waves a friendly greeting to passers-by from the rooftop.

K Riddick & Partners, explains that their brief centred on two key requirements: to acoustically isolate the Arena from the outside world and to design it so that, as he says, "It wouldn't stop them staging anything that they hadn't even yet considered."

The latter aspect – playing soothsayer – wasn't too difficult given a little imagination. As mentioned above, totally re-configurable seating arrangements and zoned lighting provided the guts of the solution and with other major shows by Pink Floyd and Pavarotti, plus two car launches and a sports event by now successfully staged, the Arena's promised flexibility seems well proven.

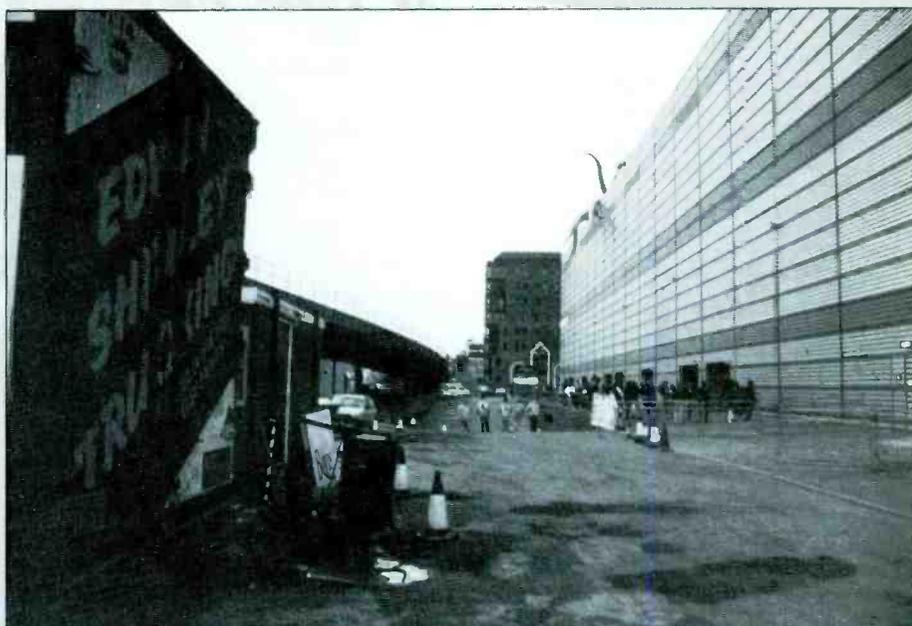
The acoustic requirements, however, were more complex. In effect the Arena had to be acoustically self-contained, taking on board the local authority's demand for no more than 1 dB Leq over ambient noise level at the nearest housing, just 50 m away, plus the need to eliminate railway and aircraft noise from outside.

Says Bracey: "The Arena gave us some interesting and novel problems to solve. It had to be isolated from its surroundings and at the same time provide a good acoustic environment for any type of show – all in a massive box."

To achieve it at reasonable cost they used a combination of careful analysis and fairly simple building materials. Ted Hands, acoustic consultant to the project at Moir, Hands & Associates, outlines their chosen solution.

"In a rectangular room of this size – it measures roughly 99x60x15 metres – the major problems are reflections from opposing parallel walls and the overall reverberation time. For insulation we used double-skin walls and roof with a half-metre void in between. The internal wall and roof surfaces are covered in 75 mm-thick Wood Wall Slab [a mix of wood fibres and light Portland cement], which is an ideal material; it's structurally very strong, has the high mass needed to contain sound and absorbs reflections better than almost anything else."

As a result, the RT has been curtailed to 2 seconds in the 250 Hz to 4 kHz range, only rising to around 4 seconds at low frequencies. A



credible performance with the extra benefit that pre-show soundchecks won't be rendered meaningless once the audience is in.

With reverberation so well tamed the usual problems of uneven dispersion and slapback echo are noticeable by their absence. Even the rearmost tiers received a coherent sound from Duranduran's PA; quite an achievement in such an angular box. In fact, the 'dryish' acoustic gives the Arena an unexpectedly comfortable and civilised ambience, heaven forbid!

Duranduran's sound engineer Mike Wolf found few difficulties in setting up a good mix, other than some low end 'boominess' that's to be expected in a hall of this size.

Inevitably, no-one would expect such a massive hall to be all things to all men – it's unlikely to mollify purists who rage at hearing amplified opera at Earls Court, for example.

SOUND BY CLAIR BROTHERS

A Clair Brothers *S4 Series 2* system provided the PA for Duranduran's world tour. Clair first worked with the band three years ago.

How was the Duranduran tour system adapted for this unknown quantity on his itinerary.

Wolf: "When we're doing small buildings it's a case of whatever we can fit in – the average theatre system on this tour is about 16 boxes. In arenas it's been much more consistent and we've had pretty much

the rig we've got out here now: 48 *S4s*; eight long throws and 40 medium throw cabinets, 20 a side flown, and four a side onstage."

No sub-bass enclosures were used although, he qualifies: "On shows like U2 and Michael Jackson we do use them but only for a big, heavy effect – this system doesn't really need them."

"The PA is driven by Carver amplifiers and each cabinet has about 2000 W of headroom RMS available, although we don't normally drive 'em that hard. We like to give 'em plenty of room to breathe because it gives you more dynamics and makes it more controllable around the edge."

"The *S4* system does take a while to get used to because it's basically flat and colourless so it's up to the engineer to make it sound the way he wants the show to sound, using the EQ and the dynamics.

"It's more like a studio situation even though it's made for live buildings, you can make it sound bright and raspy and punchy for rock'n'roll or you can make it smooth and mellow for the MOR groups."

The *S4* system has now been around for over a decade but the current *Series 2* design, according to Clair Brothers, reflects a constant update programme in which little but the single black box concept has remained unchanged. The *S4* cabinet's tuning, bracing and construction have been upgraded, and its drive unit components frequently revised.

AT THE DURAN DESK

Wolf's 40-channel Yamaha *PM3000* console drove the *S4 Series 2 PA* through a combination of standard and Clair-customised signal processing hardware.

"We create a lot of electronics for our own use, strictly for sound quality. We're using a crossover design which we built ourselves – new processors with time alignment and phasing and improved filters built in. Also in the crossover rack are two of our older models which we've since upgraded."

The company's latest crossover, however, doesn't include a limiter stage: "We kept them on the outside, to give us the flexibility to build each other for the show we're doing. Some engineers just want to slam everything up to the top and let it ride, you know!"

Wolf outlines the FOH control set-up. "For the main mix consoles there are 36 inputs from stage with another 14 inputs from FX returns.

"The show uses a lot of delays and reverbs through two AMSs and two Lexicon *224s*. Otherwise, the effects are fairly straightforward because most of the instrument effects are based on-stage. We have two dbx limiters and an Eventide *Harmonizer* on

the vocals, *Drawer* gates on the drums plus a pair of *SPX90s* and a *REV5* for other effects."

The signal distribution system was equally uncomplicated.

"It's more or less straight into the desk; we use a hard split between the monitors and the house, and if we have to split to a recording truck we use a transformer isolator one. It's pretty straightforward."

Here, the conversation unexpectedly stepped into a wholly new territory: Clair Brothers' current thinking regarding live consoles. The subject is clearly dear to the company's heart since a new and apparently rather revolutionary design is on their drawing boards right now.

"Back in Pennsylvania we're working on a new multipurpose house/monitor console. It'll be flexible and expandable with up to 112 channels on one frame; and a lot of it will be digital with recallable memories, so you can load all your settings from disk."

Stan Horine however, affirms that their forthcoming desk is not intended for mass consumption. "We've had lots of enquiries about installations but we're not designing it to sell on: it's purely for our own use, so we can offer the best live desk along with the best PA system."

ON STAGE AT LONDON AREA

The stage setup was reasonably complex including vocals, lead guitar, sax, bass, drums, two keyboard players, two backing singers and numerous other instruments. MIDI was well in evidence, providing local links between various sequencers, samplers and keyboards.

Most instrument FX came from the musicians' foot pedals and stage racks, augmented by reverb and

so they can use them for house mixes as well."

The London Arena's 16 monitor mixes were routed through Court graphics, with two noise gates on drums and two Lexicon *PCM70s*, a Roland *SDE3000* and a Yamaha *REV5* for general effects.

As with the house system Carver amplifiers powered the monitors, in Clair's own customised racks. Their 2-way monitor racks carry eight amps apiece, each with a built in Clair crossover. Three-way racks also incorporate Carver monoblock amplifiers for the additional LF drive.

"This way we only use a couple of external crossovers, because for the most part they're built into the amplifiers and tailored for the monitors."

Clair Brothers point out that their modifications to 'off the shelf' Carvers are not aimed at tinkering with the amplifiers' performance but simply to accommodate their extra crossover and phase connectors into a more compact package.

FEW FIRST NIGHT BLUES

For both the London Arena and Clair Brothers, the launch of this prestigious new venue passed off with barely a hiccup. Of course,

tradition demands that grand openings mean a few frayed nerves: the

foyer wasn't quite ready to sell

tickets and

Edwin Shirley's

trucks were held

in holding

patterns around

an unfinished

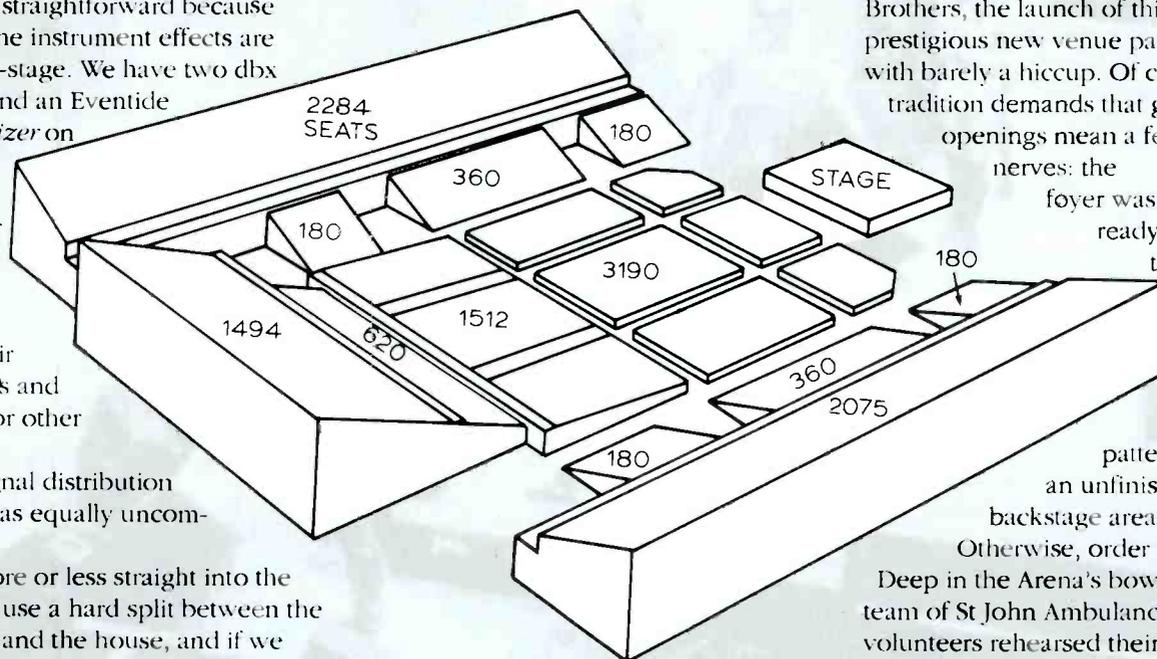
backstage area.

Otherwise, order prevailed.

Deep in the Arena's bowels a large team of St John Ambulance volunteers rehearsed their last pre-show drill as Harvey Goldsmith gave the stewards a stirring pep-talk from the stage.

The London Arena is clearly a well thought-out concept which works extremely well in practice.

And as Clair Brothers' success here showed, it's also likely to prove an ideal showcase for every PA company that's ever wished for an indoor venue that doesn't sound like one.

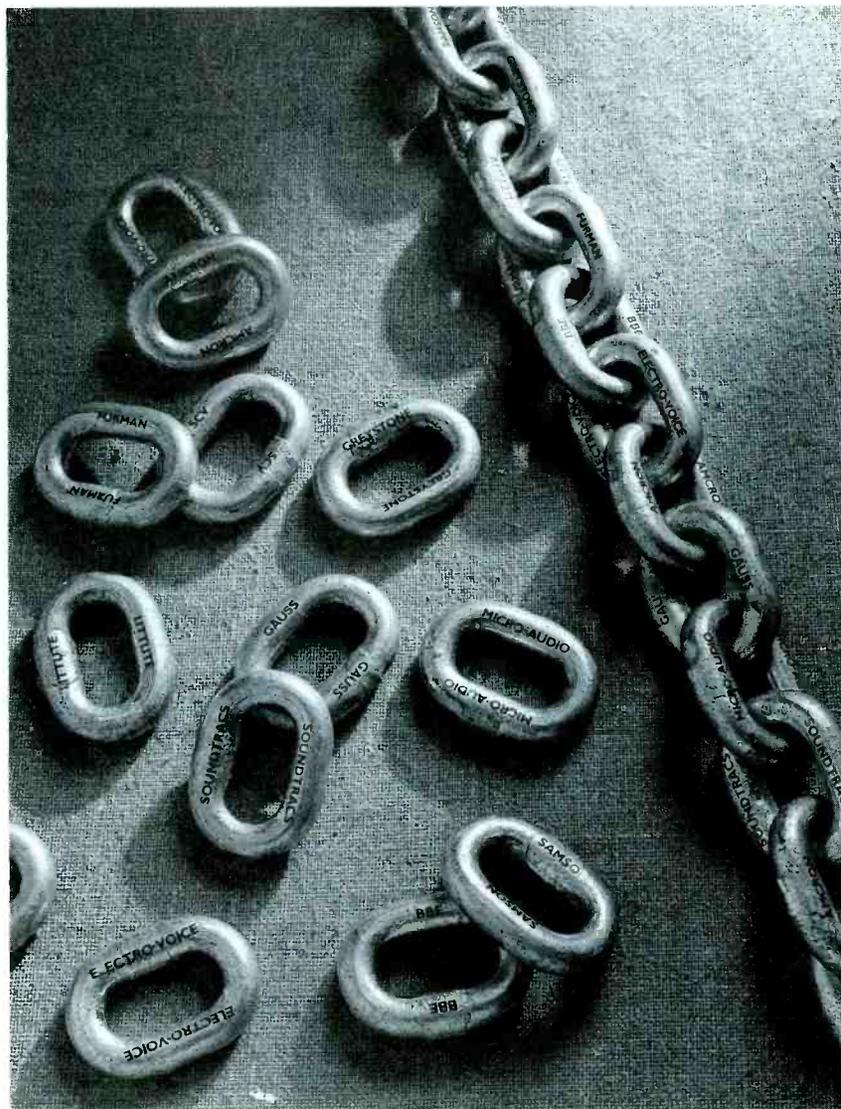


delays on drums and vocals in the monitor mix.

MONITOR MIXING

Duranduran's monitor desk was one of Clair's Harrison-built *SM5* consoles – the fruit of a joint design project between Clair Brothers and Showco.

"Ours," Wolf clarifies, "are just for monitor mixes, 32 in/32 out. Showco's desks are set up differently



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It was billed as The Ultimate Tour. Frank Sinatra, Liza Minelli and Sammy Davis Jr, three of show business's longest players, shared the limelight on a unique package tour of European capitals.

Cynics who asserted that the stars' egos would never stand the pace or that Sinatra's voice would crumble were confounded. It was a remarkably successful tour and only the most churlish critics felt moved to complain about the music on offer. Nonetheless, the concept was certainly adventurous. And the task which faced PA company Britannia Row Productions was also unusual.

Mike Lowe, tour sound production manager, has overseen a Turbosound PA on Sinatra shows since 1984. BRP's track record with the singer, meanwhile, dates back to a tour in 1979. So with BRP's acquisition of the UK Turbosound hire system last year – along with

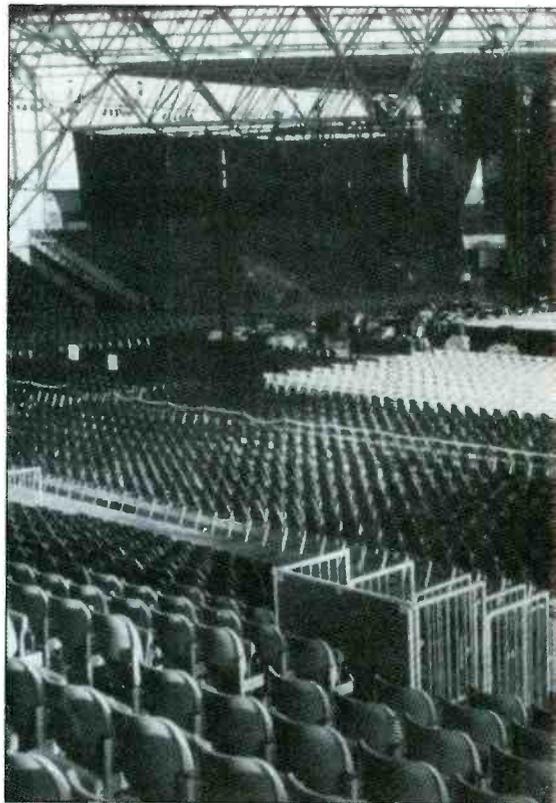
the primary consideration.

"Sinatra's production people look for quality of service first; and only after that, quality in equipment. So if the service is right, we have total choice of what equipment we use – one of the very few artists where this happens.

"Turbosound has worked very well for Sinatra over the years and we see no reason to change. The design of the Turbo system, with its seamless coverage of the mid range, is obviously a big factor with so much vocal content in the show.

"We have two main PA formats. At proscenium-style shows we fly the *TMS-3s* three deep, eight cabinets round a side. And in the round we hang eight blocks of six *TMS-3* from 32x32 ft box truss.

"For most places we spec'd the PA system from plans but no two shows have been the same. We've got a couple of unique venues on this tour



FRANK, LIZA AND SAMMY

Lowe, who joined as BRP's full-time productions manager – the Sinatra connection was neatly completed.

They had plenty to contend with – three major artistes, each with their own half-hour set, personal rhythm sections and entourages, and a range of venues from an exclusive nightclub to an outdoor stadium. Some shows were staged in the round, others proscenium-style. For good measure, they also played two venues where no amplifier had ever gone before.

We looked at both formats – in the shape of two very different shows at London's Royal Albert Hall and the RAI exhibition centre in Amsterdam.

THE SYSTEM ON TOUR

BRP's Turbosound *TMS-3* system formed the house PA. However, as Mike Lowe said, technology wasn't

Mike Lethby looks at the systems and problems at two of the venues on the recent Sinatra/Minelli/Davis tour: RAI, Amsterdam, and The Albert Hall, London

– the Paris Opera House, which has never staged anything but opera before now – and Lansdowne Road rugby stadium in Dublin, which until we arrived was hallowed ground!

"And at the smallest venue on the tour, the Borsen nightclub in Stockholm, we used their Turbosound house system. It's one of the best club set-ups I've ever seen: a centre cluster of four *TMS-2s* and an aligned *TMS-1* delay system, with effects, processing and radio mic systems – all very professional.

"But we threw the Swedish technicians into a complete flap because we felt the balance between the main and delay systems wasn't as good as when we last did a show there.

"It transpired that they'd extended the stage by two metres to accommodate our orchestra. They'd also moved the cluster forward by the same amount – and forgotten about the re-aligning the delays! Mystery solved . . ."

Otherwise, only at the two Dublin shows did the setup vary greatly.

"At Lansdowne Road we were playing to one very wide and high stand, which holds 18,000 people, with another 4,000 down in front of the stage. A wide PA array was the

obvious choice but the stadium is slap in the middle of a residential area. So we used high columns, starting from 2.5 metres above stage level and angled down to decrease spillage."

To cover all these options there were six sound technicians on the tour: three from Britannia Row and three from Sinatra's permanent US crew.

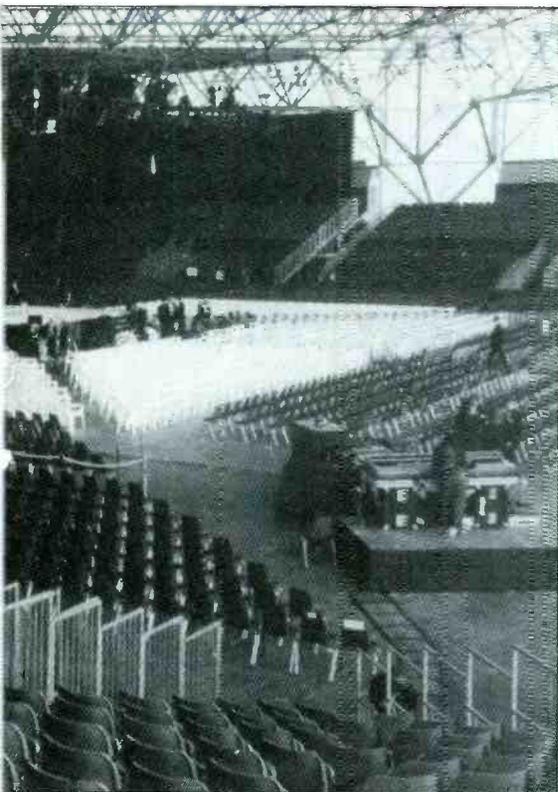
Potential hazards abounded on every show because, Mike Lowe said, detail was critical: "Any problem – however rare has to be dealt with very quickly. Any buzz, bang or click in this show is very noticeable; hence the number of sound crew to deal with those eventualities."

The standard FOH desk was a 40-channel Soundcraft *Series 4* console. At the Albert Hall, a Soundcraft *800B* was drafted in to accommodate nine extra orchestral musicians.

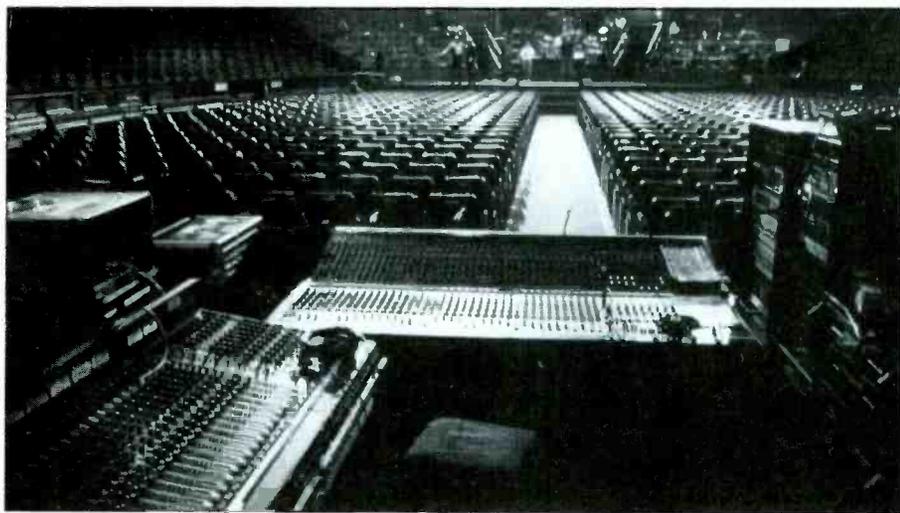
FOH effects were predictably very basic: a couple of Yamaha *REV-7*, two *SPX-90*, eight channels of Drawmer gates and the same number of BSS compressors.

PROSCENIUM-STYLE AT THE ALBERT HALL

The Albert Hall is every PA company's favourite nightmare. Its



ON TOUR



earliest flirtations with rock shows were ill-starred and for a few years in the '70s anyone who came bearing amplifiers was definitely *persona non grata*. Attitudes have changed, of course but the acoustics are still as tough as ever.

Reinforcing stage sound around the hall requires dispersion of almost 360° horizontally and 180° vertically – with the problem that flying capacity from the famous domed roof is limited in practice to just 120°.

Among the various solutions tried here over the years, Turbosound cluster arrays have become a fairly familiar sight. BRP's rig followed a similar layout.

Mike Lowe: "One has to plan it well. There's a centre cluster, which is six cabinets wide and four deep, and two side bars of six cabinets, three wide and two deep.

"We've covered the rear choir seating with a couple of flown *TMS-3s*. The bottom row of the cluster is angled down and under-hung with *JBL 2445* horns to cover the front seats—because this tour requires a very clean stage, so we can't use any ground level in-fill."

The most difficult problem, Lowe explained, was balancing the orchestra's acoustic sound with the PA.

"Our ideal is to have a full orchestra mix in the system, so that although we're working to very low volumes the acoustic volume from the orchestra won't be heard. We can control the overall sound far more if the whole orchestra is in the system, but here it doesn't work that way.

"The Albert Hall being the room it is, there's a tremendous amount of volume from the instruments

themselves so balancing the louder instruments against quieter ones is tricky; we have to pull some of the instruments out of the system at times and allow them to play naturally – especially the drums, which we can't really amplify or EQ at all.

"We're close-mic'ing everything with Countryman *Isomax*'s and Sony *ECM-50* pick-ups on the strings. But there's still a slight loss of control compared to the arena shows. This half-and-half situation isn't exactly desirable.

"We also send a full house mix back to the stage entrances so that production people can monitor what's going on, and we supply a

video camera with a mix for the production areas."

Monitoring at the Albert Hall was another complication. In order to keep the stage clear BRP's new Ramsa monitor console had to be sited alongside the FOH desk at the back of the hall, giving the monitor engineer the unenviable task of dealing with 19 mixes under remote control.

Mike Lowe: "And he's doing a good job too!"

MONITORS & MICROPHONES

Orchestra monitoring centred around a dozen TOA 'hotspots' mounted on mic stands, Meyer *UPA-1s* for the sidefill mixes and a front-of-stage floor monitor mix using Meyer *UM-1s*. Another *UM-1* provided a mix for the pianist; and two mixes each side fed the rhythm section to the strings and the brass/woodwind/reeds on Turbosound *TMW-212* low profile wedges.

Liza Minelli's drummer set up his own mix on a Yamaha *1202* console via a pair of PAS 1x15 inch wedges.

Stage monitors in the round were fairly simple as far as Frank, Liza and Sammy were concerned – just one *UPA* at each corner of the stage, laid on its side.

Stage mics included Cetec-Vega radio mics on vocals and the aforementioned Countryman *Isomax* on violins.

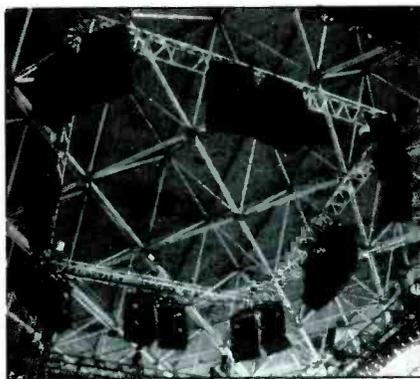
Mike Lowe: "We've been getting through our string microphones pretty fast; it's difficult to train musicians not to leave them on the floor at the end of the show for the next guy to walk over. I think we're starting to bite into a few of our Sony *ECMs* now.

"As for Sammy's tap dance spot, where we're in the round and can get under the stage, we're using an AKG *C-451* with a *CK-1* head. Otherwise we just gaffer an Amcron *PZM* in

Top: Before the show. Setting up the concert hall at RAI, Amsterdam
Below: Front-of-house at London's Albert Hall. The mixing consoles used were Soundcraft series 4 and 800B



Top left: Front-of-house mixing position at RAI, Amsterdam
Top right: The Turbosound rig at RAI
Below left: Britannia Row's Mike Lowe at the monitor desk installed in Amsterdam



front of the stage, which actually works fine.

"For the orchestra, we use Sennheiser 421s on reeds, cellos and toms; SM-57s on guitars and snare; C-451s on percussion and hi-hat; SM-58s on trumpets and French horns; SM-87s on trombones and for the drum kits, a straightforward set-up with four overheads.

IN THE ROUND IN AMSTERDAM

For their shows 'in the round' BRP flew the PA from a 32x32 ft box truss with a block of six TMS-3 – two wide and three deep, in the centre of each span – and a further block of six cabs across each corner. (Outside of that, a further 56x56 ft box truss supported the lights and eight follow spot operators.)

This was the basic rig for the RAI Exhibition Centre in Amsterdam. But its resonant square hall, measuring about 360 ft on each side and boasting a sonorous *Meccano* set for a roof, provided unforeseen problems on a large scale.

Mike Lowe takes up the story: "The seating tiers here are very low and there's a 5 metre wall of glass all the way round from the top of the seats up to the roof. So to avoid putting anything into that glass, we've

reduced each block of TMS-3s to just two deep.

"It's exceedingly difficult because it was never designed for concerts. The acoustics are horrible and there's tremendous reverberation; even when we took frequencies below 100 Hz out of the system anything, like a snare drum kit, would set up a huge rumble.

"Normally, when we play venues in the round we aim to put everything into the PA to get maximum control over the sound. But here again, like the Albert Hall, it's a 'halfway' situation with only part of the orchestra in the PA.

"Alan Richardson, the house engineer, has done a great job tonight because the sound is certainly acceptable, and, in the hands of a lesser engineer, this room could well be a disaster. Where he's really winning is simply in holding back and being very patient with the room.

"Apart from that we've got a normal setup; the other speakers on the FOH system are two UPA-1s on three sides of the 24 ft square stage which face the audience (the fourth side faces the orchestra pit) with six UPA-1s for nearfield in-fill."

CONCLUSION

Mike Lowe is one of rock 'n' roll's most irrepressible raconteurs. He recalled, with relish, a highlight of 'The Ultimate Tour'.

"In every country we've visited that's had a Royal family, we've had the Royal family there.

"The Borsen, our smallest gig, with seats at £1,500, was a very tight setup; we had our monitor desk on the stage with the engineer standing on floor level by the backstage doorway.

"During the show a woman came up to him and asked if she would use the backstage toilet. He said, 'Sorry, you'll have to use the toilets on the other

side of the club' – which was absolutely chock-full of people; it was impossible to walk during the show. But she persisted, and he was trying to do his 19 mixes and he got rather fed up with her and yelled in her ear, 'Lady, there's only one way you can come backstage and that's if you're the King or the Queen of Sweden.'

"So she said, 'But I am ze Queen.' And yes, she was!"

On a more serious note, reinforcing the sound of an essentially acoustic show for up to 22,000 people without destroying all sense of intimacy is clearly a trickier job than the average rock tour PA hire.

As Lowe drily observes: "Their expectations are very high in terms of sound quality – it's definitely a CD audience.

"I wouldn't say it's been super-difficult, though. You could meet as many parameters with a heavy metal band, just different problems. Getting a good sound at different venues for a rock band with a weak vocalist can be just as hard!

"But this kind of show does demand 100% attention to detail. The type of music and artists we're working with mean that anything even slightly wrong will stand out like a sore thumb.

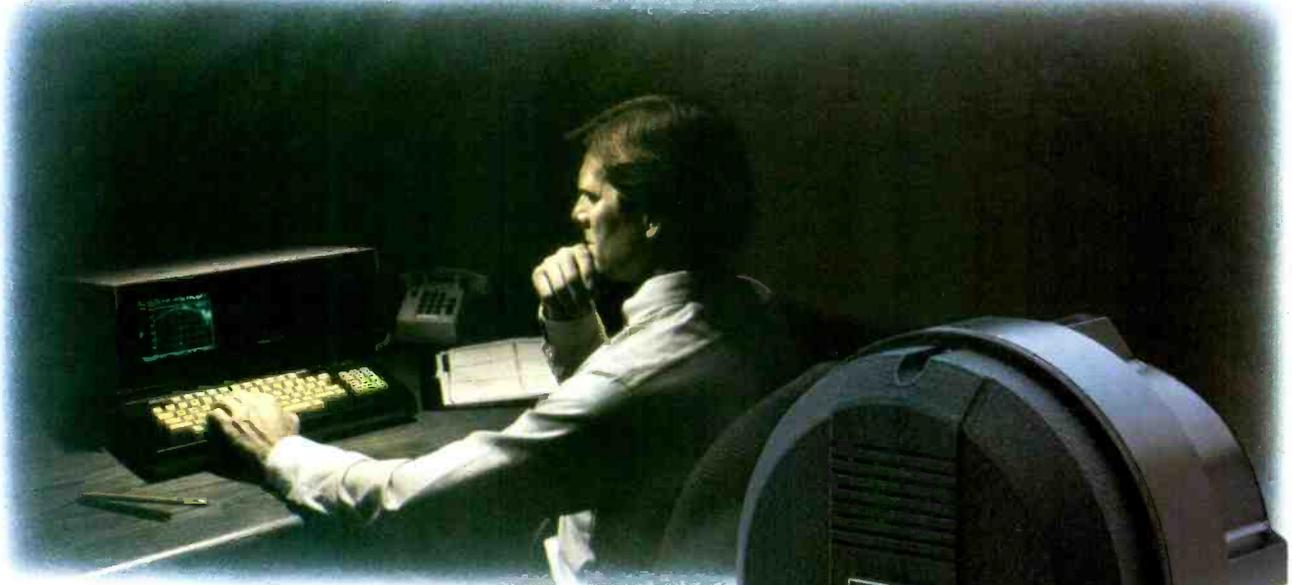
"At the Albert Hall, for example, we had a marginally noisy strings channel which on a rock show would have been inaudible, something to be solved later. Here we could hear it, so it had to be corrected on the spot. And any substandard venue mains, which again we'd normally live with, had to be properly sorted out."

If anything, the tour reiterated the argument that shows in-the-round provide the best solution with artists who people hope to see in the close-up – helping to preserve that elusive 'club' atmosphere.

Mike Lowe: "It's always the same, even with a rock show. Although our rigging problems may be compounded, the sound problems are cut dramatically in the round because we're only throwing half the length we'd normally have to deal with.

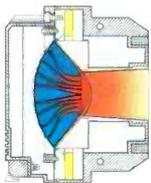
"Especially with an act like this where one doesn't want to have a tremendously loud sound at the front in order to get it to the back."

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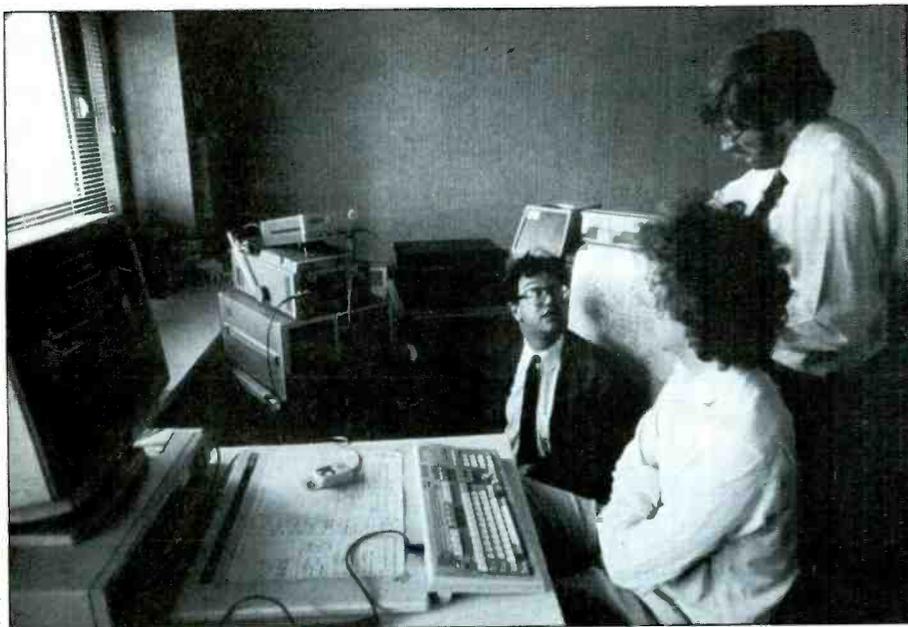
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INSIDE NEXO

computer simulation for high power loudspeaker manufacture

Nexo is a French manufacturer of high power loudspeakers. The company is headed by Eric Vincenot with Philippe Robineau leading the research department. Founded in 1979, Nexo has concentrated solely on loudspeakers for the PA industry since 1983.

The heart of their design philosophy is computer simulation of real loudspeaker systems and they have no regard for the 'rock'n'roll'

By David Mellor

school of loudspeaker design techniques.

Computer simulation of real loudspeakers, for Vincenot, began before Nexo existed as a company:

"When I was at university I had a very simple simulation package, which was running on a Hewlett-Packard programmable calculator, working from the basic books by

Olson and Beranek, and integrating some of the classic AES papers. At Nexo, we bought our first microcomputer in 1980, which was a Hewlett-Packard HP85, so we had microcomputers since a very early stage.

"We started developing a complete simulation program, which has built up over a number of years, because when you are doing the program yourself you can add modules as time goes by. Philippe Robineau is right now working on the next version of the program, because we are releasing products for which we need new facilities."

The Nexo simulation program uses traditional electrical and mechanical drive unit parameters: moving mass, compliance, inductance, voice coil DC resistance, BL product, cone surface area, mechanical resistance etc.

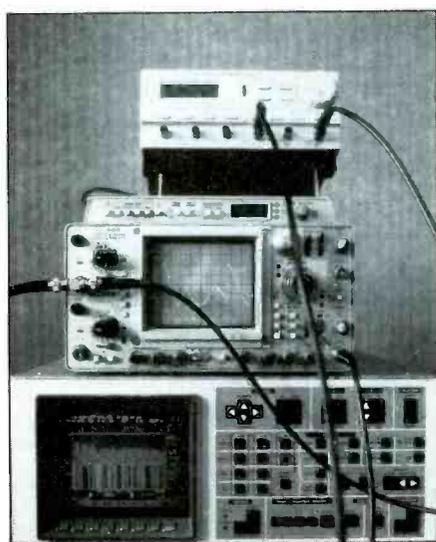
"Initially it was basically for horn design. We simulate the behaviour of the horn – not ideal horns, real horns – including the way they couple together in the environment, and the influence of the reflecting surfaces, shape of the mouth, that kind of thing.

"Then we started to do more complicated horns. Any shape could be simulated, including any hyperbolic or exponential section under its cut off frequency. We started integrating various kinds of chamber resonators, which are used in the *PC Line* where you have three acoustic resonating chambers."

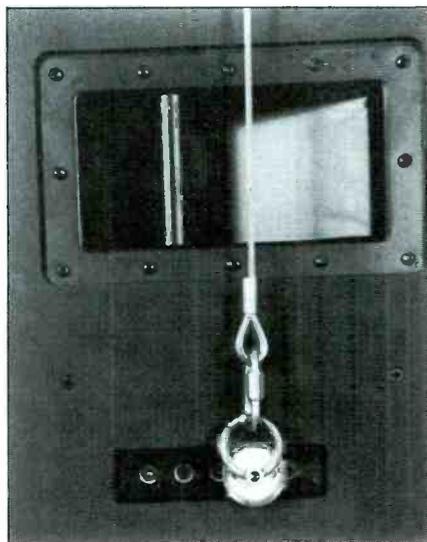
Obviously, even with a sophisticated computer simulation program, there has to be an object in view, a design goal. But according to Vincenot, that goal will be more easily reached if proper techniques are applied.

"The objective of a car designer is to design a car that handles well, and feels good. But he doesn't do it by throwing bits in the air until it falls together to make a BMW. He makes a good product by understanding how to make a good product. If he makes a bad product he will also understand how he made that bad product. What he doesn't understand, he tries to model or measure, and then understand why, so that he will not make the same mistake twice

"I have extremely strong negative



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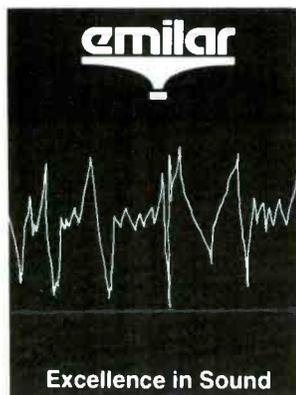
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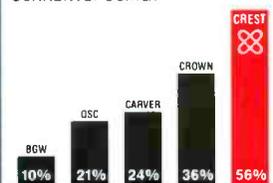
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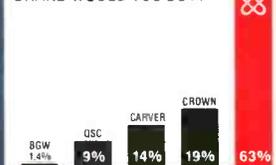
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feelings towards people who say they do everything by feeling. Designing speakers is a science, it is not an art. It has artistic aspects but you are converting an electrical current into the vibration of molecules, you are not creating music. It is a purely physical process. There is nothing especially beautiful to it, or creative. It is engineering."

The computer simulation covers more than just the drive unit, horn and cabinet:

"All the acoustical path is modelled, and several other parameters. We model all the passive filtering and equalisation. We also model the thermal performance. We check things like efficiency, response, displacement of the voice coil, the heat dissipation versus frequency, the speed of sound in the port, phase . . . all the mechanical and acoustical parameters you can get, including the acceleration, speed of diaphragms, things like that.

"If we have an idea for a design, it doesn't mean we work stupidly with the computer. It means that when we have an idea that we think is good, we can quickly model that system and see if it could work. If it had terrible flaws that proved that it was never going to work, there would be no point in actually building it. It just cannot sound right anyway.

"If the model is favourable, then we stand a good chance of having a good product. It doesn't mean we don't have to listen to it but at least the design is valid. It is worth building."

DESIGN TECHNIQUE

Nexo use a step-by-step approach to loudspeaker design, gradually replacing the simulated data during

the prototype building process. This approach means that real test data can be incorporated in the model as the design progresses.

"We start building it in stages, with a bass loudspeaker and a cabinet. We then take measurements with very sophisticated test systems. We can measure, for example, an unfiltered bass unit with its cabinet. If we measure, with an FFT (Fast Fourier Transform) analyser, the amplitude, phase and the complex impedance of the system, we get a quadripole which we can then put in the simulation system.

"We first compare that with the theory to see if the simulation was valid, then replace the part that was simulated with the part we have actually measured, and put in the computer and carry on. We then design the filter on the *true* impedance, on the true phase curve and the frequency response.

"When all this process is finished we are left with a finished prototype. The development time we have on thinking of products and designing

them is long. But after that, we only have to make a few prototypes, maybe two or three maximum for a product."

Computer aided design, of course, depends on thorough and accurate testing of finished prototypes. Testing methods at Nexo combine sophisticated measurement equipment with a fascinating way of conducting comparative listening tests.

"We started having FFT analysers about five years ago. We now have a Japanese Onno-Sokki machine, which is probably one of the most advanced; it is a very powerful machine. Bruel & Kjaer microphones, and also Bruel & Kjaer accelerometers.

"The accelerometer is a very useful piece of equipment. Through the FFT we can see the acceleration and displacement of the cone, the peak, average, spectrum of displacement, spectrum of acceleration, these kind of things.

"We don't have and we don't need an anechoic chamber. But we have a huge field in front of our premises. We take the cabinet and put it facing upwards on a fork lift, and put the microphone one, two or three metres above it, and lift the whole thing six metres above the ground. There are no buildings around which are higher than this, so we can have an extremely good anechoic chamber when we need it.

"Reflections are no problem because the cabinet is facing upwards. Only the low frequencies would be affected by reflections from the ground. We spread some absorbent materials on the ground so that the effect is around half a dB or something – slight undulations below



MS1C

MS1V

MS1W

100 Hz, which is in fact less than an anechoic chamber would have.

"We don't have a listening room as such, because for the kind of products we do it would have to be massive. But we have an agreement with a large modern theatre that when we need a good quality, good size auditorium, we just ask them and work there.

"We have developed a technique to compare a loudspeaker against the processor's signal input – not against a reference loudspeaker. We have a system which allows us to increase the volume of the cabinet and decrease the level from the test microphone simultaneously. We record the direct output from a reference tape onto one channel of a DAT, and on the other channel we record what is coming out of the cabinet, at the same level. The recording level is constant whatever the listening level.

"We listen to this DAT recording through a pair of Stax electrostatic headphones, which have an extremely wide bandwidth and dynamic range. In this way, we can archive our listening experiments and relisten to them whenever we want to make reference.

"This test is quite interesting because when you listen to high power speakers at high levels, the quality is not always very agreeable. It's too loud and too much distortion, things like this. When you listen to a loudspeaker that was played very loud at a lower level, it is closer to the original than you might have thought. It means that a lot of modern sound listening levels are so high that you are entering an area where it is actually not an agreeable experience."

So do Nexo aim at an accurate sound, or a sound that is more suited to some purposes than others?

"We are very much against colouring the sound voluntarily. A loudspeaker shouldn't sound good on rock and roll and terrible on classical music. It shouldn't sound good on classical music and terrible on rock and roll. At a level which is not stressing the loudspeaker, I would say that any material should have a good sound. For that kind of performance, I would say that you

have to have a flat frequency response. There is not, in my opinion, such a thing as a cabinet for rock and roll. There are only cabinets which have defects that some customers like. In reality, engineers have good enough EQ and effects, and they can do the colouring with that, and not have the cabinet do it permanently for them."

DRIVE UNITS AND CABINETS

"We use several driver suppliers, from England, Italy, Japan and France. We make modifications to some cones and units. On some drivers we do a ferrofluid injection. We build all the horns ourselves. We also make one of the drivers ourselves, a patented compression midrange driver.

"The twin HF driver (which is built by Nexo, apart from the drivers) is not the first such product but we think we have done it in a more efficient way.

"On the two narrower sides of the constant directivity diffraction throat, we have square holes – not round – which are *not* aligned with the driver. They introduce a minute time delay into the small space next to the reflector. There is a wedge-shaped piece, which you can see on the photograph. This is a parabolic reflector which transforms the two square holes, through which the drivers are radiating, into a virtual point source at the apex of the angle made by the horn throat. To force the propagation into the throat there is a triangular fan-like waveguide, where no two surfaces are parallel. There is a

constant expansion. The rays of sound, if you can say so because it has been done with ray tracing techniques, are forced to follow that expansion. All these elements are in the computer simulation."

Vincenot believes that enclosure materials have come in for more attention than is justified.

"We have found through measurement if you pay attention to good design, make some measurements with the accelerometers and keep your vibrations well behaved, there is no specific need to go through extensive vibration and material analysis for the cabinets.

"If you have an acoustic resonant mode inside your cabinet – which you are bound to have at low frequencies – even if you make a one metre thick cabinet, the resonance will get out through the cone, which is only one millimetre thick. It has some degree of isolation, but still there is a point of diminishing returns where it is not worth building a heavier cabinet.

"We do use high quality materials, but the main reason we use birch ply is not acoustical – it is because it is an extremely strong material. We have also done vibration analysis on the material of the horns, and we have seen by experience that you do not need extremely high thickness to get good performance."

NEXO SYSTEMS

Nexo currently produce three system ranges, the *SI (Integrated System)* consisting of the *SI 1000* and *SI 2000*, the *Mini Integrated System*, and the *PC Line*.

The *SI* systems are both fully horn-loaded and use an active system controller – the *TD* controller. The *SI 2000* is exactly the same size as the *SI 1000* (41 x 27 x 22 inch bass, 14 x 27 x 22 inch mid/top) and has twice the power handling capacity.

The *Mini Integrated system* combines the mid and top section of the *SI* with a direct



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radiating bass driver using a passive crossover and an electronic processor.

The PC Line is a range of small volume cabinets with a triple resonator loaded bass unit, directing radiating midrange and a horn for HF. It uses an active controller.

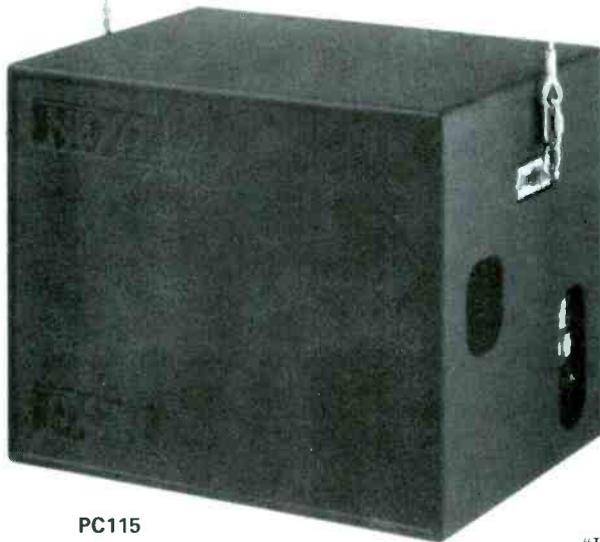
"The *Mini Integrated System* is a fully passive system, which does not necessarily mean that the performance is less good. A lot of people believe that you get more power by actively crossing over a system, which is not true. What you get is a diminished crest factor, which gives you additional voltage headroom but no more power.

"We are letting the midrange and top end run at the full efficiency of which horn drivers are capable. The bass has a lower efficiency because it is a direct radiating system. We electronically attenuate the mid and top before the amplifier. The amplifier really only sees low frequencies and a very low level of mid range and HF. The cabinet's high efficiency in the mid and top end restores the level of the mid and top."

The *PC Line*, being a compact system, uses quite different techniques to achieve a good performance/volume ratio.

"On the PC line we use a high efficiency triple cavity tuned resonator, which means that the bass unit is not on the front panel. It goes through a sort of port, which is also ported. What you get is a high efficiency system, which is not very linear in frequency and amplitude, so you use the reverse transfer function – tuned electronics – to restore a flat frequency and phase response. But you keep the advantage of high efficiency – for that volume – very low displacement of the cone, and also an extended low frequency response for a cabinet of that size.

"Also, the proportions of the bass and mid range drivers are roughly 2:1, vertical to horizontal. This means that we are maintaining a correct proportion of directivity, even if it cannot be constant (which is not



PC115

possible with radiators of this size). This means that for a small cabinet we still maintain good intelligibility at reasonably long distances in reverberant rooms"

Many current speaker systems now use active control units. The *TD* controller for the *SI* systems, has a number of interesting features:

"The first purpose of the *TD* controller is to control the temperatures and displacement of each drive unit by measuring the voltage and current through the system. We have an analogue simulator which models the cone displacement and the voice coil heating in the system. We then know what the temperature of the voice coil is at any moment, and what the instantaneous displacement is.

"We also model the heating of the drive units' chassis themselves. The heating time constant of the loudspeaker chassis is several hours, whereas the voice coil is seconds. If you use a very high power drive it will take into account that your system is heating more and more. This is remembered by the system. If you switch off the *TD* controller for five minutes and plug in again, it will remember that you used your system at very high power for two or three hours and that your speakers are hot.

"After this come, not VCAs or VCFs, but something else which we call VCEQs. We do not have low or highpass filtering or sliding filters or VCAs, because are all very audible processes.

"Take displacement for example: all loudspeakers have very specific

frequencies at which they move far more than any other frequency.

At low frequencies, for example, if you put a sine wave at 32 Hz into an *SI 2000*, the driver will not move at all but it will heat a lot because it is the Helmholtz tuning frequency of the cabinet, because it is a ported horn. If you go to 55 Hz the driver will move a lot but heat very little.

"If you have a lot of displacement at 55 Hz, rather than bringing the level down, or putting in a highpass sliding filter, what we do is to reduce the level only at 55Hz, like a sort of notch filter which is matched to the driver. This is far less audible than the alternative solutions. We also have a system which forbids any imbalance between the drivers beyond a certain limit, so that the system remains reasonably flat.

"After that, we have an intelligent peak limiter, which is always riding above the clipping level of the amplifier, but is also in realtime measuring that clipping, so that even if the amplifier is current clipping it can take this into account. There is also a compressor in parallel with the thermal limiting, which only operates when the thermal limiting is functioning."

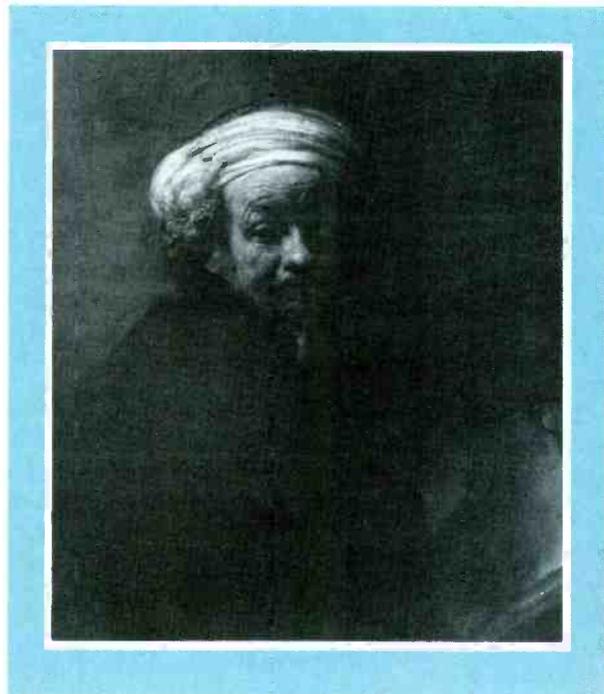
Eric Vincenot's explanations of the Nexo systems and philosophy reveal a high degree of attention to detail and a devotion to a true understanding of what makes a loudspeaker system work.

Also in the Nexo product line is *Nexocaad*, an acoustic modelling system, developed in association with researchers in room acoustic simulation from a company called APPIA, which will run on an IBM AT or compatible personal computer. So the user of Nexo loudspeakers, and those of other manufacturers, can extend computer simulation techniques to the design of complete installations.

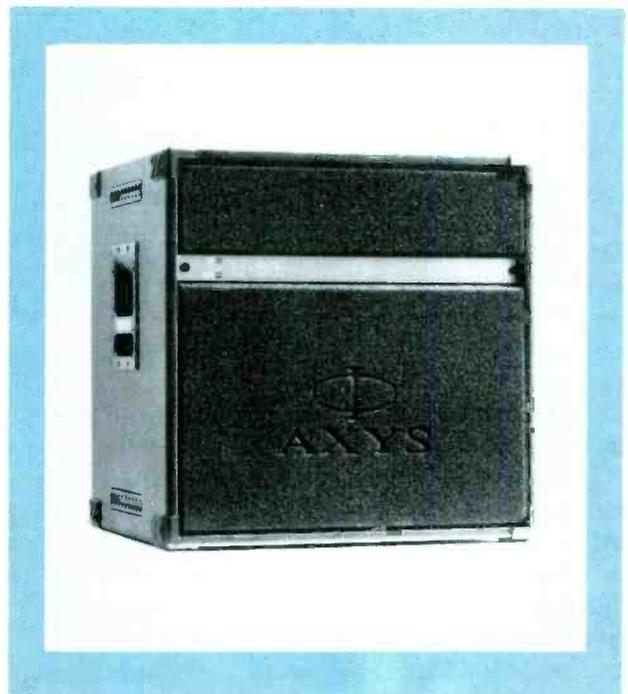
We look forward to finding out more on Nexocaad on another occasion.



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review

AMB TOOLS

ACTIVE REMOTE CABLE TESTER

An age-old recipe for jugged hare begins 'First catch your hare!' Anyone wanting to make a device to test the integrity of audio cables would do well to first define the ideal cable. After all, if you do not know what a perfect cable is, how will your cable tester be able to tell a good one from a bad one.

To make a simple tester must be the easiest audio construction task possible – a battery and bulb (or LED plus series resistor, for the more ambitious). To make one that would be useful during the heat of a show fit-up is another matter.

But first, the ideal cable. Here is one interpretation of what a cable should look like in a perfect world: A balanced audio cable will have three conductors, hot, cold and screen. They will have zero resistance from one end of each conductor to the other, and have infinite resistance between the conductors. Unnecessary properties such as inductance and capacitance will be conspicuous by their absence. The cable will also be mechanically strong and resistant to 'stage abuse'.

If you will excuse the items I have omitted from this specification (such as coilability and interference rejection), the next step is to figure out how to test the closeness of any given cable to this ideal. Equipment would include a resistance meter and an inductance/capacitance bridge for starters. Already this is a task much too complicated for everyday operation. A compromise has to be made.

A cable tester, simple enough for pre-show or pre-session checks, will not give the full lowdown on the quality of any particular cable, it is just not possible in the time available. It should, however, give a reliable 'go/no-go' test, which is easy to perform and is unambiguous. Save

David Mellor



the resistance meter for checking permanent installations.

The Active Remote Cable Tester is as comprehensive as a quick tester could get. Simply, it will tell the operator whether there is continuity and whether there are any shorts. It will also show, by the combination of LEDs that light up, precisely what the fault is.

The unit's biggest advantage over the battery-and-bulb tester is the fact that you do not need to have both ends of the cable connected to the tester itself. (Testing a multicore before rolling it out would be a procedure of dubious value. Using one pair as a return to the tester is normally the preferred, somewhat inelegant, alternative).

With the AMB tester you need to have access to both ends, wherever they may be, and preferably an assistant, but the unit is able to use the three conductors of the cable to form a complete circuit.

It comes in two parts – the unit itself and a remote connector built into a male-female XLR coupler. The unit is built into a type of aluminium die-cast box that will be very familiar to most of us. Externally, there are two male and two female XLR connectors, two 1/4 in jacks, three multicolour LEDs, on/off switch and a test button. There is also a 4 mm

socket which is connected to the case.

Internally, the active circuitry is encapsulated. This could be for one of two reasons: to shockproof it; or because the makers don't want people to see how simple it is. I would be inclined to believe the second of these options, especially as the connections to the XLRs and jacks are also covered with opaque resin. It doesn't really matter, if the device works, because it would probably cost more to pirate the design than to buy one in the first place – and you wouldn't get the benefit of the neatly printed fault descriptions and a clear conscience.

To test an XLR cable, connect one end to the male or female XLR on the front of the unit and the other end to the appropriate socket on the right hand side. The XLRs on the side can be ignored and the remote connector used if preferred, the function is exactly the same. If all is well, there will be two LEDs showing green. If, say, pins 1 and 2 of a connector are reversed, then the first multicolour LED will show red, the second green. Similarly for most conceivable misconnections and missing connections, the pattern of colours can be used to diagnose the fault, as listed on the top of the unit.

I checked all the combinations listed and found one oddity among the fault descriptions given.

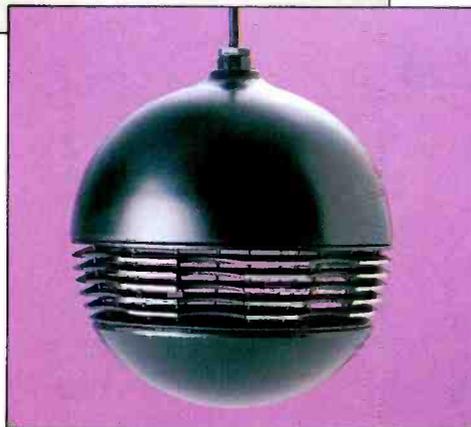
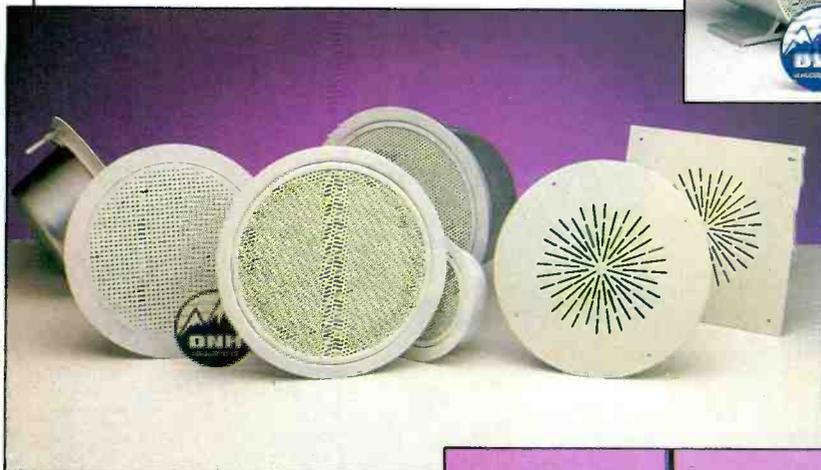
The combination of LEDs red-off-off is quoted as '2 and 3' reversed and 3 open'. This seems to make no sense as if 3 is open, how can it be reversed? Discussion with the manufacturer revealed that it means this: pin 1 to pin 1; pin 2 to pin 3; pin 3 to open circuit.

An exotic fault by most people's standards and, if you reverse the cable, it becomes '2 and 3 reversed and 2 open'. Perhaps puzzlement such as this is a necessary result of trying to cope with all eventualities.

THEY SPEAK FOR THEMSELVES . . .



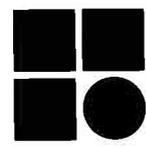
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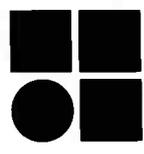
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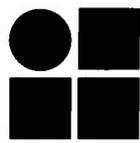
linear frequency response, sufficient dynamic headroom, even SPL at earheight within a radius and avoidance of combfilter effects by



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review

As well as testing shorts and continuity, shorts between conductors and the connector shell can be picked up – provided the connector in question is either connected directly to the unit, or its shell is electrically connected via the 4 mm socket. This comes up as a red 'fault' LED. (Although having the connector shell tied to the cable's ground conductor preserves electrical screening through the mating *XLR* pair, it can cause earth loop problems if the connector touches bare metal on any equipment).

Quarter inch jack (type A) cables can also be tested. If a mono jack is used then the green-yellow-off indication ought to come up showing that 1 and 3 (by analogy with *XLR* pins) are shorted or green-off-off to show that 3 is open, according to your wiring preferences. The unit does not work with type B jacks.

I found the AMB Active Remote Cable Tester to be a very handy little box – when used within its limitations. It doesn't have X-ray vision so it can't see that unruly strand of screening braid inside the *XLR* that will one day sort out the hot pin. Neither can it point out a freshly made dry solder joint. (A dry joint often makes an excellent electrical connection – until the air gets inside it and oxidises the metal). But as a quick way of picking up the most common cable faults it is ideal.

PHASE CHECKER

The traditional method of checking the phasing of equipment is to supply a sinewave to it and compare the input and output signals on a dual trace oscilloscope. If the output is the wrong way up then there is a phase (strictly speaking, signal inversion) problem.

The main snag with this method is that it is cumbersome, you need four pieces of equipment (scope, signal generator and two probes) and you may have to slacken off the shell of the input connector to find somewhere to connect one of the probes. This is definitely a test bench

procedure.

There is another problem with this method. You usually can't use it to phase check a power amp that works in the bridged-mono configuration, where neither side of the output is connected to earth. Unless the scope has differential inputs then you will find yourself driving the amp into mains earth, through the earth pin on the scope's mains connector. Or, if you lift this earth, there will still be a direct connection between the 'earth' of the signal generator and the output of the power amp, through the scope. Meaningful phase checking is impossible.

The ideal way of checking phase is to use an asymmetrical signal as the test waveform so you do not have to compare the input and the output signals. You can see from the output signal alone whether it is the right or wrong way up. (If the signal is symmetrical, then the switch on the scope will decide which way up it appears to be). If the testing device could be independent of mains earth, that would be useful too.

The AMB phase checker conforms ideally to these requirements. It comes in two parts, the generator and the detector, both battery operated and built into palm-sized die-cast boxes. The generator creates a signal whose polarity the detector can recognise – a positive going pulse, closely followed by a smaller negative going pulse. If all is well, a green 'in phase' LED comes on. If not, a red 'out of phase' LED shows.

The generator has an on/off switch, male *XLR*, a small speaker, level control and a pin 2/pin 3 hot switch. The speaker makes the pulse audible to a microphone, or the line level output (up to +6 dBV) can drive other equipment. On the underneath of the unit is a recessed control which can adjust the pulse repetition rate.

The detector has its own internal microphone, or it can be fed via the female *XLR*. There is a 3-way switch to select between external microphone, line level and internal microphone. A symmetrical/asymmetrical switch provides for balanced or unbalanced signals to the unit with either pin 2 or pin 3 of the *XLR* hot.

Microphones, loudspeakers and processing equipment were checked



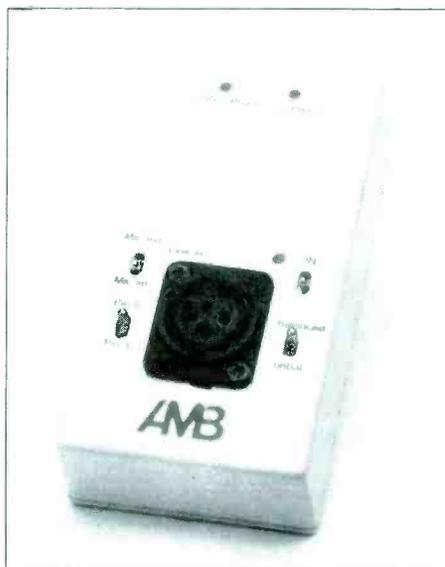
AMB Phase checker/generator

using the unit. All checked out as expected, apart from a cable which I had inadvertently left phase reversed after checking out the cable tester!

The only worry I might possibly have had over the performance of the unit was whether the test waveform could be sufficiently distorted to make readings meaningless (for 'meaningless' read 'wrong!'). Pieces of equipment such as equalisers and crossovers have phase shifting properties so the possibility is there.

As a test, I put the signal through a parametric equaliser and viewed it on a scope, while monitoring the detector's LEDs. Fortunately, no setting of the equaliser could remove the characteristic 'strong positive pulse followed by weak negative' and the detector always read correctly.

Verdict: It works.



AMB Phase checker/detector

review

HEADPHONE DISTRIBUTION SYSTEM/LINE MONITOR

A long title for a very simple piece of equipment. I suspect when AMB were deciding what products to make they noticed that decent headphone amplifiers are rather thin on the ground. Even the headphone sockets you find on equipment are often incapable of driving headphones (particularly high impedance phones) to a high enough level without distortion. What is needed is a device that will let you drive headphones from the output of a power amplifier, and let you parallel several pairs. Here is such a device.

The unit is so simple with just two potentiometers and the necessary connectors but that is all it needs. There is a switch that will allow stereo operation (XLR pin 2 left, 3 right) or mono (2 hot or 3 hot). Mono



operation is particularly handy as two separate channels of foldback could be supplied for the musician to choose between.

As well as the female input XLR, there is a straight-through connected male XLR so that units can be chained. With a 200 W/8Ω amplifier (which the unit claims to be able to handle) you could chain up to 40 or more high impedance headsets, or smaller numbers of low impedance types. The only slight problem is that level controls are left and right, rather than master and balance, which would have been better, but requiring more complex innards and probably greater cost. The unit I had for review had melted insulation on some of the

internal wiring, probably due to a slip of the soldering iron, but fortunately not through to the conductors.

The sound quality was perfectly adequate up to the highest levels the headphones, and my ears, could tolerate.

OVERALL VIEW

All of these units are built to a good standard and should prove resistant to normal professional use, although the stick-on rubber feet will soon be lost, and a TORX type screwdriver will be necessary if any of the XLRs ever need replacing. In the headphone box connectors are fixed internally by one self locking nut and one conventional nut, without washer. This may lead to loosening.

The performance of all of these units was very good.

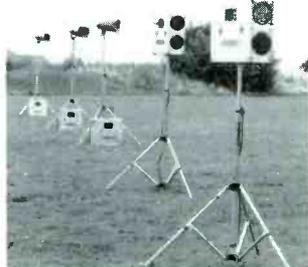
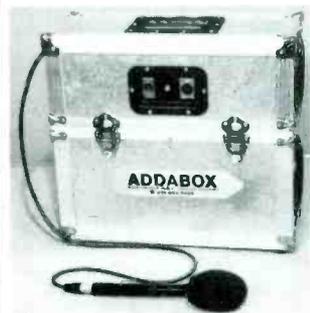
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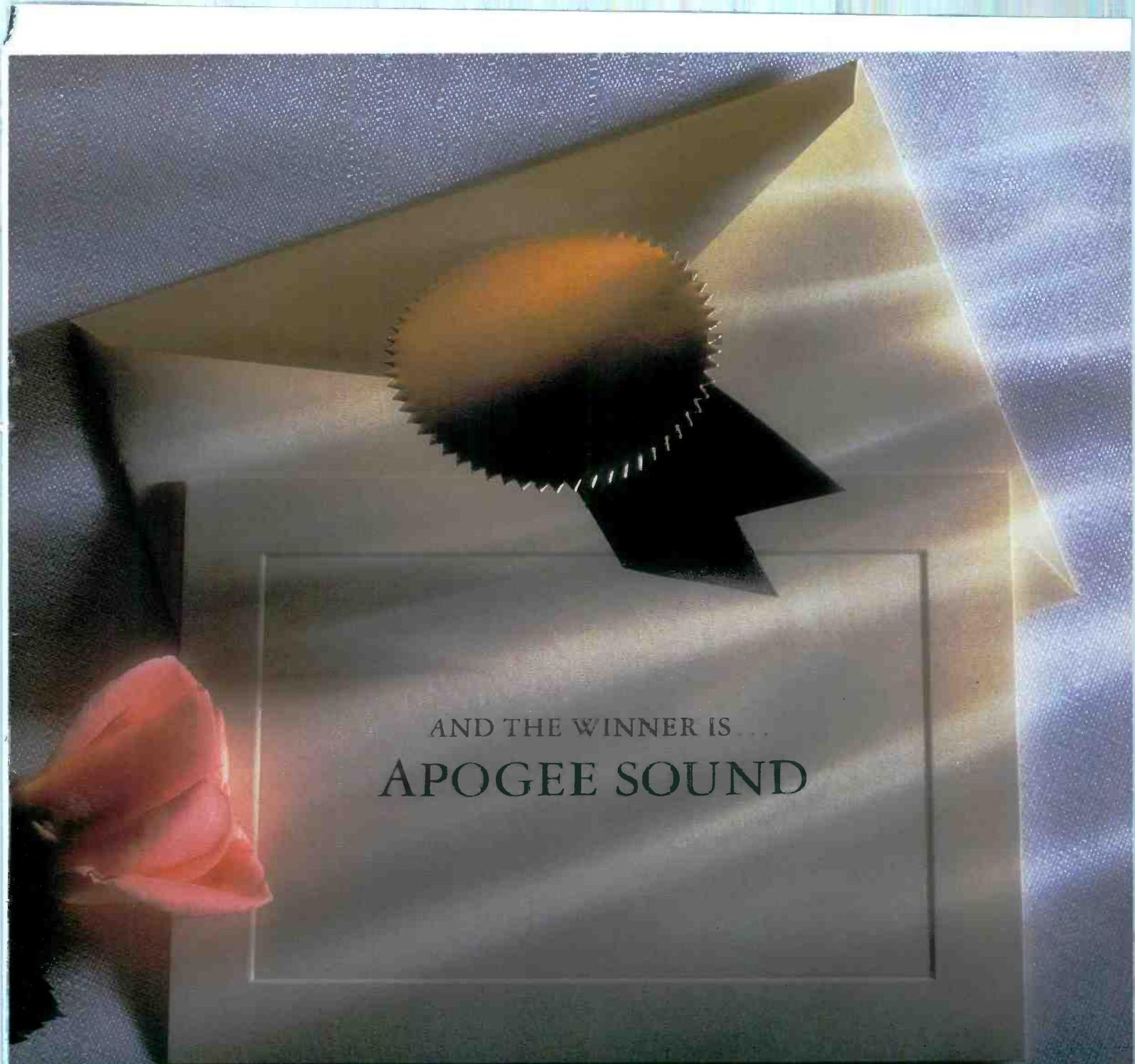
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