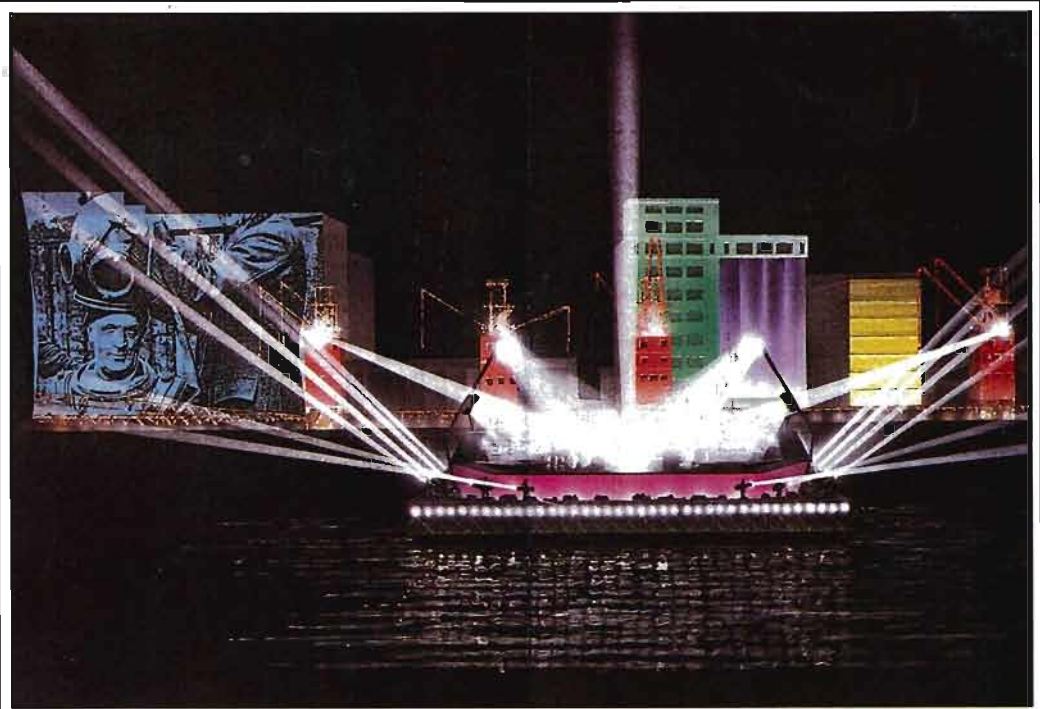


# LIGHTING+**SOUND** *International*



## Docklands Dozen

Jean Michel Jarre's 'Destination Docklands' concert will include 12 large frame lasers supplied by Laserpoint Limited, and shown above are artist's impressions of how the concert will look to the expected audience of 1.5m people.

See Laserpoint at the PLASA Light & Sound Show (Stand Nos S185/175) for a taste of the laser effects to be used at the concert on the 24th September 1988.

**PLASA**  
PROFESSIONAL LIGHTING  
AND SOUND ASSOCIATION

**September 1988**  
Volume 3 No.9

**EE**  
Light &  
Sound  
Show

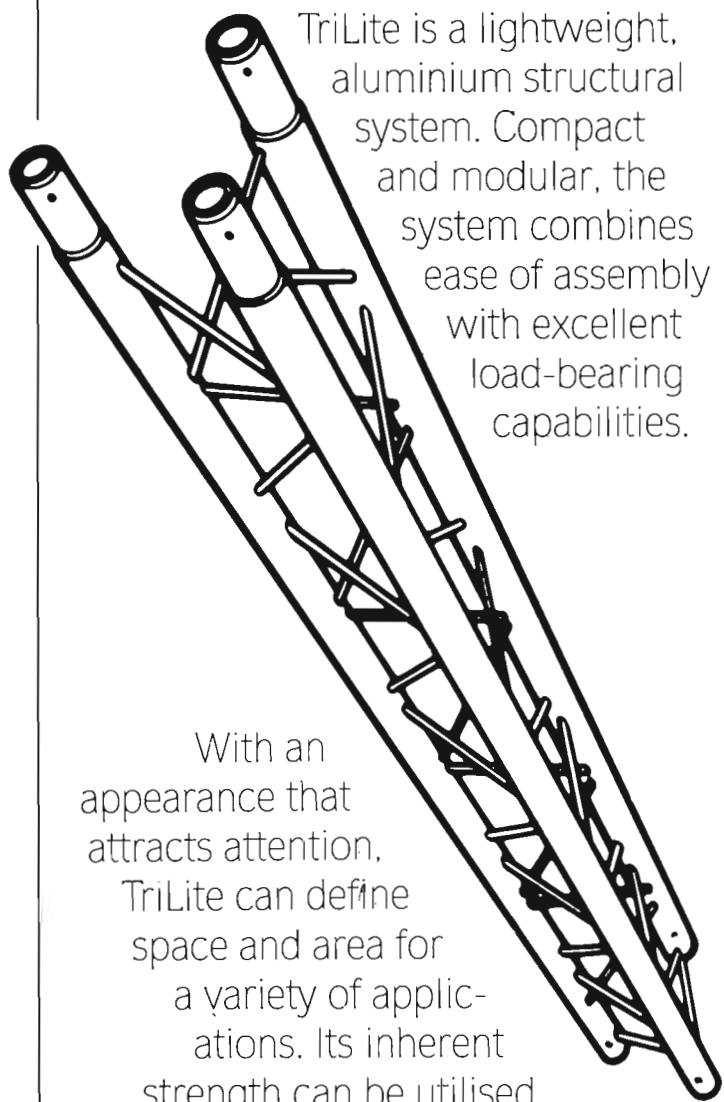
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**OFFICIAL CATALOGUE**  
for the **PLASA**  
**Light & Sound Show 88**  
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Show runs September 11-14  
at Olympia 2, London



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# CELCO.

## CONNECTIONS



The Series 2 range of lighting control systems are designed and manufactured by Celco Ltd. For further information please contact our distributors. **Worldwide Distribution** Caronim Lighting Ltd, 168 Chiltern Drive, Surbiton, Surrey, KT5 9L. S. Tel: (01) 899 4015. Fax: (01) 899 4017. **US Distribution** Celco Inc, 10000 Farm Road, Farmingdale, New York 11735. Tel: (516) 342 1111. Fax: (516) 342 1112.

# LIGHTING+**SOUND** *International*

## SEPTEMBER 1988

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### Iron Maiden at Castle Donnington 1988

Headliners at this year's 'Monsters of Rock' at Castle Donnington on Saturday August 20th were Iron Maiden, with lighting design by Paul Devine and structure design by Ronan Willson of Meterolites Productions. See story on page 51 this issue.

## LIGHTING+**SOUND** *International*

published by the  
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## Lee Colortran to Launch New Windsor Theatre Lighting Range at PLASA Show

Despite background pressures and management structure changes in the Lee group brought about by financial problems following their purchase last year of Panavision's camera manufacturing and rental business in the United States, Lee Colortran have confirmed to L+SI that they will be going ahead with a major new product launch at the PLASA Show at Olympia 2 September 11-14.

Their new range of 'Windsor' theatre luminaires - 'a new concept in theatre lighting design' - will receive a public debut at the Show, and comprises a fresnel, PC, and four zoom profiles. All are interchangeable between 1000W and 1200W. A modular design concept enables six basic units to be permuted with combinations of high and low voltage axial profiles as required to form a 16-product range. Double skin rigid housing construction gives strength, weight saving, and excellent ventilation say Lee.

Also on display will be the new Powermaster range of dimmers and accessories together with Lee Filters' newly-introduced range of High Temperature polycarbonate filters.

Staff on hand will be from Lee Colortran's new Nottingham facility who can provide professional consultancy and technical advice as needed.

## Cerebrum in Major New Link-Up

Light & Sound Design Ltd., arguably the world's largest concert lighting production company, have signed a multi-million pound contract with a new company formed by John Lethbridge, managing director of Cerebrum Lighting (Sales & Hire) Ltd and former president of Celco Inc. The agreement grants sole rights to Presentation Consultants Ltd. to distribute Light & Sound Design's entire product range of luminaires, trussing, 'Colourmag' gel scrollers and motor control systems throughout the world.



Getting down to serious business at LSD's Birmingham headquarters are (standing, left to right) Tim Murch (vice president Light & Sound Design Inc), Steve Dawkes (director Light & Sound Design Ltd), and John Lethbridge (managing director Presentation Consultants Ltd), and on sofa Simon Austin (director Light & Sound Design Ltd, with Fido the Cat) and Terry Lee (director of Light & Sound Design Ltd, with Eric the Pigeon). L+SI's editor feels there must be another story here somewhere, but press deadlines stopped him making further enquiries in time for this issue. (Entries for a caption competition will, of course, be welcome).

The new company will be launched at the PLASA Light & Sound Show at Olympia 2 where an extensive range of Light and Sound Design products will be on display. Presentation Consultants Ltd. will be actively seeking major distributors for all countries excluding Germany, Holland and Japan. Cerebrum Lighting (Sales & Hire) Ltd. will become the main UK distributor. Rod Bartholomeusz, who recently left Strand Lighting to become international sales manager at Cerebrum Lighting, has been appointed as sales manager for Presentation Consultants Ltd. The new company will be moving to a new industrial complex in Surrey during October, but in the meantime, can be contacted at Cerebrum Lighting on 01-390 0051 or 01-390 4841 (Fax 01-390 4938).

## PLASA's First Annual Dinner

PLASA's first-ever Annual Dinner will be held at the Royal Garden Hotel in Kensington on Sunday evening September 11th, on the first day of Light & Sound Show 88. Entertainment will be provided by the Ronnie Scott Quintet and George Melly with John Chilton's Feetwarmers. Tickets cost £25 plus VAT and are available from the PLASA office: (0323) 410335.

## Show Entertainment

In addition to PLASA's own Annual Dinner (see this page), other evening entertainment has been lined up for the Monday and Tuesday of the PLASA Light & Sound Show. Monday 12th will see Disco International's Annual Awards Night take place at the Empire Leicester Square, and on Tuesday 13th, Pulsar Light of Cambridge are inviting guests to a special event at the Camden Palace. Tickets will be available at the door (£4) from 9 p.m. for those not invited directly, Pulsar director Ken Sewell told L+SI.



## Flickering in Tokyo

Action Lighting, one of the Lighting Technology Group companies, has recently supplied over 600 of their electronic flickering candles for installation in two Tokyo discotheques: the Java Jive and Java Bay, both commissioned by lighting designers Ken Billington Inc. of New York.

(See L+SI cover feature November 1986 issue).

<p>MARQUEE AUDIO · SHEPPERTON STUDIO CENTRE STUDIOS RD · SHEPPERTON · MIDDLESEX TW17 0DD Tel: 0932 566777 · Tx: 8942278 ENTEC G · Fax: 0932 566989</p>		



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STAND NO. S188

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## JUST AS SMALL • JUST AS FAST JUST AS LIGHT

At last, the new improved version of the highly successful GelJet is available in Europe. This compact 0-10 volt colour scroller weighs just over 1Kg, and can scan accurately through twelve colours in under 2 seconds.

Designed to work from any Celco memory board or any other high resolution lighting board, via the GelJet 12-way power supply unit, each colour selection is controlled and stored direct from a channel fader, and played back in groups on a cue fader.

For paired systems such as twin follow spots, the GelJetster two-way controller with built-in power supply provides a low-cost all-in-one system.

The GelJet fits directly to Light & Sound Design and Thomas PAR 64's and most popular theatrical luminaires.

**NOW AFFORDABLE, RELIABLE AND AVAILABLE FROM CEREBRUM LIGHTING**

### Technical Advice on Theatre Design

The Theatres Trust has become increasingly concerned by the building of new theatre spaces and even new theatres without specialist technical advice for the architects and builders.

This advice is no longer available from the Arts Council of Great Britain but it can still be provided by the Theatre Planning Committee of the Association of British Theatre Technicians. Although very low, indeed virtually nominal fees are involved, surprisingly and unhappily little use has been made of the facility in recent years, say the Trust.

In an attempt to help, the Trust has consulted the Arts Council and the Association and it has been agreed that all new enquiries will be notified to the Association and that the availability of this specialist advice will be made known as widely as possible. Both the Trust and the Council believe

that independent expert examination is essential for any theatre project seeking public funds and is highly desirable in every practical circumstance, whether or not public funds are involved.

For information contact ABTT on 01-434 3901.

### Special Effects at G-Mex Pub/Club Show

Visitors to the National Hotel Pub Club & Catering Show at G-Mex in Manchester from September 27-29 will have the opportunity of enjoying a tremendous lighting display within the Exhibition which will include weird and wonderful disco acts supplied by top agency Big Bang Management.

A laser display will be presented from the futuristic lighting rig specially built by Stardream Audio Visual of Blackpool and will include special effects supplied by leading companies including Clay Paky, Mode, Optikinetics, Laser Systems, Pulsar, Zero 88, SIS, Coemar, Astralloy, Le Maitre,

Citronic, NJD, Toa, Harrison, JEM and Bose.

Free tickets for the event are available from Iain Macfarlane Exhibitions at 676 Wilmslow Road, Didsbury, Manchester M20 0DN (061-434 5300).

### PLASA with AETTI

PLASA has become the twentieth member of the Arts and Entertainment Technical Training Initiative (AETTI) joining employers, unions and other associations. The initiative was founded by Alan Stevenson (secretary) and Graham Walne (chairman) and is now officially recognised as the Lead Industry Body to identify and deliver occupational standards, and research will begin soon across the country.

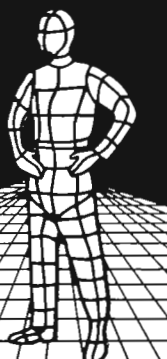
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OLYMPIA 2, LONDON  
SEPTEMBER 11-14**

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## Super Supergel

In line with Rosco's policy of continually reviewing their range of gel colours through discussions with designers and users world-wide, in both theatre and television, the level of new colour introductions in the Supergel range is being stepped up.

Following the information and opinion received through discussion and via Supergel competition earlier this year, a total of 12 new colours have been added to the Supergel range and there will be additions to the Tinted Hamburg diffusion and directional Silk range between now and the end of the year.

The 12 new colours include Canary, evocative of tropical environments; Gaslight Green, ideal for recreating the feeling of gaslight for period pieces; Broadway Pink, a deeply saturated romantic pink developed for clubs, dance and musical performances; and Royal Blue, the most highly saturated blue appropriate for darkest night skies, romantic shadows and non-realistic effects. Also new is a series of 4 theatrical blues ranging from Theatre Booster 1 to Theatre Booster 4, which allows lighting directors to raise the Kelvin Temperature of tungsten halogen sources, boost the colour temperature of fading HMI lamps and plan lighting effects based on subtle value variations of a basic hue. There is also a clear Supergel for scroller colour changers and similar applications.

To be added to the Tinted Hamburg diffusion range later in the year will be Hamburg Lavender and Hamburg Steel Blue, with Lavender Silk and Steel Silk added to the directional Silk range.

As with the whole of the Supergel range, these new additions are made to the same high standards, combining long life with heat resistance in a self-extinguishing extruded polymer. The Rosco technique of extruding a core of colour between two layers of clear polycarbonate minimalises the possibility of the colour bleaching and fading, assuring lighting designers that colour will be maintained time after time.

An enhanced and updated edition of the Supergel guide, in an easily accessible Filofax format, is available from Rosco, as is a new design of swatchbook. For these and the Technote on Rosco Supergel diffusion, prepared with the help of Francis Reid, contact Roscolab Limited at their new address, Blanchard Works, Kangley Bridge Road, London SE26 5AQ, telephone 01-659 2300.



## For Your Fibre Optic Ceiling . . .

A new component from fibre optics people Par Opti Projects Ltd simplifies the construction of fibre optic ceilings. The new bullet lens mounting bezel, available in black and chrome, allows fast installation, easy cleaning or redecoration with a simple professional finish. It will be shown for the first time at the PLASA Show.



Andrew Briggs - now with Vector Marketing.

## The Launch of Vector

After over six years with disco equipment market leaders Citronic Limited, latterly as sales manager, Andrew Briggs has left the company to take a fully active role in Vector Marketing.

Vector was formed by Briggs and marketing/distribution consultant Martin Prescott earlier this year, 'in order to satisfy a demand from manufacturers that both felt was not being either efficiently or professionally catered for at present.'

"In virtually every other field of sales there is a well established and coherent producer/distributor/retailer structure, unlike the blurred lines of definition that pervade in the pro-audio and disco markets," say Vector.

"My experience with Citronic showed me that changes in distribution practices will have to take place before our industry will be able to grow and prosper," said Briggs. "Vector marketing will emerge as one of the few to do the job properly."

Vector have already secured exclusive distribution of American-made Renkus-Heinz loudspeaker systems.

## Celco Look Ahead

To be premiered at Photokina 88 at Cologne in October is a completely new line of lighting control boards, software and accessories from entertainment lighting specialists Celco Ltd.

The Celco 88 Range will feature three different types of lighting control board, the Celco Major, Celco Plus and Celco Baby, Digital Storage and Recording Systems, Control Board Monitors and the SoftOptions 88 package.

## Artistic Licence

Communication and control are the key to creating any concert, theatrical or entertainment experience, say Artistic Licence (UK) Ltd, a company formed to provide the hi-tech solutions required by this demanding market.

Artistic Licence is currently involved in a variety of custom projects, including SMPTE, MIDI, MTC, and DMX512, as well as developing a complete range of 'off the shelf' standards converters.

With a background spanning video engineering, concert PA, and stage lighting, the company is ideally placed to develop its impressive new product portfolio. Artistic Licence's first major product, the 'Q-Patch' digital patching system, is now in full production with Avolites.

For more information about this innovative new company, or to discuss your custom requirements, contact Wayne Howell on 01-904 2803.

## Club Crawl and Rodeo at Lighting Dimensions

Exciting evenings are in store for Lighting Dimensions International 88 participants. Stops at the West End, Southfork Ranch, Dallas Alley, and Max's 403 are 'in the works' say LD.

The new entertainment technology show is to be held in Dallas November 18-20 and over 190 exhibit units have been sold say the organisers. A PLASA group of exhibitors will be taking part.

## TOA at PLASA

Sound reproduction specialist Toa Electronics Limited will unveil at the PLASA Show (Stand S188), and for the first time in the UK, a range of products they say are ideally suited for the club and discotheque market. It will coincide with the promotion of its newly appointed dealer network, which boasts some of the best dealers and distributors in the UK.

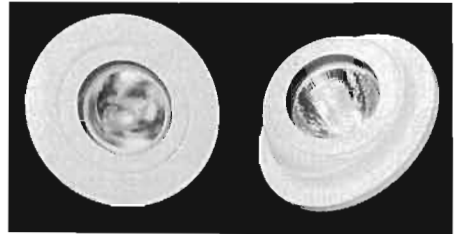
"We have set up a very strong, hand-picked dealer network that is capable of tackling every situation, thus ensuring complete customer satisfaction," Paul Ward, manager of the professional sound division, told L+S.

Among the new products that Toa will be launching will be the SF30 flying speaker system, the SW-46W twin 18" sub woofer system and the F500 and F600 series of loudspeakers, for foreground music application.

## SIS Dichroics

SIS will introduce their new Dichroic Downlighters at the PLASA Show. "With an increase in demand for low voltage yet economical light fittings we have brought out the first two in our dichroic range," SIS's David Mitchell told L+S.

First is a downlighter which is an elegant slimline unit and can be supplied in a choice of finishes. Installation is straight forward and provision has been made for simple fitting of a filter if this is desired, say SIS.



Secondly, the Eyeball is a compact yet attractive light unit. Installation again is simple, yet the end result is extremely eye-catching. As with the downlighter, standard finishes are white, black, polished aluminium, chrome and gold - but custom colouring in SIS's paint plant can be undertaken and work turned round in a very short time.

In conjunction with these units SIS are able to supply a variety of 'approved' transformer packs which will suit most requirements.

## Prosound Seminar 1988

Shuttlesound will be hosting their fifth Prosound seminar in conjunction with Electro-Voice on October 17 and 18. It will take place at the company's newly extended premises in SW18, but numbers will be restricted to 80. Details from 01-870 9300.

## STOP PRESS Light & Sound Show

Audilec have taken an extra stand (S171) to show the JAMO range of loudspeakers plus the new Goodmans GCD 550 multi-play CD player.

From Jamo is the new Magic Series of hi-fi speakers which are recommended for background/foreground music systems. Also on show will be the popular compact range. The Goodmans GCD 550 has the facility to load up to six compact discs, has infra red remote control, and random programming of up to 32 tracks.

Audilec's main stand is S188/189.

Leamington Sight & Sound have set up a trade wholesale subsidiary UKD (United Kingdom Distributors). The company is headed by Peter Maddison, has two vans permanently 'on the road', and will be officially launched at the Light & Sound Show (see Catalogue for details).

Hill Audio will highlight their '00' and '000' ranges of power amplifiers and a full range of mixers including the rack-mountable Multimix and the newly-introduced 'Remix' 24:8:16:2 live and recording console. Their Concept range of modular consoles will also be represented. On the speaker side they will be showing a pair of M6 triamped full range cabinets and the new M100 small full range cabinets.

## Eurolight in Action

Over the past few months Eurolight have completed a number of major supply and installation contracts. These have included the complete rewiring of the Connaught Theatre in Worthing together with the supply of 96 channels of dimming, a new Microlite 3 computer system and patch panels. Another major project completed in August was the complete re-equipping of Southport Little Theatre that was severely damaged due to a fire earlier in the year. This included supply of dimmers, stage management system, ring intercom system, patch panels, lighting bars and a line level paging system. Jointly with Theatre Sound & Lighting they also designed, supplied and installed the lighting scheme for the Chinese Dinosaurs Exhibition at the Natural History Museum. Again with Theatre Sound & Lighting they are providing purpose built circular internally wired lighting grids for the new Madame Tussauds at the London Pavilion.

Control system sales continue to show major advances with Microlite 3 systems being chosen for Birmingham Hippodrome, Towngate Theatre Basildon, Lilian Baylis Theatre at Sadlers Wells and the National Theatre in Indonesia. Micron sales have been very high over the past two months with successful sales to the new Millfield House Theatre in Enfield and the Pavilion Theatre in Shanklin to name two.

Projects being completed in the coming months include the complete supply and installation contract for the Technical Planning designed theatre installation at the new Lilian Baylis Theatre at Sadlers Wells (this project includes major support from Euro Trak Ltd and Paul Farrah Sound), a complete Micro based lighting system with dimming and patching for Kingston Polytechnic's Delissa Hall and drama centre, a complete theatre based lighting system for the award winning project at Jacksons Lane Community Centre in London, together with supply only contracts to Manchester's Library Theatre and Shrewsbury Music Hall.

Continued product development has led to a



## British Trio Win Algerian Contract

A major touring concert stage lighting and sound system (pictured above) has been supplied by three major UK companies to the City of Algiers. To be used as a 'facility for the people', the £800,000-plus contract included the five trucks used to transport the equipment to Algeria.

**Tomcat Engineering** supplied the outdoor stage roof system, together with PA wings and spot towers. It spans 64ft x 44ft and has a 25 tonne load capacity. Also included were 500 Tomcat Par cans on six lamp bars. The control system from **Avolites** includes two QM500 desks and 144 ways of dimming equipment. **Shuttlesound** took care of the sound side, supplying their new MT4 system powered by Amcron amplifiers together with numerous other touring sound equipment and special features.

number of very specialised lighting systems being designed, for installation in early 1989, for shopping malls, exhibitions, showrooms, etc. In all cases they are based on taking Eurolight's proven computer based lighting systems and integrating them into general building services. A project using

these facilities is the new Doncaster Leisure Park opening late 1989. Similar facilities have already been installed in Uckfield's Utopia Pool and the new leisure pool in Hailsham. Examples of these systems will be shown at the 1988 Light and Sound Show in Olympia in September.

# punto 650

automatic electrical safety

compact diecast body

fireproof cable

thermally insulated handles

strong diecast components

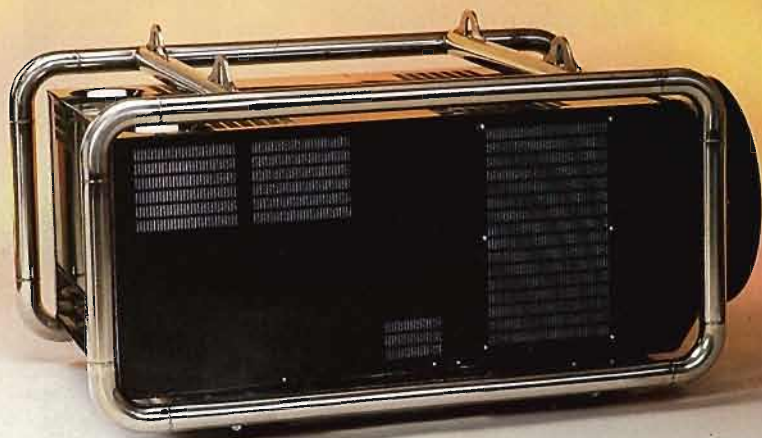
# Mighty Light

Look closely into Teatro stage spotlights: quality isn't just skin deep. You'll see diecast components that are inherently strong and lightweight, a power switch which automatically isolates the lampholder for safe lamp replacement, thermally-insulated handles, special fireproof cable. Elegant design at a light price. Available from:

<p><b>Action Lighting</b>  <b>BEMCO Ltd</b>  <b>Dial Sound &amp; Lighting</b>  <b>Mushroom Lighting</b>  <b>W.B. Lighting</b></p>	<p>2 West Point Trading Estate, Alliance Road, London W3 0R4  Wandsworth Bridge, London SW18 1TN  Unit 4G, Wharfedale Rd, Euroway Ind. Est., Bradford, BD4 6SG  30 Tenter Road, Moulton Park Ind. Est., Northampton NN3 1PZ  4 Tenter Road, Moulton Park Ind. Est., Northampton NN3 1PZ</p>
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# THE MOST ADVANCED SPECIAL EFFECTS

# HEAVY



For many years people wishing to create an effect of low lying fog clinging to the floor are only too familiar with the problems of doing so. Invariably it entails a long journey to the chemical company for supply of dry ice, carrying special storage containers and by the time you have returned 25% of the dry ice has evaporated; also by the time you are ready to use it, you probably just have enough for the show and that is after you have spent an hour or so boiling 100 gallons of water!

JEM are pleased to announce the demise of dry ice CO<sub>2</sub> — dry ice is a thing of the past, just a bad memory. From October 1988 JEM will be in full production of HEAVY FOG, the most advanced special effects smoke/fog machine in the world.

HEAVY FOG has taken three years and over 20,000 hours of development and has revolutionised smoke/fog effects throughout the leisure industry. HEAVY FOG is not just a machine that simulates a dry ice (look-a-like) effect, it is vastly superior in every way, and is capable of producing a vast range of special effects.

JEM's Research and Development Department has developed a very specialised low temperature freezing plant capable of temperatures below -30° combined with a high power industrial fog generator. HEAVY FOG has an enormous output and is able to throw a layer of fog to cover a floor 4,000 square feet (371.60 square metres), 1 inch (2.54 cm) off the floor to 6 feet (1.83 metre) high in the air, and at the touch of a button can produce normal smoke effects.



JEM have also developed three special water-based Fog Fluids.

- A1 Quick dispersing
- B2 Medium dispersing
- C3 Long lasting

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# Volume Regulation — the Net Closes

An L+SI special report by Ken Dibble

## Introduction

The volume levels experienced at rock music concerts and in discotheques has long been an emotive and contentious issue, with performers, sound engineers and the majority of their audiences demanding ever higher volume levels whilst the authorities, convinced that we are all going deaf, seek constraints in order to protect us from our own folly. This time however, it really is going to happen. At what level, under what circumstances and for how long may be issues still open to debate, but on January 1st 1990, for the first time, legally enforceable regulation of volume levels will be with us - and will apply throughout Europe.

## The Background

I suppose that the first serious attempt to regulate entertainment volume levels came from Leeds City Council when, in 1976 a volume limit of 90dB(A) was imposed as a condition of license on every discotheque, nightclub and live venue unfortunate enough to fall within the Leeds area. The move caused a furore at the time and the regulation was only rescinded in the face of determined opposition by some of the major venue operators, threats of crippling legal action and when every club in the area had almost died on its feet as their customers trooped off to venues in other areas not affected by the Leeds autocracy.

In the wake of this unfortunate experiment came a Government-funded study spear-headed by Mr. J. Bickerdike as a course project at Leeds Polytechnic when, in the late 1970s he investigated the volume levels in no less than 49 discotheques and interviewed 4166 patrons in an attempt to find what the typical volume levels actually were and, using the Damage Risk Criteria method, provide an assessment of the likely effects on the hearing of the population. The results of this survey were published in 1981, but it was not until 1986 that the Department of Environment published its 'Draft Code of Practice on Sound Levels in Discotheques', prepared by Bickerdike on the basis of his 1979 investigation. Because of its excessive regulation and unnecessarily bureaucratic approach this Code has fortunately yet to find widespread acceptance (see *Disco & Club Trade International*, March 1987) and now looks like being overtaken by actual legislative regulation to be enacted under the provisions of Section 2 of the 1974 Health and Safety and Work Act.

## The 1974 Act

Part 1 Section 2 places an obligation on every employer to:

“... ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.”

And under Sub-clause 2(e) thereof to ensure:

**“the provision and maintenance of a working environment for his employees that is, so far as is reasonably practicable, safe,**

**without risks to health, and adequate as regards facilities and arrangements for their welfare at work.”**

For the purpose of enforcement, the exposure of employees to excessively loud sounds - termed 'noise' by the authorities, is considered to be injurious to health and therefore to contravene the Act. Until now however the definition of what constitutes excessive noise exposure has rested with a voluntary Code of Practice introduced by the Department of Employment in 1972 entitled 'Code of Practice for Reducing the Exposure of Employed Persons to Noise' which because of its unmistakable bright yellow cover, has become affectionately known as the 'Yellow Peril'.

Despite its Code of Practice status, many successful prosecutions have been brought by Her Majesty's Health and Safety Inspectorate under the provisions of the 1974 Act using the Yellow Peril as the base line. Hitherto however, these existing legislative provisions have been primarily directed towards noisy industry and as a result great strides have been made in changing the attitude of employers to noise and in reducing the levels of noise in many working environments.

## So What Has All This Got To Do With Us? A great deal!

Since 1982 the EEC Advisory Committee on Safety, Hygiene and Health Protection at Work have been deliberating this matter with the result that Council Directive 86/188/EEC, dated May 12 1986 requires that all EEC member states will, by January 01 1990, introduce harmonized legislation to protect workers from the risks related to exposure to noise at work. In essence the EEC requirements are not dissimilar to those of the Yellow Peril and in the UK, compliance with the Directive will take the form of compulsory Regulations to the 1974 Act, to be known as the 'Prevention of Damage to Hearing from Noise at Work Regulations'. These Regulations were published in draft form at the end of last year for public comment. The closing date for response was June 30 and towards the end of next year we shall see the final document.

Once enacted the Regulations will apply to all employees, trainees, and to the self employed, whilst at work, whatever form that 'work' might take. Entertainment is specifically mentioned as an area outside traditional industry which is expected to fall within the scope of the new legislation.

## The Essence of the Regulations

Firstly, the noise level is measured in dB LAeq. This is a unit of noise exposure and is an integration of decibels with time - in this instance an 8 hour working day.

The EEC Directive sets a First Action Level at 85dB LAeq and a Second Action Level at 90dB LAeq.

When an employee is likely to be exposed to sound at or above the First Action Level

the employer will be required to have an assessment of the exposure level carried out 'by a competent person'. In practical terms this means bringing in a specialist with the necessary instrumentation to actually measure the dB LAeq value and to assess the implications of the results. If the measured value is found to be above the First Action Level but below the Second, the employer will be required to:

- 1) Make arrangements for the safe keeping of the assessment records.
- 2) Reduce the risk of hearing damage to the "lowest level reasonably practicable".
- 3) Make hearing protectors available on request.
- 4) Provide the employee with instruction and training on the risk of hearing damage and the steps available to minimise that risk.
- 5) Ensure that the employee is aware of his or her obligations under the Regulations to properly use and maintain anything provided to reduce the level of exposure.

If the measured value is found to be above the Second Action Level, then the employee must be provided with hearing protectors and will be required to use them.

Failure to comply will lead to prosecution by Her Majesty's Factory Inspectorate and will leave an employer open to damages claims from past and present employees should a hearing deficiency develop. Now just sit down for a moment and consider the implications of that little lot for starters!

## The Implications

In the first instance, anyone involved in the action in any club, disco, live performance venue, recording or broadcast studio, etc., are bound to come above the First Action Level and probably above the Second. The regulations will affect DJs, musicians, producers, engineers and technical operators, lighting technicians, bar and front-of-house staff, waitresses, security, management - you name it. In a recent survey it was estimated that around 60,000 staff are employed in the discotheque industry alone!

Now what about the practicality of compliance? Whoever saw an artiste performing on stage or a DJ in a club wearing hearing protectors! How on earth can a musician - in a rock band or in a symphony orchestra - on stage or in the studio - work, when they can't hear the foldback, playback, or each other because they are wearing ear plugs?! Imagine one of those scantily clad waitresses at your favourite club wearing ear muffs, as she brings a large gin and tonic in response to a passing comment that the "lager is chronic". The whole concept is clearly folly - or is it?

## The Underlying Concern

Research into the effects of exposure to loud sound has been going on for many years and of particular relevance is a study carried out

by Professor W. Burns and Dr. D.W. Robinson in the late 1960s, the results of which were published by HMSO in 1970, formed the basis of the 'Yellow Peril' recommendations and in effect, form the basis of the new EEC Directive. The research is based entirely on noise associated with industrial processes and on expectations of hearing loss over a 40 year working life. So there is a sound basis for the introduction of regulatory legislation in an industrial environment.

The problem is that there is no such evidence to show that exposure to loud music has the same effect. Tests carried out in America prior to 1976 involving almost 300 professional musicians and regular rock concert or discotheque attendees, some of which were spread over a 7½ year period with the same subjects, showed little or no hearing defects. In another study, carried out by J. L. Fletcher of the National Institute for Occupational Hygiene and Health, for the US Department of Health, Education & Welfare in 1972 involving a study of 400 normal hearing subjects, 100 rock musicians and 100 rock concert attendees, produced the conclusion:

"... knowing the levels and durations of exposure these persons receive in that pastime it is almost unbelievable that no clearly observable (hearing) losses could be found."

Note the element of surprise in that statement. Everyone it seems hears the talk of 50 kilowatts here and 100 kilowatts somewhere else, immediately conclude that we must all be going deaf, and are surprised when research fails to confirm the expectation. Surely, there is a fundamental difference between a 'noise' which is produced as the undesirable by-product of some other process and 'music' which is the painstaking and dedicated end product of a highly developed art form and technological process. The Concise Oxford Dictionary gives the following definition of 'noise':

'Loud outcry, clamour, shouting, din of voices and movements; any sound - especially loud or harsh or undesirable one.'

And for 'music':

'Art of combining sounds with a view to beauty of form and expression of emotion; pleasant sound. . .'

These two definitions are surely mutually exclusive - yet here we are facing a proposal that the entire music industry is to be included within the scope of its Noise at Work legislation!

It was because of the horrendous ramifications of the Draft Regulations that The Sound Practice was commissioned by the British Entertainment & Dancing Association (BEDA) to prepare a report to the Health and Safety Commission on behalf of the Industry in response to the Draft Regulations at the public comment stage.

#### The BEDA Survey & Report

One of the basic problems of this industry is that whilst for many traditional industries there exist fairly good records of typical noise levels generated by certain types of machine or by specific industrial processes, this is not the case for the entertainment industry. So the starting point had to be to survey a cross section of representative venues to find out what the 'noise' levels actually are. So 12 venues were chosen from Scotland to the Home Counties, from North-West to the South East, some in provincial or urban areas, some in busy city centres, and the sound level on the dance floor, behind bars, in the lounges and restaurants and in

the DJ console monitored. Additionally, selected staff members were equipped with personal noise data loggers to monitor the actual 'noise' exposure levels as typical staff went about their normal nightly duties. Using a staff questionnaire we were also able to get some idea of the average age of persons working in this industry, typical length of service, work patterns and other relevant data. It was altogether a very interesting, if somewhat exhausting project which produced some useful and interesting data, much of which is now entombed in a report to the Health and Safety Commission in response to the Draft Regulation proposals.

By way of a very brief summary, having made the point that there appears to be but scant evidence to support the inclusion of the music industry within the scope of the regulations anyway and that there is little or no correlation between the exposure to industrial noise for 40 hours each working week over a 40 year working life, and the typical exposure durations to be found in the entertainment industry, the Report shows that given certain exemptions and conditions, and a spirit of co-operation between the HSC Inspectorate and club operators, it would be possible to bring the club and

discotheque industry largely within the Second Action Level requirements in all but a few instances. But the matter is far from settled and discussions will be continuing for some time yet. Perhaps now is the time for PLASA and other interested bodies to become involved in the process in order that a cohesive industry approach can be made on the back of the BEDA initiative?

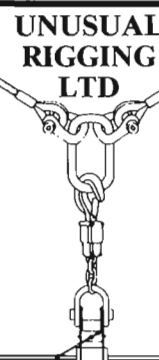
There is only another 15 months to go before the new Regulations come into force and it is imperative that we have our act together in good time.



Ken Dibble is the principal of The Sound Practice, an independent consultancy in acoustics, noise control and audio engineering. He is a well known author and reviewer for the technical press and is a member of the CBI Noise Working Party and the Entertainment Noise Working Party of the Noise Council. He is a member of the Institute of Acoustics, the Acoustical Society of America and the Audio Engineering Society and a Fellow of the Institute of Sound and Communication Engineers.

As an ex-'sixties pop group' guitarist and ex-mobile disco operator, and with more than a decade of experience as a concert sound engineer, another decade as a leading consultant and still a practicing musician, Ken considers that his roots are firmly planted at ground level.

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*Light & Sound Design*





# Dichroics - a Step Forward in Colour Filter Technology

Dichroic colour filters are creating something of a commercial lighting revolution. So far, only a lack of colours and high prices have prevented them from being considered a serious alternative to gels and coloured glass, but this has changed with the arrival of filters known as Dichrolight, which offer 17 basic colours. Peter Knight of Balzers outlines the specific technology and its suitability in certain applications.

'Dichroic' is very much a lighting industry buzz-word at present, although real understanding of it is vague: "Dichroic reflectors are used in low voltage lighting, aren't they?" and "I've heard that some new moving light systems use them" - and so on. This is understandable because although the technology is not new, its application in commercial lighting is still relatively so.

Dichroic colour filters come from a branch of vacuum science known as thin film technology, and represent a vast improvement on gels and coloured glass by giving only pure colours, extremely high light transmission and temperature resistance, and by not fading. These properties mean that it is quite possible for them to be 'designed in' as an integral component of a lighting system, or used more conventionally as an add-on accessory. It is true that this level of performance does not come cheaply, but in the right environment the practical and economic benefits, not to mention the impressive visual effect, can become a cost-effective proposition.

Most people are familiar with dichroic reflectors used on light sources to separate visible light from the infra red (heat producing) and other unwanted wavelengths (the conventional cold light source). These operate on the same principle of interference that is employed to create colour filters. The interference action is a function of the dichroic coating itself, which selectively transmits or reflects light/electromagnetic radiation according to its wavelength.

The value of coatings used in dichroic reflectors (cold light mirrors), is in the light that they selectively reflect. A dichroic colour filter, however, is used to selectively transmit a part of the incident (normally white) light - all the red wavelengths, for instance. And because the untransmitted wavelengths are reflected there is minimum absorption, so internal heat build-up in the filter and its associated problems are not encountered.

It all sounds easy - the filter transmits the light you want and reflects everything else, but it has taken some very advanced technology to set it up. The components - the coating material and glass - are not tremendously expensive, but the technique that brings them together is.

The filters consist of a multilayer coating of different dielectric materials applied on to glass in microscopically thin (thousandths of a millimetre) layers at high temperatures in specially designed high vacuum plants. The number and thickness of these layers varies with each filter, as they determine which wavelengths (colours) are to be transmitted/reflected. It therefore requires a precise

control that makes it a lengthy and complex procedure.

Yet despite the cost and amount of technology that goes into creating a beam of coloured light, the benefits make it all very worthwhile, as the industry is already discovering. Firstly, it gets a filter that is highly heat resistant. This is largely dependent on the substrate used. The standard heat resistant glass used by Balzers will withstand 350-400°C even with fast heat build up. With the increasing use of higher power and higher temperature light sources this is obviously important.

Because of the hardness of the coating and the method of deposition, the colour of a dichroic filter will not fade or change over its lifetime. Being a transmitting/reflecting system, rather than an absorption system, its

transmission with intense colours is particularly high, which may even allow the power of light sources to be reduced.

Lighting designers already working with dichroic colour filters also refer to what they describe as "sharper, purer colours". What they are observing is a filter, say green, transmitting a very high percentage of the green wavelengths and virtually none of the others. By comparison the traditional absorption based colour mediums allow through a greater amount of these other wavelengths, which unavoidably affect the purity of the colour intended. Figure 1 shows a comparison of typical transmission curves for dichroic and gel filters. Because dichroics have minimal absorption, several filters can be used in series with minimal light loss, popular combinations being the secondary

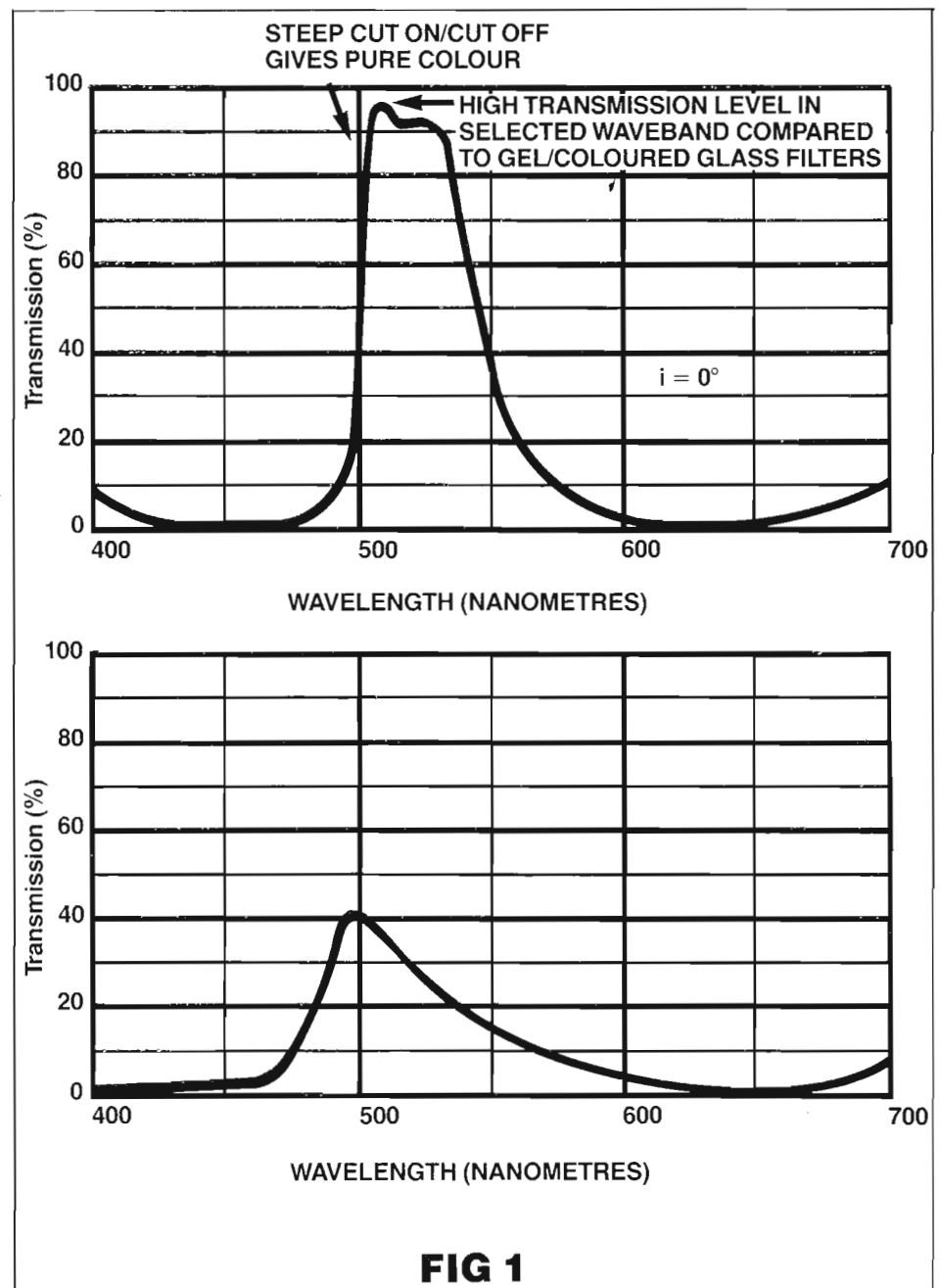


FIG 1 Comparison of transmission curves for (top) Dichrolight green filter ref. G50/55 and (bottom) for a typical green gel filter.



Peter Knight is a Balzers sales engineer for the company's range of opto-electronic thin films. He is a chemistry graduate, and previously worked with a leading supplier of processing equipment to the printed circuit board industry.

colours yellow, cyan and magenta, to give primary colours of red, blue and green.

Applications for dichroics already cover a wide area. Some of the new moving light systems from America, utilising the majority of dichroic benefits, are recognised as significant developments. In many cases the filter is fitted internally, close to the light source, where it remains unaffected by temperature even in high powered lights. Aforementioned combinations can also be used to create a dramatic variety of colours with minimal

loss of light transmissions. Moreover, the colours produced by individual filters can themselves be varied by altering the angle of incidence. This is an unusual effect that is best explained by demonstration.

In general, the ideal instances for dichroics for entertainment purposes are with inaccessible lighting or when sharp, accurate colours are needed, for which the filters can provide a permanent solution. In discotheques the suitable applications seem to be in effects lighting, the construction of internal colour change systems and colour wheels etc.

At the moment theatre lighting is not so feasible for dichroics as one would expect. Many theatre lighting designs call for a very wide choice of colours, which are changed with even greater frequency. So, unless lighting manufacturers develop internal filter systems rather than using 'add on' filters, it is unlikely that such places will be able to take full advantage of the benefits that dichroics can offer them.

For general decorative and architectural lighting, e.g. shopping centres, leisure centres, hotels, display and exhibition lighting, the outstanding advantage of dichroics is permanency. It means that schemes will remain just as the designer envisaged, and will not depend on regular maintenance and colour changes to maintain the effect. The cost effectiveness of this is self-evident, bearing in mind labour costs to regularly change other colour mediums.

Of course, dichroic prices will never match the price of gels, but their use offers new possibilities in designing lighting systems. For example the whole lighting unit can be smaller as the filter can be mounted closer to the light source, offering design and

economy benefits.

As has already been established, dichroic colour filter technology as applied to the lighting industry, is still in its infancy. But the indications are that it will not only complement lighting systems but contribute to their development. Having produced the most extensive range of filters currently available Balzers will be continuing to work with the industry to ensure just such progress.

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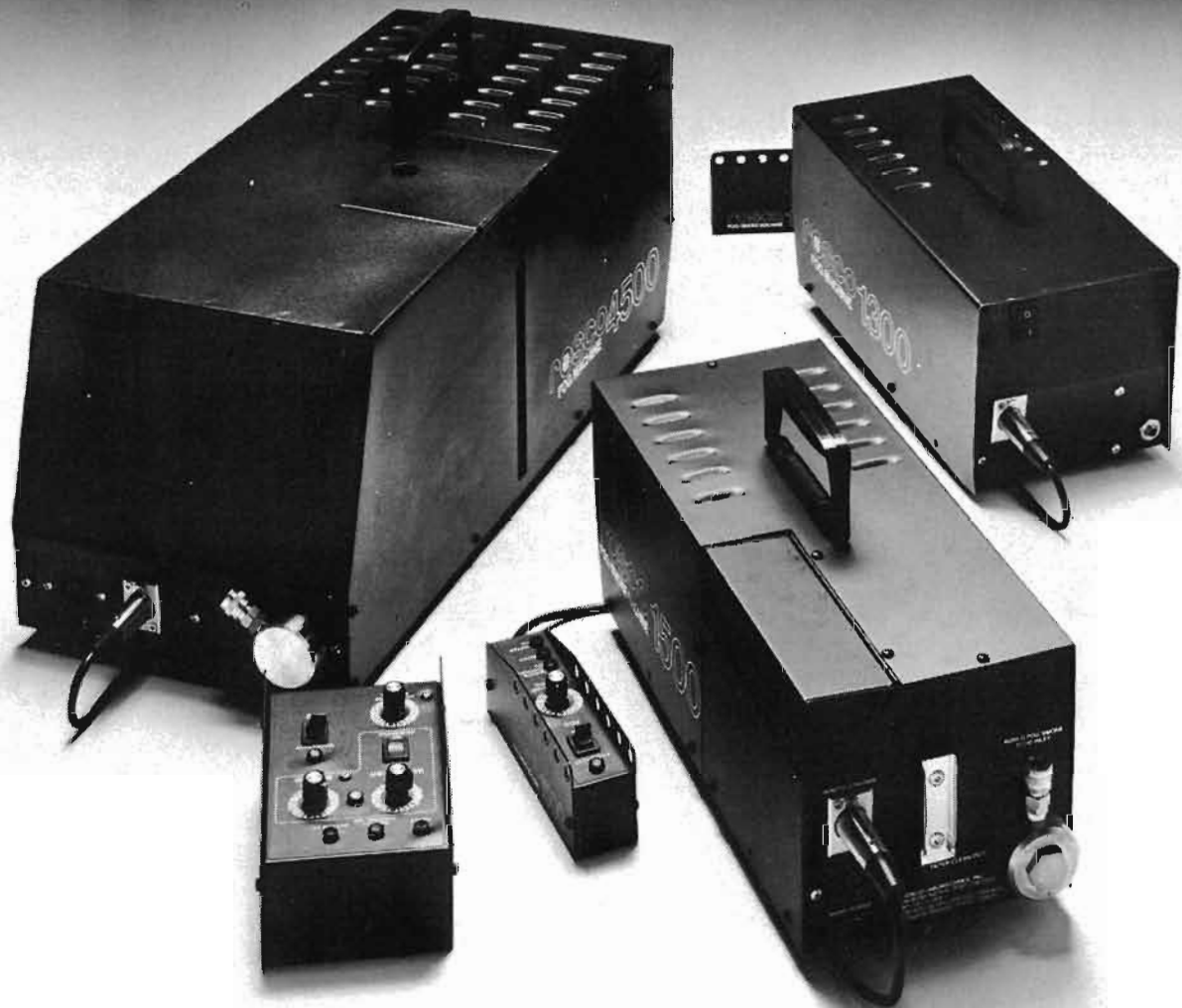
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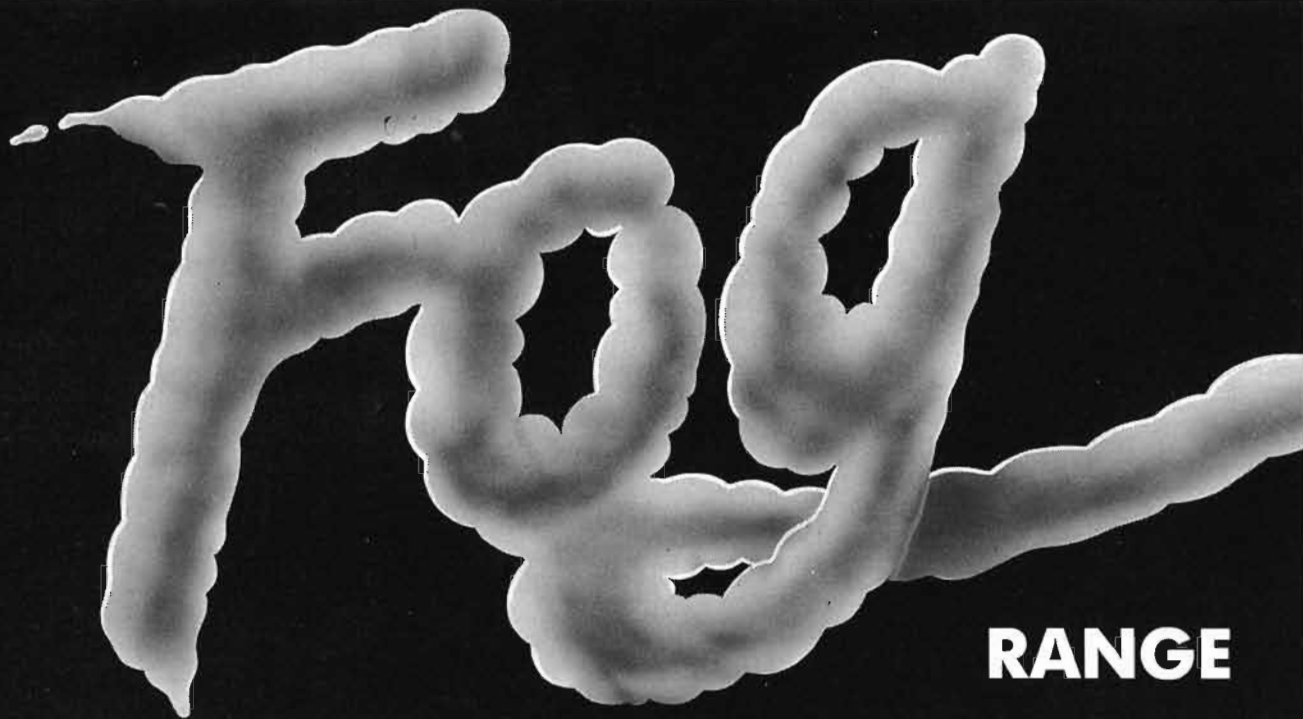
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## Exhibition Diary

### PLASA Light & Sound Show '88

September 11-14, 1988.  
Olympia 2, London.  
Exhibition Organiser: David Street,  
Telephone: 01-994 6477.  
General Enquiries: PLASA general secretary,  
Tony Andrew, 7 Highlight House, St. Leonards Road,  
Eastbourne, East Sussex BN21 3UH.  
Telephone: (0323) 410335.

### MITAS '88

September 29 - October 3, 1988  
Milan Trade Fair, Milan, Italy.  
Organised by Assoexpo.  
Enquiries: IBTS, Secretary General, Via Domenichino,  
11-20149 Milano, Italy.  
Telephone: 02/4815541

### Photokina

October 5-11, 1988.  
Cologne, West Germany.  
UK Representative: Tony Pittman,  
12/13 Suffolk Street, London SW1Y 4HG.  
Telephone: 01-930 7251.

### Entertainment '88

Exhibition & Conference  
October 17-19, 1988  
Harrogate Conference Centre, Yorkshire.  
Organised by Brintex Limited,  
178-202 Great Portland Street,  
London W1N 6NH.  
Telephone: 01-637 2400

### DiscoTec/Hop-tec

November 7-11, 1988.  
Dusseldorf Messe, West Germany.  
Inquirer: Miss Renata Born or Mr Peter Brodie,  
Dusseldorf Trade Fair, Charles House,  
108-110 Finchley Road, London NW3.  
Telephone: 01-794 0166.

### Lighting Dimensions International 88

November 18-21, 1988.  
InfoMart, Dallas.  
Enquiries: Patricia Mackay or Jackie Tien,  
Lighting Dimensions, 135 Fifth Avenue, New York,  
NY 10010, USA.  
Telephone: (212) 677 5997.

### AV & Broadcast China '88

December 2-7, 1988.  
Beijing, China.  
Organised by Business & Industrial Trade Fairs Ltd.  
4/F China Underwriters Centre, 88 Gloucester Rd.,  
Wanchai, Hong Kong.  
Telephone: 5-756333.

### Nightclub & Bar Expo

January 15-17, 1989.  
Atlanta, GA.  
Contact: Angela Benvenuti, Night Club & Bar,  
305 W. Jackson Ave., Oxford, MS 38655.  
Telephone: (601) 236-5510.

### Frankfurt Music Fair

January 28 - February 1, 1989.  
Frankfurt Fair Centre, Frankfurt, West Germany.  
UK Representatives: Collins and Endres,  
18 Golden Square, London W1R 3AG.  
Telephone: 01-734 0543.

### Sound Eighty-Nine

February 21-22, 1989.  
Heathrow Penta Hotel, London.  
Enquiries: SCIF, 4b High Street, Burnham,  
Slough SL1 7JH.  
Telephone: (06286) 67633.

### SIEL '89

April 9-12, 1989.  
Porte de Versailles, Paris, France.  
Organised by Bernard Becker Promotion,  
161 Boulevard Lefebvre, 75015 Paris.  
Telephone: (1) 45.33.74.50

### Pub, Club and Leisure Show

April 11-13, 1989.  
Olympia 2, London.  
Angex Ltd., Europa House, St. Matthew Street,  
London SW1P 2JT.  
Telephone: 01-222 9341.

### SIB/MAGIS

April 10-13, 1989.  
Rimini, Italy.  
Ente Autonomo Fiera Di Rimini,  
PO Box 300, 47037 Rimini, Italy.  
Telephone: 0541/773553.  
UK enquiries: PLASA general secretary,  
Tony Andrew, 7 Highlight House, St. Leonards Road,  
Eastbourne, East Sussex BN21 3UH.  
Telephone: (0323) 410335.

### USITT Conference & Stage Expo

April 12-15, 1989.  
Calgary, Canada.  
National Office: 330 West 42 Street, Suite 1702,  
New York, NY 10036.  
Telephone: (212) 563 5551.

### Expo Musica, Madrid

April 19-22, 1989.  
Madrid, Spain.  
Organised by IFEMA (Institution Ferial de Madrid),  
Avda de Portugal, s/n Casa de Campo,  
28011 Madrid 1101.  
Telephone: 470 10 14.

### Audio Visual 89

May 8-11, 1989  
Wembley Conference Centre, London.  
Organised by emap Maclaren Exhibitions Ltd.,  
840 Brighton Road, Purley, Surrey CR2 2BH.  
Telephone: 01-660 8008.  
Contact: David Copeman.

### Showlight 89

May 15-17, 1989.  
Hilversum Studios, Amsterdam, Holland.  
Organised by The National Illumination Committee CB  
in association with Netherlands Broadcasting Svs.,  
NOB, PR Department, Postbus 10, 1200 JB Hilversum,  
Netherlands.  
Contact: Maureen van Woudenberg.  
Telephone: 035-775115.

### ABTT Trade Show

May 18-20, 1989  
Riverside Studios, Hammersmith, London.  
Enquiries: ABTT, 4 Great Pulteney Street, London  
W1R 3DF.  
Telephone: 01-434 3901.

### APRS Show

June 7-9, 1989.  
Olympia 2, London.  
Enquiries: APRS, 163a High Street, Rickmansworth,  
Herts WD3 1AY.  
Telephone: (0923) 772907.

### PLASA Light & Sound Show '89

September 10-13, 1989.  
Olympia 2, London.  
Exhibition Organiser: David Street,  
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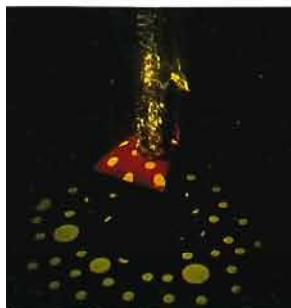


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# BSS Audio: A Showcase

Ben Duncan sets out to find the background to a success story.

## BSS Audio: A showcase

Today, BSS Audio's products are found in nearly every major sound reinforcement system and in broadcast and recording studios around the world. The company is successful, not by chance or marketing strength alone: it's liked and respected by countless sound engineers. What makes BSS so special?

## History in brief

BSS was founded as 'Brooke Siren Systems' in 1979 by Chas Brooke and Stan Gould. Both had a working knowledge of the Pro-Audio electronics industry, in particular with London-based **Midas**, who had become respected manufacturers of mixing consoles by the mid 1970's, notably after completing a 100+ channel quadrophonic console for Pink Floyd's 'Animals' tour in 1977. Chas Brooke was a partner at Midas and Stan Gould a design engineer when the two decided to concentrate their talents on the creation of innovative frequency-dividing systems and ancillary equipment.

The first product to emerge from the newly formed company was the radical **MCS** series, the first modular active crossover system. The **MCS** series broke new ground in providing effective yet inaudible speaker protection, in the form of mid-filter limiting, a technique that's now recognised as the industry standard. Before, sound engineers had mistakenly placed compressor-limiters in line with the individual crossover outputs. This led to an unpleasant change in sound balance when one frequency band (usually bass) was over driven before the others. The **MCS** also featured plug-in modules and frequency-determining cards which were particularly appropriate at a time when PA rental companies (in the UK at least) were experimenting with 4,5, 6 and even 7-way frequency division, to attain a flat frequency response from the drive-units and horns that were available at the time. Chas Brooke drives the point home: "What we were doing was educating the professional user as to the importance of the crossover part of the sound system, and that meant not just the proper use of filters, but the correct implementation of power limiters, input conditioning, high current balanced output stages and signal level monitoring."

A decade later, the **MCS** series is still manufactured, and finds popularity with engineers, since aside from standard 2,3 and 4 way configurations, it can also form the basis of a customised system to meet specialised needs.

1980-1 brought a series of equally innovative ancillary products - beginning with the **AR-125** cable tester and the **AR-116** Direct Inject box. Again, they were designed to exacting standards and were introduced only after road trials. The **AR-116** did away with the problem of exhausted batteries; it could be fitted with a compact, proprietary power conversion module which allows the unit to be powered from the console's phantom voltage while retaining 100% isolation. The **AR-116** has gained an international reputation for sonic quality. For example, BBC sound engineers in London's famous



Chas Brooke, managing director of BSS Audio Ltd.

Maida Vale music studios rate it above a D.I. box costing 3 times the price, while in an independent test in **Criteria** studios in Florida, the **AR-116** was judged to outclass every other D.I. box.

BSS have built up a solid reputation for providing equipment that addresses real needs in a cogent fashion, and above all for super-reliability, gained through zealous design and Q.A. (quality assurance) procedures. To quote Chas Brooke: "BSS has always made a product that is interesting - that is not just a straightforward answer to meet a need, but rather, a thoroughly researched innovative solution that gives the end-user an ergonomically packaged, powerful tool for his trade." More recently, BSS have become part of the **EdgeTech** group of companies, with offices in London, New York and Tokyo. Over the past 9 years, BSS has been based in London. Today they've just moved to a new, custom built location near St. Albans, to accommodate ever increasing production requirements.

## What's State of The Art in signal processing?

BSS are best known as a manufacturer of active crossovers, but their range of products is far more extensive.

**Signal Distribution:** Under this heading are the **MSR-604** Active Microphone Splitters, the **FDS-360** and the **MCS-200** Active Crossovers, and the **EPC-780**, a radical new power amplifier. The **Signal Processing** range comprises the **DPR-402** De-Esser/Compressor/Limiter, complemented by the **DPR-502** Noise Gate with full, processor-controlled bi-directional MIDI interface and **Automatic Dynamic Enhancement** technology (ADE). In the **Accessory Range**, **AR-116** is the DI box mentioned earlier, and **AR-117** the optional phantom powering unit. **AR-125** tests leads and fuses, while **AR-130** checks system phase and polarity. Finally, **AR-204** is a 4 channel, 600ohm line balancing unit. BSS also produce 'OEM' versions of

their products for other sound system manufacturers.

## Theatre & Opera Sound

In June, Vittorio Rossi staged Verdi's spectacular **Aida**, with a cast of over 600 at Earl's Court. With seating for 15,000, sound reinforcement was a must - despite opera singers' famed immense vocal projection! At the same time, the producer naturally insisted on a sensitive, low key approach on the basis that for opera goes familiar with pure acoustic sound, 'see no technology' means 'hear no evil'.

Various items of BSS equipment were included in the specification for the PA system, which was provided by **Sound Hire**. On stage, the 8 principals used 6 x Micron 501 radio mikes and a pair of Micron 203 radio mikes. The remaining mikes were assorted 'upmarket' capacitor and dynamic models, including rifle mikes, namely Sennheiser 416's, 816's, Neumann KR82's and Shoeps MK5's. Of these, 8 mikes covered the chorus, 4 the **Banda** (a subsidiary orchestra backstage), and another 3 for harp and percussion. The main (front of house) orchestra utilised a further 6 'spot' mikes, 8 'Boundary Layer' units (like PZM's) placed on the floor near specific instruments, and 2 overheads for ambience.

To interface the mikes with the two f.o.h. boards **Sound Hire** were using a pair of 44 way microphone splitter racks totalling 88 channels, under the stage. Comprising 22 of BSS's **MSR 604** Active Microphone Splitters, the racks were originally built for Stevie Wonder's recent UK tour. Normally, each **MSR-604 1U 19"** module is used to accommodate four mike channels, each with 4 active buffered split outputs. Two are electronically balanced for connection to f.o.h. and stage monitoring. The other two are transformer isolated feeds, for broadcast and multitrack recording. In spite of the absence of the latter 3 feeds on this occasion (opera singers don't need stage monitors, and there was no broadcast or recording required), **Sound Hire** were using the **MSR** units because they'd found that the powerful active drive positively enhanced the sonic quality received at the mixing board, about 150 yards distant from the splitter rack. It's not surprising, considering the complex, reactive nature of dynamic mikes and the limited drive capabilities of capacitor mike circuitry, set against substantial shunt capacitance in the multicore 'snake'.

At the f.o.h. position, sound designers **Bill Cadman** and **Simon Johnson** had available four **DPR-402** De-Esser/Compressor/Limiters for their dynamics processing needs. One of these served on reverb. The other three were on hand for the principals, because with different singers on each of the 7 consecutive nights, the vocals represented an unknown factor. The **DPR-402** has gained an excellent reputation for being simply and quickly adjustable to accommodate all kinds of vocal techniques. The **DPR's 1U** enclosure fulfills BSS's reputation amongst engineers for packing more and more useful LEDs and knobs into their equipment than any other manufacturer. Aside from 2 channels' worth



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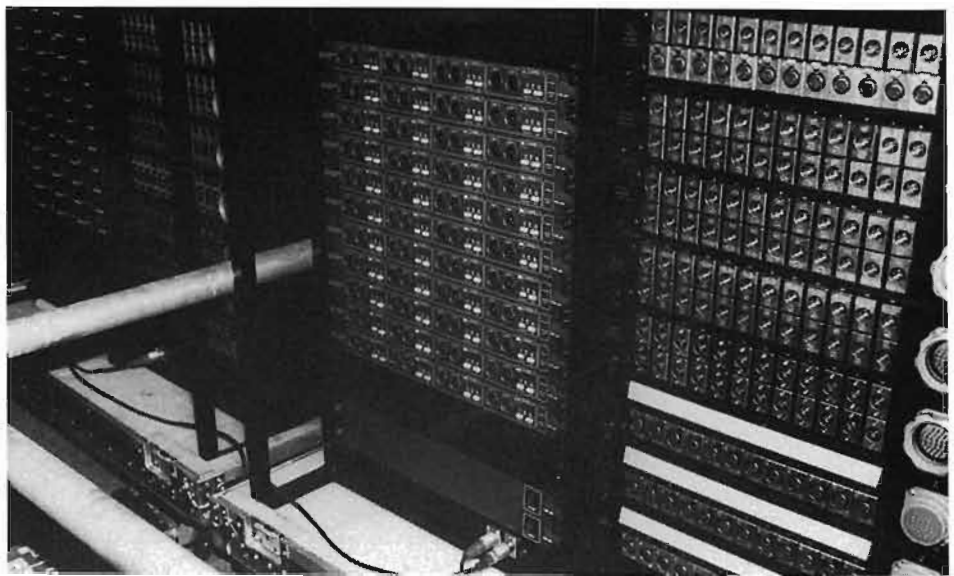
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of comp-limiting controls, the DPR-402 goes on to provide advanced facilities, such as tuneable sidechain EQ (for 'de-Essing' at any audible frequency), as well as sidechain monitoring, so engineers can get a quick intuitive feel of the sidechain EQ's likely effect. A novel LED display simultaneously shows gain reduction and 'below threshold' limits, while a second LED meter permits comparison between input and output levels. Then on the rear panel, a barrier strip allows engineers to program up custom options such as expansion, both broadband and frequency concious, external gain control, amplitude controlled mixing, and 4 channel processing tracking.

In the US, NYC's Masque Sound are using DPR-402 De-Esser/Compressor/Limiters for Broadway productions, including 'Les Miserables' and 'Into the Woods'. At Autograph in London, Andrew Bruce, sound designer for Les Miserables, specified the three DPR-402's for productions around the globe. He said: "I love the way the DPR-402 displays what it's doing." Two are used in compressor mode, in conjunction with four mono keyboards to handle some fairly extreme variations in level. The third unit provides group de-essing for the radio miked vocals. De-essing is important for theatrical productions, because sound designers like actors to wear radio-mics on their heads. This position offers better timbre, since there are no chest resonances to contend with, but at the same time, there's more sibilance, hence the stress of de-essing. Bruce has also specified BSS D.I. boxes for the worldwide productions. The very idea of using an English DI box caused raised eyebrows when broached in the US - but then the American sound team quickly came to accept them!

#### Broadcast and recording Links

On 11th June 1988, MSR-604 Active mike splitters starred in the Nelson Mandela 10



The MSR-604 rack as used for Aida at Earl's Court.

hour 'birthday party' charity concert held in Wembley's 80,000 capacity Stadium. 112 channels of the MSR splitters formed the link between the stage distribution system and isolated feeds to **Advision's** mobile recording truck, and the BBC's SCV5 and SCV6 mobile units, where the music balances were created for the global satellite link to an estimated 1000 million listeners and viewers. The concert was notable for the absence of hums, buzzes and interactive effects that have plagued the set up and running of similarly complex multi-media concerts in the past.

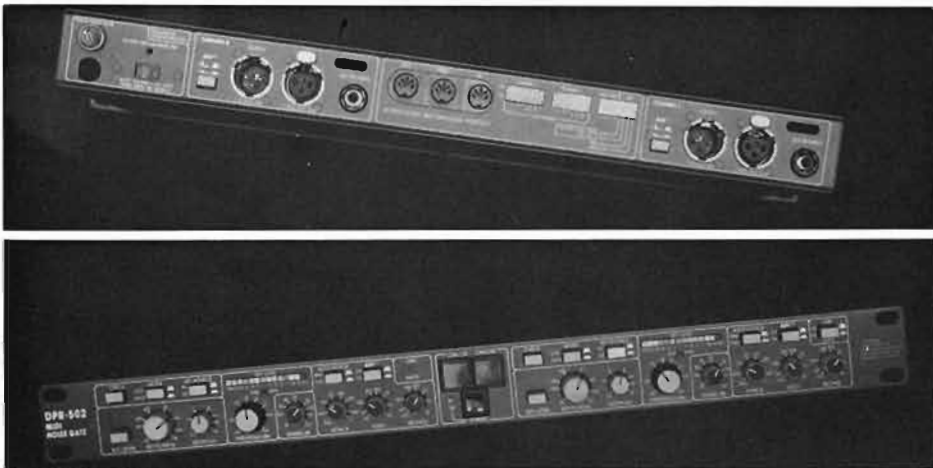
In Holland, the North Sea Jazz Festival, Europe's most prestigious contemporary Jazz event was held in the Hague on 8,9, 10th June. 10 stages utilised an PA and stage monitor equipment, supplied by AMPCO and driven from FDS-360 crossovers. For the remainder of Europe, 48 channels of

MSR-604 & 602 mike splitters provided high integrity split feeds to the Dutch National Broadcast Company to record the sets on digital multitrack, for transmission later.

In France, top FM stations like **SkyRock** and **Radio Monte Carlo** are using a custom rack system comprising MCS-200/FDS-360 active frequency dividers feeding multiple DPR-402s. It provides band-selective compression, similar in its objective to Orban's Optimod, but found to be more creative in its dynamic control flexibility. It was conceived by the BSS French distributor **Regiscene**; their technical director designed proprietary phase-compensated combining amplifiers to re-combine the separately processed bands, before the final link to the transmitters. It's only a matter of time before the same equipment gets used in an upmarket installation, as a sonic 'sweetener'.

#### Showtime and Stadium Sound

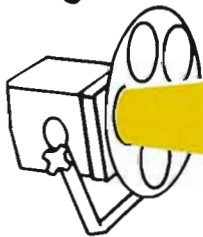
Returning to the Nelson Mandela concert, the 2 stages, mainly equipped by **Concert Sound**, also employed BSS's AR-116 D.I. boxes throughout, with DPR-402 De-Esser/Compressor/Limiters being available at the f.o.h. position. For both the main PA and the stage monitoring, active frequency division was accomplished with a mixture of FDS crossovers and the modular MCS units. Custom modified versions of the latter were designed in conjunction with Concert Sound's Tim Boyle to provide powerful, full-range line drive capabilities, isolation and grouped level control to over 100 power amplifiers needed for the occasion. Boyle identified the need for isolation when considering the risks of a short across a feed to one amplifier silencing a whole section of the PA, plus potential parallel loading problems due to the large number of amplifier



The BSS DPR-502 midi noise gate.

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inputs being fed.

Meanwhile, for their 1987/88 world tour, Pink Floyd chose BSS to supply 96 Active Mic Splitter channels as part of their complex stage system, together with DPR-502 Noise Gates and DPR-402 De-Esser/Compressor/Limiters for f.o.h. processing.

At the **World Expo 88**, Brisbane, Australia, 3 MCS-200 and 15 FDS-360 crossovers provided frequency division for out-front and on-stage monitoring at the main River stage and each of the four subsidiary venues. The FDS-360 is justifiably reckoned by BSS to be the world's **de facto** 'industry-standard' active crossover in sound reinforcement. 'FDS' stands for 'Frequency Dividing System'. Aside from having BSS's classic integral mid-chain limiters and gain trims with their range limited to a sensible +6dB, it's also highly flexible, with pluggable cards allowing not just the crossover frequency, but the filter slopes too, to be tailored to suit very different loudspeaker system philosophies. "Nowadays, most operators have appreciated the benefits of the -24dB per octave 'Linkwitz-Riley' slope" said Chas Brooke, "And we were amongst the first manufacturers to put the idea into practice after Siegfried Linkwitz presented his AES paper about 8 years ago. We were also the first manufacturer to offer speaker protection limiters designed as part of the filter stages, as standard." Flexibility also means a pluggable EQ card, which engineers are able to set up to accurately compensate for constant directivity horns' falling response towards 20kHz, for example. Another original BSS idea is a 0° to 180° phase trim between adjacent bands, accessible on the front panel for ease of loudspeaker phase alignment by ear alone. Used in conjunction

with the polarity reversal switch on each band, the control allows phase to be trimmed over the full 0° to 360°.

#### Installations

BSS processors are naturally found in fixed installations around the world. A recent example close to home is Fairfield Halls, Croydon's famous multi-purpose venue. It deals in the arts, conferencing and all kinds of music concerts, many of which are televised or recorded to multitrack. Leopold Stokowski described it as "the perfect symphony hall". Earlier this year, a prime UK installer, Wigwam Acoustics refurbished the sound system and fitted MSR-604 modules, again to ensure continued sound quality, irrespective of the number of paralleled feeds required from individual microphones. Acoustic musicians were pleased to note that the MSR's noise floor was low enough to be unnoticed.

In the US, First Baptist Church, Charlotte in New Conneticut is a prime example of a modern religious installation using BSS equipment, namely FDS-360's and DPR-402's for signal processing. Then at Candlestick Park in San Francisco, California (home of the **49ers** and the **Baseball Giants**, 24 FDS-360 crossovers are used in a high level distribution system, for relaying the live entertainment on the stage in the centre of the field, to crowds of 65,000. Recent 'acts' include Willy Nelson - and The Pope.

#### The Future

The EPC-780 is BSS's latest product. It's their first power amplifier, and a radical one at that. EPC stands for 'Electronic Power Converter' and model 780 is billed as the flagship of a range of amplifiers expected to be

available later this year. The preliminary specification anticipates over 1KW per channel into 4 ohms. Fitting into 2U and weighing just 20kg, it promises new standards of power density for touring and installed sound systems alike. Innovative features include intelligent fault diagnostics, and a self-adjusting supply which automatically accommodates different supply voltages, a big advance for touring rigs. For central cluster installations, the EPC 780's levity coupled with remote control facilities for level and muting promises to do away with lengthy, expensive and interference-prone speaker cables: these amplifiers will be light enough to live up amongst the horns.

BSS's close involvement with the pro-Audio industry's needs and applications is demonstrated by their publication of a range of detailed User Manuals for each of their products. These go beyond simple functional descriptions and technical specification, to give useful background such as active filter theory and its implications in sound system design (FDS-360), and pictorial examples of control settings to achieve smooth HF de-essing of sibilant vocals (DPR-402). The latest of these books explores the uses of the DPR-502 Noise Gate, not only in basic and advanced analogue noise gating techniques, but also its various specialist applications relating to MIDI controlled digital samplers and musical instruments.

Lars Brogaard - who's acted as live sound engineer for Rod Stewart and Lionel Ritchie before coming to London to run the European arm of Electrotech, an LA-based PA rentals company - sums up the reason for engineer's confidence in BSS: "I've used all of BSS's products over eight years without trouble - they're the business."

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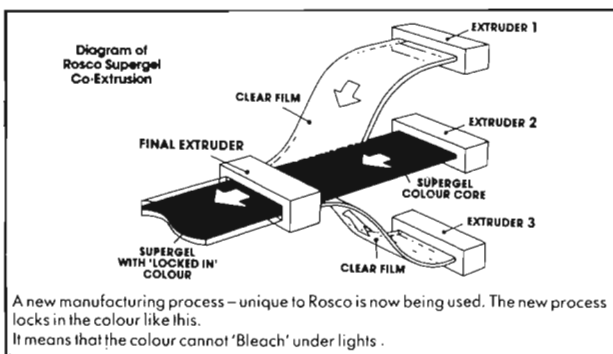
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# Talking Loudspeakers

Ben Duncan talks to Paul MacCallum of Wembley Loudspeakers

Wembley Loudspeakers was formed in London in 1971 by Arthur Lampkin, ex-service manager at Goodmans. At the time, Goodmans were based at Wembley, hence the name of the new company, which Lampkin set up to repair and service most makes of power loudspeakers for unfortunate musicians, and the rock 'n' roll industry (discos had yet to arrive). Paul MacCallum took over in 1976, and over the past 12 years, the company has become established as probably the most well known loud speaker 'repair station' in Europe. Today, Wembley Loudspeakers services nearly all the major PA rental and discotheque service companies, and are starting to establish outlets in Europe.

## The repair business

Wembley keep spares for over 400 types of drivers from over 20 manufacturers, from ATC to Vitavox, in sizes ranging from 8" to 30". Typically, a recone costs a third to a fifth of a brand new replacement driver. When a cheap driver fails, Paul can offer a variety of improvements to the reconed unit. For example, a new voice coil can be wound on an aluminium or kapton polyimide former with high temperature wires and glue.

PM: "We can change the impedance and/or the character of the unit by selecting different 'software'. We can also completely rebuild, re-centre and re-magnetise the magnets of your speaker. This is the single most expensive part of any professional loudspeaker's metalwork, and should NEVER be tampered with!"

## Bass Developments

Wembley's new range of bass drivers include the B-Line 300 & 500. Of these, the B-Line 500 is particularly innovative.

BD: "What was the starting point for this design?"

PM: "We spend a lot of time rebuilding other people's bass drivers, particularly for the (reggae) **sound system** market. The excursion limits on existing 18" drivers mean they can't handle **really** deep bass at high levels without the voice coil bottoming."

To overcome any chance of damage, the B-Line 500 employs an unusually deep magnet. This sets an excursion limit above 30mm - more than 1 1/4" of linear cone movement.

PM: "Then - like Cerwin-Vega's 189 'earthquake' driver - we've wound the voice coil in 4 layers, putting an unusual amount of copper in the gap.

"About the same, in fact, as a 6" voice coil would have, with the normal double-layer winding. Also, the extra mass of copper can handle higher thermal dissipation, which results in less thermal compression for a bass 'thump' of given power. Next, the cone is made from an especially heavy, 70 grams pulp. Then, there's a double suspension, both at the voice coil (like Gauss's drivers), **and** at the cone's edge. Last, we tested out a number of manufacturer's baskets (the metal frame). With such a heavy magnet assembly, most broke or buckled when we dropped them on to a concrete floor. The basket we



Paul MacCallum shows 'Deuce' and 'B Line' at the 1988 Frankfurt Music Fair.

chose is supplied to us by Goodmans." For the new drive-unit, there was just one snag:

PM: "Owing to the very large excursion, we found that ordinary tinsel (connecting wires) couldn't stand the strain. We had to specify tinsel of double the usual diameter."

BD: "Surely you must have created a fairly power hungry driver!"

PM: "Yes and no. We've basically broken the rules. Most manufacturers set out to attain efficiency, using lightweight materials. These are inherently delicate. We've set off in totally the opposite direction. However, the end product is a driver with an efficiency of 101dB SPL (@ 1 watt @ 1 metre), which is respectable for any 18" drive unit - a manufacturer who claims a much higher figure is probably measuring efficiency at 1kHz, rather than over 40 to 120Hz, the frequency range over which any 18" driver is going to be used. The long magnet redeems the efficiency. Plus it's unlikely to blow up and can never bottom!" ("Bottoming" happens when the voice coil hits the end-stops.)

## Enclosure Design

Building on their expert drive unit design, Wembley LS have produced a range of highly-customisable enclosures. The first of these is the DEUCE. As it's name suggests, the installer can 'score' either way: it's a dual position enclosure, cleverly designed so the nameplate and HF driver's dispersive 'lens' can be undone and quickly switched around, so the latter is kept at the top of the enclosure. Associated with the Deuce is a list of 15 optional features, ranging from a choice of impedance and crossover point through to wall fixings and flying points. There's also a choice of cabinet colour, with white being a firm favourite for upmarket clubs and bars.

For the more cramped species of wine bar, restaurant or background disco, Wembley's MAXI CUBE measures just 10 1/4". Inside,

there's an 8" co-axial (i.e. 'dual concentric') driver, rated at a fairly exceptional 125 watts rms.

PM: "This unit was put together for us after meetings with David Lyth from **Volt** loudspeakers. It incorporates a heavy duty rubber surround, dual suspension system and a small but very efficient hf tweeter, mounted directly on top of the bass driver magnet's pole-piece. A specially tailored crossover fits inside the magnet cover, so the whole unit is completely self-contained."

At the other end of the spectrum, B-Line 2820 is a compact bass bin fitted with the B-Line 500 driver. It's naturally intended for **projecting** bass in bigger venues and for live sound reinforcement.

## Installations

As a loudspeaker designer **and** a musician, Paul is quite uniquely placed to comment on installations he's encountered.

PM: "A lot of smaller venues do quite well financially, but don't get around to investigating new investment in the sound system beyond fitting in a couple of Bose 802's. Conventional 'small box' speakers are fine for some jobs, but not for playing disco tracks, let alone live music. Nowadays, people are used to better quality in their homes, from their CD players. I feel club owners should actually go into a venue and listen to the system they intend to buy. Most of all, when the venue is active and **filled** with punters."

BD: "What happens when club owners take the wrong decisions?"

PM: "We had an installation order 'up north'. The contractor specified our speakers, but later discovered that the club owner insisted on a very cheap 'front end'. This included an under-powered amplifier, at best rated at 150 watts, whereas our speakers like to see a clean 250 watts, from say a 350 or 500 watt amplifier. Because the system wasn't loud enough, it was constantly driven into clip,

and regularly blew-up the drivers as a result. Then we, the loudspeaker manufacturer, get the blame."

Wembley Loudspeakers have been providing systems in discos, pubs and wine bars for 3 years. A notable recent installation was at **The Sir George Robey** in Seven Sisters Road in London's Finsbury Park.

PM: "It's a popular venue with up and coming bands, on a par with Dingwalls. Owing to the fairly high ceiling, we were able to do something unusual for a venue of this size. we've hung a central 'mini' cluster above the stage, comprising three Deuce cabinets, wired for stereo and mono. Then for added vocal clarity for the kind of acts that require it, we fitted a further two Deuce enclosures on the back wall, pointing downwards. For stage monitoring, we positioned four Deuce cabinets high on the lighting truss (which is positioned like a proscenium arch), again pointing down."

BD: "In other words, you abolished wedge monitors?"

PM: "Yes. Floor monitors have a certain minimum size, enough to crowd-out a small stage. When I'm on stage I'm tired of bruising my ankles on floor monitors, and the usual clutter of speakers is visually bad. In this installation, we have a clear stage. All the bands who've played at the **George Robey** have been in favour of this. Plus we've found that the truss-mounted monitors did away with the usual howlround problems. Maybe it's because the wedges are pointing downwards, and not picking up floor reflections."

Notably, the first musician to play the new system was Flaco Jimenez, who's an ex-member of Ry Cooder's band, and taught him a lot about the 'Tex-Mex' feel.



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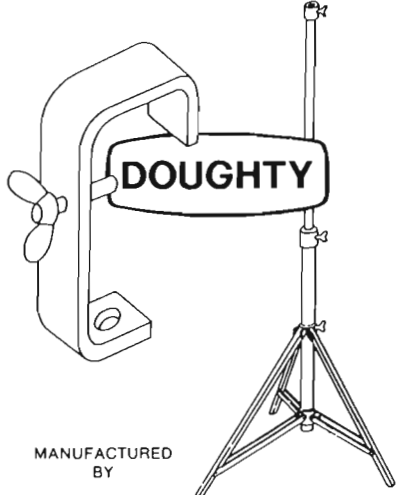
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**Practical Psychoacoustics and loudspeaker mechanics**

BD: "As a musician, maybe you have some astute observations on the nature of human psychology when it comes to entertainment sound?"

PM: "Energy from loudspeakers deteriorates after a while; heated up, the sound is compressed. The ear is similar. After a few drinks and some excitement, the DJ's hearing has changed. He re-equalises and turns up the faders. We know this, because when system settings have been left intact overnight, the system sounds horrific when turned on the following morning."

BD: "What are your thoughts on loudspeakers, having spent 17 years of rebuilding other manufacturer's driver units?"



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PM: "Well, it's interesting to see the rubbish certain manufacturers put in! OK - everyone has to work to a price, but it's interesting to see where and **how** the different companies choose to make necessary compromises. A basically good design can be ruined by one badly thought-out 'short-cut'. Some of the most elegant speakers are old designs, in the days when (amplifier) power was in short supply, and efficiency counted. You can't fail to admire the engineering of classic JBL and Altec drivers. Today's Gauss units are an example of that kind of standard, but the cost of such workmanship is high. We've learnt enough from studying other manufacturers' mistakes to know how to make the quality of our B-Line drivers comfortably above the UK average, while keeping the cost very reasonable."

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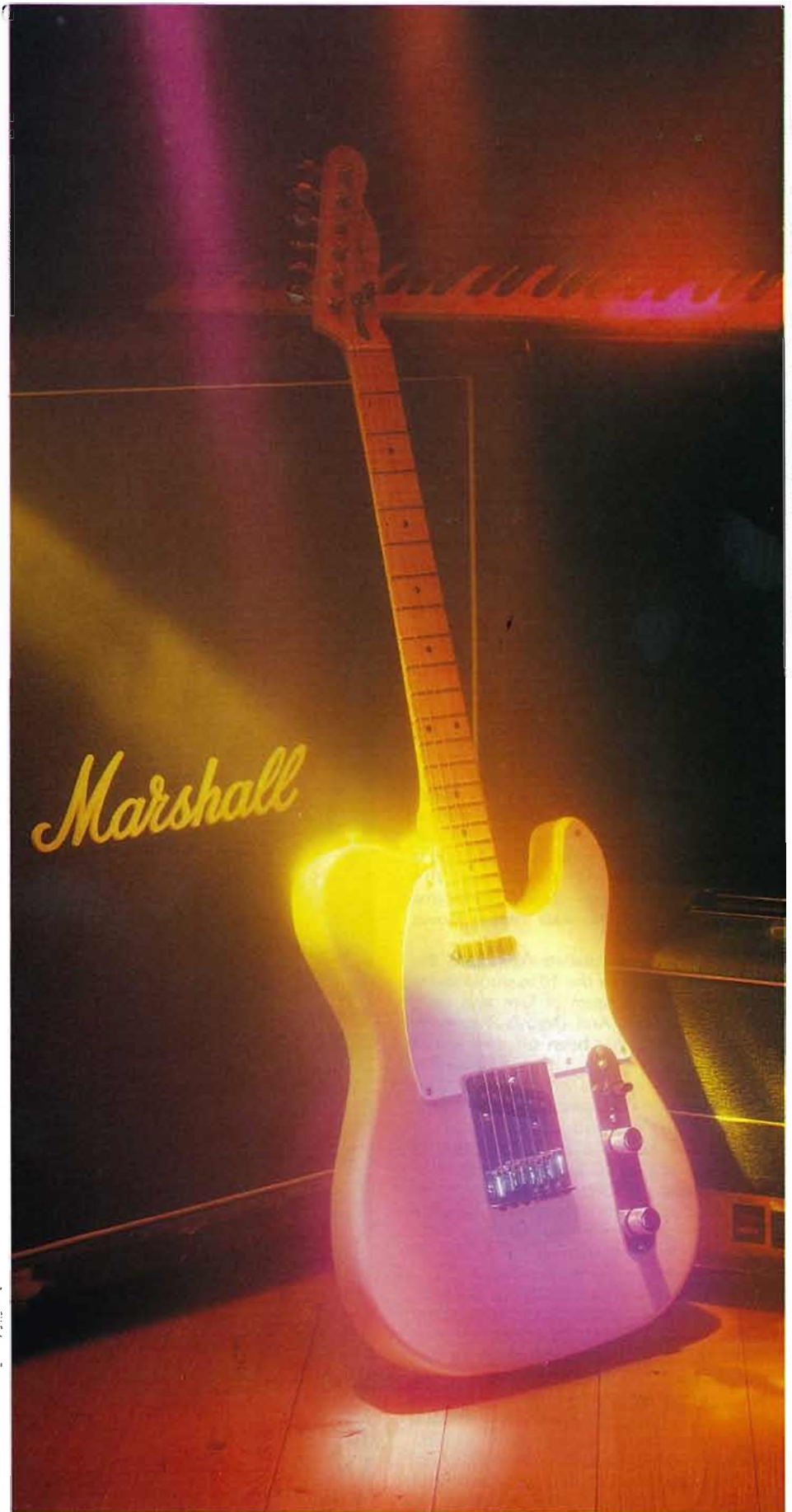
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# Light Archaeology

Francis Reid visits Jim Laws Lighting

Most lighting firms boast that they deal in the very latest technology, but Jim Laws takes pride in supplying the stuff that was dropped from the catalogues long long ago.

But who would want to buy or rent old lights? Well, television companies for a start. **The Good Companions**, **Lost Empires**, and **The Bretts** are just some of the series for which Jim has supplied period authenticity. Coming up shortly is a Thames Television series on the young Charlie Chaplin's early years in English Music Hall with Jim Laws Lighting putting the lighting clock back in such historic theatres as Hoxton Hall, Wimbledon Theatre and the Amusement Hall in Normansfield Hospital whose stage has uniquely survived intact since the 1870s. Feature films include the dance hall scene in **Wish You Were Here**, and the Old Vic **Kiss Me Kate** used a lot of pageants for the backstage sequences. Most productions of **The Dresser** ring 050-275-264 for help, not just with lights and a tracker wire resistance 'temp board' to dress the stage authentically, but for a pre-tapedeck storm package of wind, rain and thunder machines.

But if a production requires a light that is not in Jim's collection (and if it is not in Jim's collection, the chances are that it is not readily available anywhere else), then he is prepared to make an authentic copy. For example, the bunch lights standing in the wings of the theatres in **Lost Empires** were made to the design illustrated in original GEC adverts in the archives of Brian Legge.

Another regular rental area for the collection is Trade Shows, since a Hollywood studio set offers suitably glamorous associations for product launching. In preparation is a portable kit for producing the Twentieth Century Fox searchlight beams that are so synonymous with movie glamour.

Major permanent installations include the lighting equipment for the 1936 studio scene at the National Museum of Film and Television at Bradford. And Derby's **Twentieth Century** nightspot has been supplied with a Hollywood theme. But, rather surprisingly, no discos yet. Jim has a lot of the Mole Richardson 2kW TV **Sputniks** which would look great in chromium plating and could have their lamps replaced by the latest all singing, all dancing, all flashing and all chasing technology. Indeed, as new lighting fixtures standardise on unobtrusive lookalike extruded boxes, refurbished old stage lights might well be increasingly useful to interior decorators seeking a showbiz theme.

But old lights are not only useful as decor. One TV lighting director rented some extra Pattern 35s (an early Strand acting area with a 1kW GES lamp and no spill rings) for **The Bretts** because he liked the quality of the light . . . and will the Pattern 23 ever die? Good ones have increased their second hand value since manufacture ceased. Which is hardly surprising in view of the 23s diecast durability, its short-nosed ability to fit into spaces which deny access to newer profiles, and its capability of upgrading to 650w for short term overdrive.

A year ago Jim Laws moved to a new HQ in the heart of the Suffolk countryside at West

End Lodge, Wrentham, Beccles, NR34 7NH. His stock filled twelve pantechnicons: an indication of its volume and diversity.

A particular pleasure of a visit to the warehouse is the re-discovery of one's own past. Most of the memories serve to remind just how much our industry has moved forward. I had forgotten just how heavy and bulky was the pattern 102 2kW fresnel. But I will never forget the contortions of working a grandmaster, the race to reset a manual preset before it was required, the non-proportional fading of CD, lighting an American musical on a light console with no method of presetting any level between zero and full . . . and, above all, the time to set back during rehearsal on any pre-memory lighting board.

A little grandmaster (although even with

only 44 ways, little for a grandmaster is a relative term) in the corner looked and felt familiar. It once lived in the upstage right corner of the Fortune Theatre stage, masked by black drapes which prevented the operators seeing anything, although they could not have had a better feeling of contact with the actors. I once plotted and worked a revue on it for John Wyckham and subsequently used it to light design another revue and then a play which I believe was somewhat unique. It was the only co-production ever between those two leading Michaels, Codron and White; and it was Glenda Jackson's only appearance in a flop. Even she could not save this particular play.

Also my Glyndeboune desk of 1964: the first complete thyristor installation in a European theatre. Its reset panic was reduced by



An early arc, made in the limelight tradition.

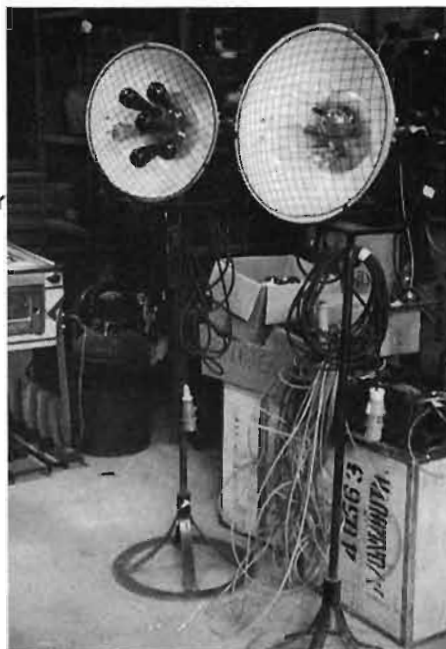


Fred Bentham and Paul Weston recall the days when working a board was never boring because the operator had to be an organist. (Light Console - 1946 - from the Bristol Old Vic).

the inclusion of a fourth preset contrary to the Strand philosophy of that time. (No one would have minded Strand standardising on three presets for economic reasons but my esteemed colleague and friend Fred Bentham insists to this day that three was the operationally optimum number of presets for manual systems).

Fred Bentham's light consoles pioneered single operator remote operation from the front of house in the 1930s. Jim has three of the post-war models. The Bristol Old Vic (1946) has a long cable to give potential of removal into the stalls for rehearsal (but was this facility ever used? - certainly the multiplug, a splendid bit of handmade brass and mahogany, is in better condition that we could expect from today's connectors). The desk made for the Royal Festival Hall's 1951 opening is especially shallow to fit a minute control room: the labels on the channel selectors are a fascinating guide to the installed layouts of the time. But the really important one is from Manchester Palace. Installed in 1948, it was still going great guns in the 1970s and I have fond memories of Gil Binks succeeding with each and every cue request. But operators have always been, and still are, a much more important factor for good lighting than the boards that they work.

Wallowing in nostalgia can be a lot of fun, certainly amongst those old enough to have become part of the archaeology of such a relatively young subject as electric stage lighting. But there are lessons to be learned from history. **To move forward, first look back** is the basis of much scientific research. Jim Law's collection is currently missing one particular late 1960s spotlight that I feel sure



**Bunch lights - as used for wing floods before large wattage lamps became available. They were made by Jim Laws for 'Lost Empires'.**



**Deja Vu for a sometime Fortune Theatre operator!**

needs re-assessing. The Pattern 265 is historically interesting because it was the first CSI follow spot (it used a 400w lamp). But, more significantly, its lens system was a coupled zoom. Which makes it mandatory research for anyone trying to develop an improved fellowspot.

Since the remnants of theatre technology are so bulky, the Theatre Museum cannot display more than a couple of token controls

and a handful of spots. An embryonic Museum of Theatre Technology has established charity status prior to seeking funding and the Theatre Archaeology Committee of the ABTT endeavours to chart the whereabouts of key artefacts, many of which are in enthusiast's lofts and garages or under their bed. Meanwhile Jim Laws is the nearest we have to a National Museum of Theatre Lighting Technology.



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# Presenting Royal Britain

**John Offord talked to Imagination about the 'background' to Royal Britain which has just opened in London's Barbican complex.**

Leading design and communications company Imagination has transformed a previously empty site in London's Barbican complex into Britain's first permanent exhibition on royalty - 'Royal Britain'. Unicorn Heritage plc has backed the project, raising £5 million last year through the Business Expansion Scheme to cover design, construction, promotion and administrative costs. The 35,000 square feet exhibition complex opened in early August and is expected to attract 900,000 visitors a year.

A key aspect of the exhibition is its unusual design approach and innovative use of technology to create a memorable experience for the visitor, instead of simply displaying artefacts and relics as in existing museums. Imagination has combined audio-visual projection and sound technology with theatrical effects and 3-dimensional design to convey the atmosphere of selected moments from history. For instance, visitors experience what Mary Queen of Scots may have felt like walking to her execution, and what it is like to be a member of today's royal family facing the 'paparazzi'. In addition there is a mechanical theatre, a talking head, and a painting that comes to life in a 360° diorama.

Imagination has been working on the project since September 1986 following initial contact by Gyles Brandreth and Adrian Gilpin - deputy chairman and managing director of Unicorn Heritage, respectively.



Royal Britain brings 1000 years of royal history to life - from King Edgar to Queen Elizabeth II. Seen above is a detail from the Saxon Kings. Harold II was killed by an arrow at the Battle of Hastings in 1066.

Both have wide experience in the organisation and promotion of theatrical and TV productions.

"They came to us with a totally open brief," said Gary Withers, Imagination's managing and creative director. "They asked for an exciting yet educational exhibition that would include all 51 British monarchs and would appeal to both the home market and overseas visitors of all ages. A restaurant and gift shop were also to be included. In response to the initial ideas presented by Gyles and Adrian, we put together a team who then realised the design concept and treatment."

Royal Britain represents a unique concept in the UK leisure and entertainment industry using an innovative blend of 3-dimensional design, audio-visual projection and sound technology to evoke selected moments of history. As the exhibition is intended to run 8-hours a day all year round, the need for a reliable, automatic system requiring minimal maintenance was of prime importance.

A purpose-designed computer system has therefore been installed to control lighting, sound and images throughout all 25 zones of the exhibition. The system was devised by Malcolm Clarke, Imagination's head of research and development, and Kevin Murphy of Electrosonic Limited, who designed a unique piece of control software for the exhibition. Royal Britain breaks new ground by utilising a computer-controlled compact



## Field of the Cloth of Gold

This 'zone' in Royal Britain represents Cardinal Wolsey's room at Hampton Court and comprises linen-fold panels around four walls above which are six screens. An animated version of the famous painting is front-projected on to these screens to produce a 360° diorama in synch with a soundtrack that comprises voice-over, sound effects (of jousting and merrymaking) and music specially composed and played on contemporary Renaissance instruments.

The a/v was devised by creative producer Alan Dobbie and a/v designer Giles Sadler as a piece of animation. All artwork was painted by Glyn Wiles, an artist from Bristol. All the 'moving' details such as flags, people, clouds, ships etc. are on separate cells and projected in sequence on to the static backgrounds.

In common with the entire exhibition, this zone is under computer control. The computer instructs compact disc players to run each track in the right order, and the CDs, which have built-in clocks, instruct the projectors to move through the animated cells in the correct sequence.

disc system for sound replay. The same computer also controls the lighting, audio-visual and special effects.

Six main computers are used to control the major 'shows' withing the exhibition. In addition, 13 small lighting computers are used (Electrosonic ES 7832) and 14 small system computers (Electrosonic 5003/II) control video and sound in zones that do not have an a/v show. Four videodisc players (Sony 1500), each play a specific track from one videodisc.

Over 800 light fittings (supplied by GFC Lighting), have been specially modified to Imagination's specification for a more 'theatrical' use, and 156 computer controlled dimmers are used to create changing lighting scenes. Motorised effects are also used to animate various scenes.

Audio-visual projection is by 84 Kodak carousel projectors (for back-projection), with automatic lamp changes built-in. 5,000 individual slides are used and special optical mirrors (developed specifically for Royal Britain by Malcolm Clarke), are computer-controlled to produce distorted images on cue.

Sound-wise, 60 different audio tracks are included (voice-overs, sound effects, music) on 2 compact discs, and 24 compact disc players (Revox B226) are controlled by IBM-compatible personal computers. Each play only one track. There are 60 Rogers loudspeakers, each with 29 Quad power amplifiers, and each audio channel has a graphic equaliser.

Much time and effort have been invested to ensure that each of the 25 zones of the exhibition has a contemporary feel. An extraordinary range of creative talent has been used to produce an extraordinary range of

music - from pre hurdy-gurdy right up to the present day. Where appropriate, authentic instruments have been used such as violes, sackbuts, rackets, shawns, crumhorns and so on.

Apart from the string sections, which involve a full symphonic line-up, and location work in Worcester Cathedral and in Sheffield for a youth brass band, Imagination has recorded everything in-house.

All voice-overs and sound effects were also recorded at Imagination's studios, and much care went into the casting of appropriate 'characters', with over 200 actors auditioned for parts ranging from Boadicea to Elizabeth I. Historical accuracy is of key importance, down to writing original plain chants and prayers in Latin, using the expertise of a voice coach and a dialect instructor who specialises in 13th century Latin.

All sound-effects were recorded to create a 'live' sound just as a film soundtrack would be made. For instance, all battle sounds were recorded on location during a re-creation of the battle of Agincourt by an amateur production company, and the Welsh Guards were recorded marching to re-create Roman soliders' footsteps.

The work took a total of four months solid work, was recorded in Dolby Spectral, and Royal Britain will be one of the first permanent exhibitions to run on a computer-controlled compact disc system for sound replay.

#### For Imagination

Alan Dobbie - senior producer  
 Peter Higgins - designer  
 Malcolm Clarke - head of research and development  
 Tim Gordon - writer  
 Julian Scott - sound producer/engineer  
 Hugh Vanstone - lighting designer

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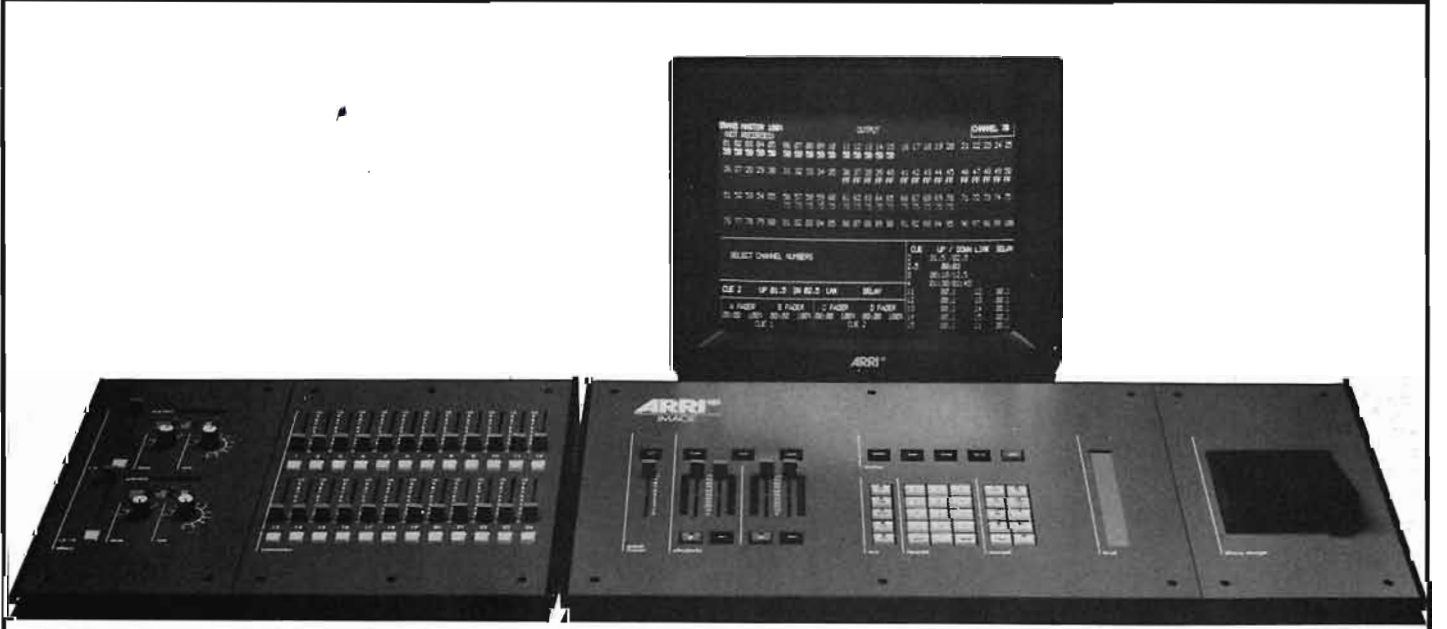
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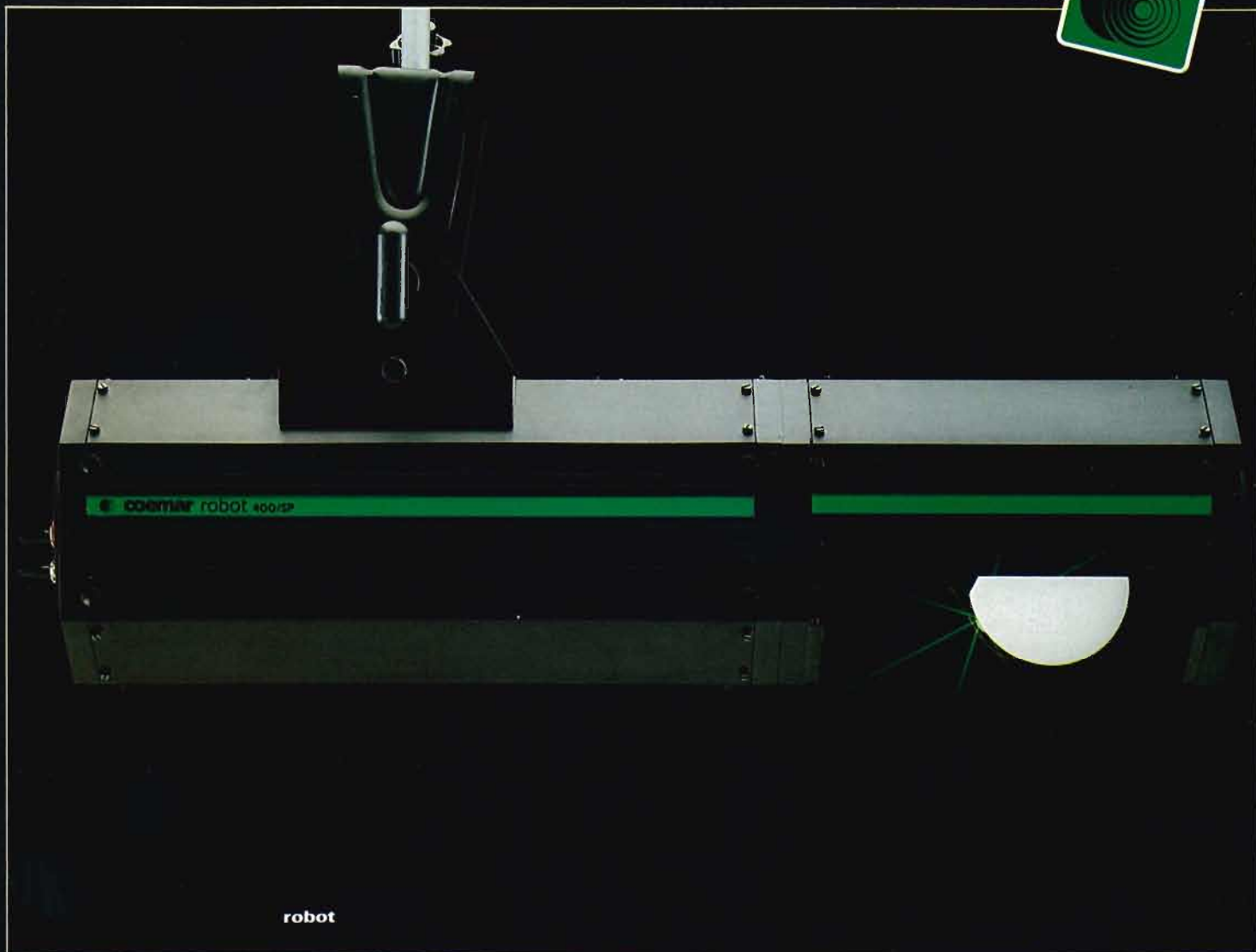
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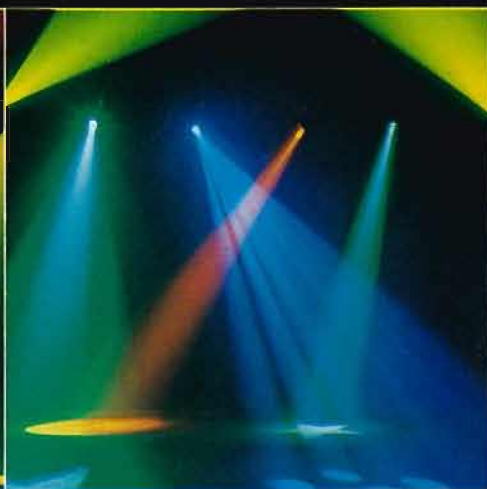
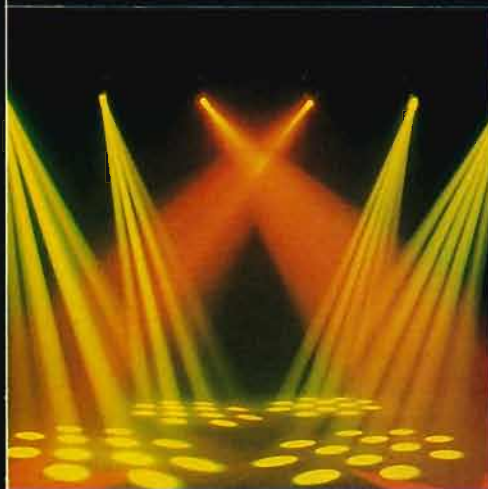


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# Live Sound Show

Tim Chapman reports on Pro Sound News' 'Live Sound Show'

The 'Live Sound Show' took place at the Heathrow Penta Hotel between the 5th and 7th of August. Organised by Pro Sound News Europe, the show claimed to be the first event dedicated to the 'live sound market' and was certainly unique in the trade show calendar in providing a separate series of lectures and seminars. Although the trade show itself suffered a rather disappointingly low level of attendance - not helped by the timing or the sudden arrival of summer - the seminars proved popular, with delegates from more than 10 countries registering for the two day event.

The series operated under eight section headings - from Sound Analysis to Loudspeaker Design - each devoted to a particular aspect of the live sound environment. It aimed to provide both public and trade with the opportunity to track developments and directly question many leading designers and manufacturers. The subject matter was selected not just to encourage discussion and debate but primarily to be accessible and of benefit to all people involved in an industry whose work has a direct effect on the quality of sound to which everyone is subjected.

Chairman Dave Ward (managing director, Gateway School of Music Technology) opened by focusing on two key issues: the major innovations and developments in sound reinforcement technology, and a topic that was to become the recurring theme of most debates - the ever-increasing importance of training and standards.

The first section - Sound Analysis and Signal Processing - set the tone with three very interesting talks on diverse topics. Peter Mapp spoke on computerised acoustic analysis with special reference to the Techron TEF system. Jim Cousins then described the useful features of the unique Scanalyser hand-held acoustic analyser and Kim Risoej followed with a demonstration of the very interesting TC Electronics 1128 combined spectrum analyser and electronic graphic equaliser. A panel, comprising representatives from many major manufacturers, then discussed points raised during the previous talks and widened the debate to cover the subjective nature of hearing and creative vs corrective use of signal processing.

Sound Engineering was next up and included talks from: Steve Dove of Clair Brothers, arguably the worlds' largest sound rental company, who described why huge concrete stadiums now present less difficulties for the engineer; Terry Nelson looking at the small-scale touring world and Cameron Crosby informed us of the very special requirements of sound reinforcement used to augment classical concerts. Mike Novak of Electromusic and Mark Burgin of Shuttle-sound, under the heading of The Installation Market, described their particular approaches to the problems faced in sound system design. One major difficulty, pointed out very forcibly by Mark Burgin, was that although by 1992 the European market for professional audio will be worth approximately 1.6 billion pounds, those involved in this market are not yet even considered to

be part of a fully-fledged industry by those who want the products!

The day's events ended with a very lively panel discussion on Mixing Console Design for Live Sound. Among the panellists were: Graham Blyth (Soundcraft), Simon Phillips (Soundtraks), Tony Cockell (Formula Sound) and David Dearden (DDA).

Saturday's seminars started with an interesting and, at times, amusing talk given by Kevin Swain and associates, under the heading of The Rentals Market, but specifically talking about the needs of modern conferencing. Steve Dove and Terry Nelson were reprised to speak in more detail on the literal ups and downs of the touring industry.

"By 1991 the professional audio industry, just like every other industry in this country, will need to adhere to a set of agreed vocational standards stated Ken Walker (S.C.I.F) who chaired a debate on this topic and the more general subject of education for the industry. Ken pointed out that it was up to the manufacturers and others working in the industry to decide on standards before the authorities set them without consultation - a point that was not lost on those present. It was certainly good to see representatives from the A.P.R.S., A.E.S. and other august, and sometimes far too insular, associations discussing a common problem.

Amplification closed the Saturday morning session with a lively panel discussion following on from Ben Duncan and Jerry Meads' excellent - and largely demystifying - overview of the different types of power amplifier and how best to use them to achieve sonically good results. The panel included: Mike Harrison (HIT), Chas Brooke (BSS), Steve Hale (C-Audio) and representation from Crown, Hill, JBL, BCW and Crest. Argument, needless to say, tended to centre around Mos-Fet vs bi-polar designs, but the debate managed to cover much other useful and in-

formative ground.

The entire afternoon session was devoted to Loudspeaker and Enclosure Design. Four separate lectures were given, the first by Tony Andrews and John Newsham of Turbo-sound. They presented an excellent talk on the development of their point-source cluster concept. Gary Margolis of JBL followed with a talk on the history of the compression driver and why it represented a "necessary evil". Dave Martin (Martin Audio) presented his new F2 loudspeaker enclosure design in a very light hearted manner. The audience delighted to Dave illustrating his talk by: dismantling and enclosure, stacking JBL components on Gary Margolis' knee and taking a quick break for a cigarette, as well as presenting an informative talk. John Dodson and Peter Child unfortunately suffered from the backwash of the previous talk and found it quite difficult to keep delegates attention on their presentation of the new Bose Acoustimass active loudspeaker system. The program was rounded off with an, at times, voluble panel debate on the relative merits of the various assembled designers' concepts.

All in all it was a very rewarding two days and a concept which I hope will be possible to repeat in the future.

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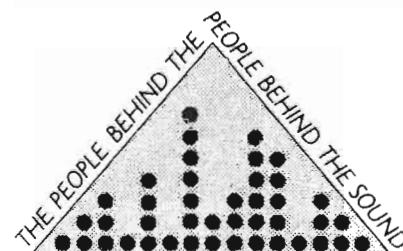
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# Cornwall's Twilight Zone

**L+SI visits Redruth's Penventon Hotel's new Twilight Zone discotheque.**

The Penventon Hotel at Redruth in Cornwall has some of the most tastefully decorated public rooms the writer has seen for some time - and it's all the work of owner David Pascoe, who also had more than a hand in the creation of the Twilight Zone discotheque next door, a highly professional and luxury addition to the hotel's top level facilities.

Together with his son Mark, and ably supported by local interior designers - aptly named Fresh Look Interiors - David Pascoe has produced something very special for Cornwall. And light and sound designers Avitec have delivered all the necessary elements to make sure the discotheque has everything just right for a great night out.

Our interest obviously lies with the discotheque, and the venue echoes the theme of twilight, with shades of purple and blues mingling with sparkling chrome steelwork and moody bars flanked by blue glassed reflective soffits.

On the VIP opening night on August 20th Avitec's Paul Dodd woke Cornwall up with a spectacular and breathtaking display to the thunder of the Cerwin-Vega sound system. It drew a completely spontaneous round of applause which almost drowned the sound system itself.

The lighting design was finalised before the building rose from the ground, and this forward planning enabled a perfect harmony between the lighting and the interior. A balcony surrounds most of the three-

dimensional TriLite moving rig, giving a superb view from the upstairs area. However, for quick escapes to the downstairs bar a 'fireman's pole' is provided in addition to the custom-made stone spiral staircase!

Locally based PSD Electronics carried out the complex installation of lighting and sound, and from Avitec's design have created an effective cocktail of lighting variety surrounding the chrome Krypton centre piece. Gamma Sunflowers are mounted either side of the stage (live acts are to be a frequent feature of the venue's programme) and wall-mounted ten-way Nisel light bars give further extension to the light show.

The dance floor perimeter is shaped in strips with alternate bands of light and dark

stained wood, and this surrounds a central eight metre square illuminated dance floor from Infinity International of Leeds, which doubles as a reflector to the hovering lighting rig above.

Perhaps the most startling surprise was the glorious laser - from Laser Creations. This is a tandem Krypton Argon unit, with multi-coloured laser beams of blue, argon, red, white, yellow, magenta and cyan fanning through the rig and over the floor in beautiful patterns.

A masterpiece was the creation of the club's complicated logo on the electrically dropped gauze screen. It was produced by Laser Creation's Carl Perkins, and was a grand finale to a night out in Cornwall to remember . . .

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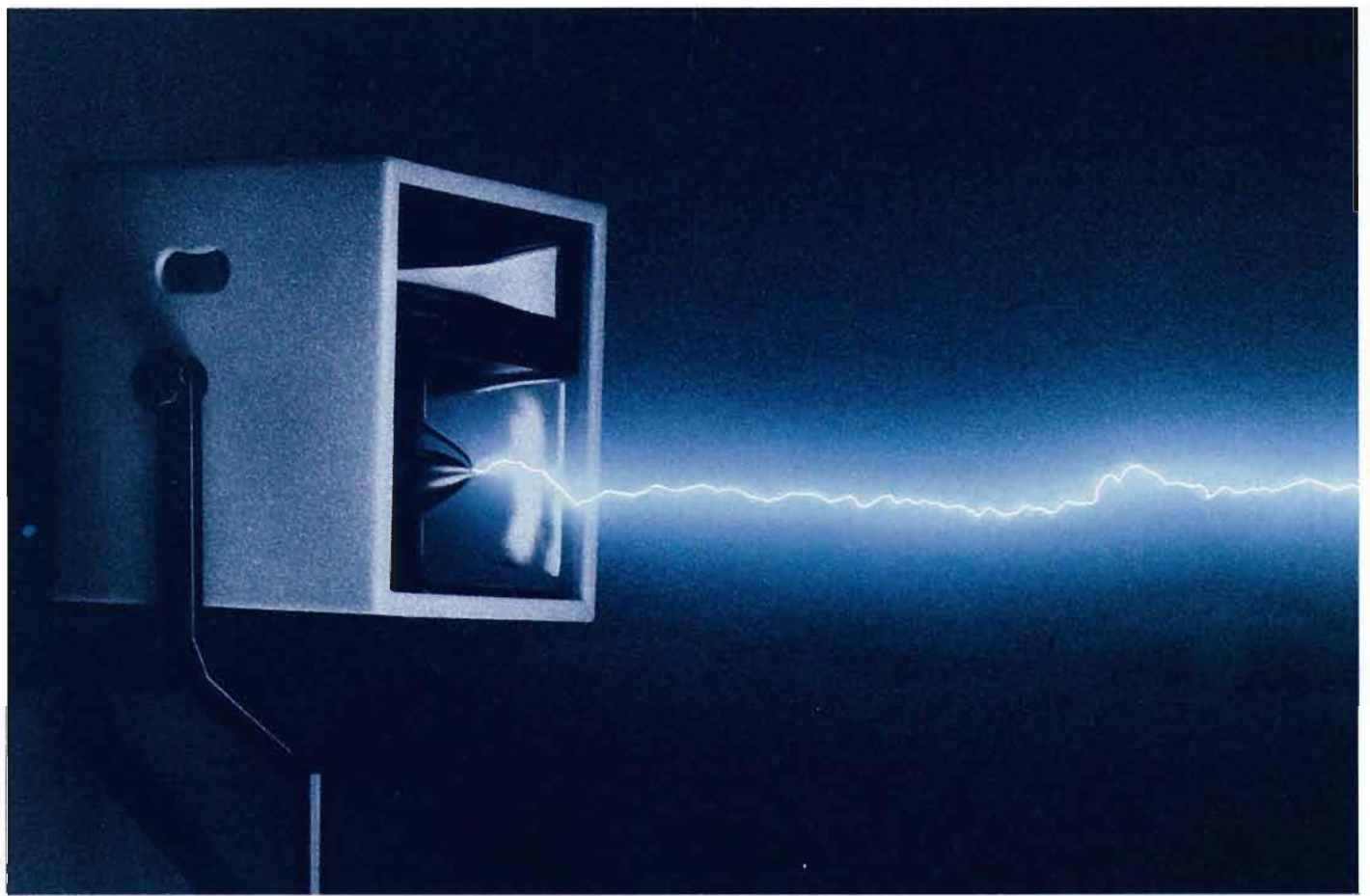
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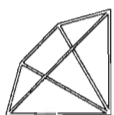
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# Touring the Galaxy

**Richard Harris talks to Mike Odam of Limelight Designs about the touring lighting rig for 'Song and Dance'**

A touring rig can mean many things. It can be a couple of 23s, four 123s and a Junior 8 assisting an amateur group to look reasonably professional while doing a three-hander in a village hall. At the other extreme I remember seeing a pop group - so famous I have completely forgotten their name - arriving at Manchester's Ringway airport.

They and all their flight cases had been disgorged from a 747 early that morning after a flight from Miami. A dozen pantechnicons then trundled to the Free Trade Hall. They did one 'concert' and were off the next day for Tokyo.

Closer to the latter than the former is the current tour, now in its U.K. phase and the subject of this piece.

Andrew Lloyd Webber's 'Song and Dance' was always planned as a touring show. When Luff Lighting and Sound, Strand's south London dealers and now one of the country's leading rental houses, won the contract to supply the whole rig, including a Galaxy, they handed over the whole of the equipment to Limelight Designs who have the responsibility for running the show lighting as well as ensuring that the rig arrives at each venue and is erected, checked and focused on time.

And what a tour it has been and continues to be. Arranged to suit the availability of theatres rather than the convenience of travel, Plymouth led straight to Bristol but then came Amsterdam followed awkwardly by Leeds. And at this point the ferry strikes did cause the odd moment of anxiety.

Consider last Christmas. Mike Odam and his team did two shows in Frankfurt on Christmas day, 'getting out' on Christmas night to open in Hamburg two days later.

The show's lighting design, by John B. Read, involves a box truss over the stage which at its maximum is 48 feet by 26 feet and is flown 9 metres above stage level, with ladder frames at the sides hooking on to the trusses. There are wheeled side booms, moved away while the 'Song' scenery is deployed and then used during 'Dance'. A backlighting bar is rigged on a house bar and bars 1 and 1a are rigged just inside the pros. In Germany a special FOH truss went on tour, but in the UK, host theatres' own FOH



The glamour you see: Wayne Sleep and company in 'Song and Dance'.



Marti Webb in 'Song and Dance'.



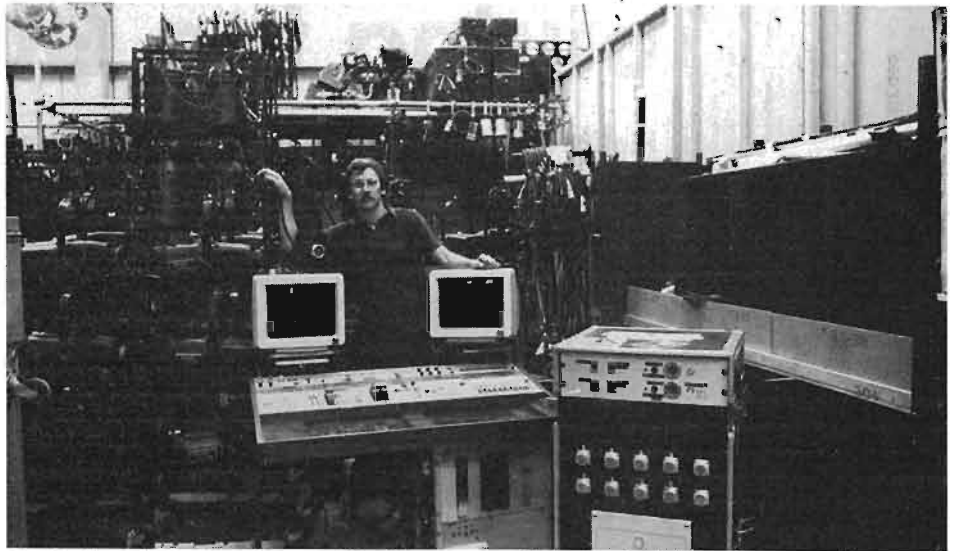
lighting has been used.

The rig goes into a 40 foot trailer and takes up about a quarter of another trailer. The touring electricians team consists of Mike Odam himself, the board operator and two production electricians. Once the show is running a member of the team goes ahead to the next date to prepare the ground and this arrangement ensures that at least one of the Limelight crew is fresh, however tough the get-out has been.

Mike recalled one get out which happened contemporaneously with a rock and roll get in, and the scene dock was so high above the ground level that a hoist was involved. Just consider that next time you think naughty thoughts as a couple of your new Cantatas have to be carried up the garden path!

The whole 'Song and Dance' lighting rig can be set up and flashed out in eight hours. The carpenters lay the false stage floor, then focusing goes on from about 8am to, say, 3pm while the dancers warm up. Then there is a final check and the team return relaxed, confident and ready for the evening show -except on the odd occasion when 'focusing' finished at 7.29 for a 7.30 curtain!

All the rig is either flight cased or 'meat racked'. The Galaxy for example was very cleverly adapted by Luffs. The crate, which has its own flight case goes under the desk to one end and a folding leg supports the other end. A flat flight case contains the desk; separate small cases holding the VDU's in warm rubbery embrace for travel. Notable among the all-Strand lantern rig are the Lekos. These truly are now the world's 'professional' touring lantern. "Lekos - I love them", says Mike. Attentive readers may remember that 200 Lekos contribute to



The Hardware behind the glamour: Mike Adam poses with the touring lighting rig temporarily at rest in Limelight Designs' Surrey depot. The complete rig, including a touring Galaxy, is on hire from Luff Light & Sound and the lighting rig is all Strand. Note the Lekos on their 'meat rack'.

Andrew Bridge's superb lighting for 'Phantom Of The Opera'.

I asked Mike if he would do another tour taking all his own lighting with him again. "Yes because we are totally self contained. When you have only got two days to set up that really counts. I tell the theatres we are going to that we shall need 400 Amps and 3 phases - and that's all we shall need!"

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- 2 500W Beam Lights
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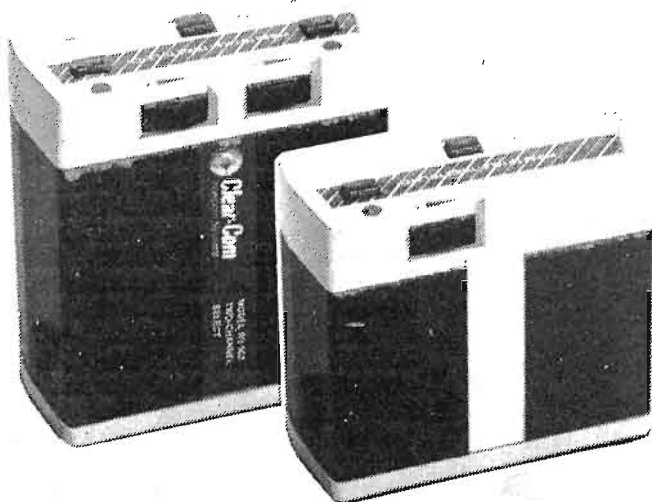
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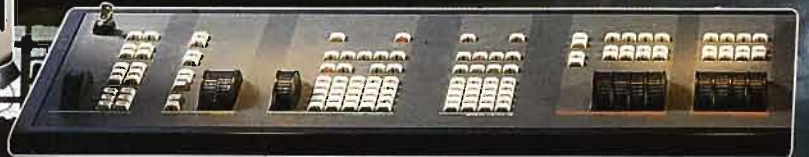


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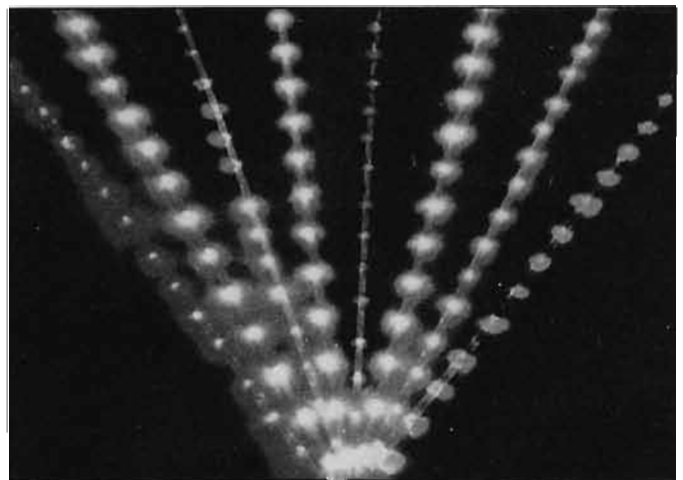
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# Paul Devine with Iron Maiden

Lighting designer Paul Devine was last featured in L+SI in our March 1987 issue when Catriona Forcer talked to him about his work with Frankie Goes To Hollywood. Since then he has toured with Gary Moore, in both Europe and Japan, operating both Vari-Lites and Par rigs, and has also spent several weeks at Thames TV. He followed that with a tour with M.S.G. in the United States and Japan before commencing work on the Iron Maiden Tour, now monster rocking its way across Europe.

"I started working on the lighting design for the Iron Maiden project in April, although Ronan Willson was already involved with designing the structure and having meetings with the band," Paul Devine told L+SI.

"In April the band were in Germany rehearsing for the tour and I had to fly out twice for meetings. They gave me pretty much a free hand on the design, and I spent April running between my office, Meterolites, Vari-Lites and DHA. Special gobos of Iron Maiden's 'Eddie' character were made by DHA for the VL2's, and the idea was to have three slightly images of Eddie to try to make it appear that he is moving around on the back drop. In the event, everything came together quite painlessly.

"The tour started rehearsals on May 6th at Sydney in Nova Scotia in Canada - a place as far away from civilisation as you can get! Once in rehearsals I went on to night shift with Warren Flynn, the Vari-Lite operator, armed with just our consoles and a tape of the band and a quantity of Lemsips and paper tissues.

"Warren and I get on well as we both hate Vari-Lites constantly moving. The band came in on the fifth day and we did a couple of run-throughs. We were then off on tour across Canada for the rest of May, followed by the US from June 1st to August 10th. As we went along the show improved tremendously."

A full week was allowed for setting up at Castle Donnington for Iron Maiden's 'Monsters of Rock' headlining appearance. Paul Devine takes up the story again: "Once I had programmed the basics it was time to start working with all the toys I had requested such as Mole 8 lights with colour changers. Eight were for cyc lighting, and the idea behind this was to get plenty of punch with eight colours and white. We also put four each side of the stage, so as not to clutter the backstage area. We then used three x 8-lights with colour changers for the three thrusts with perspex tops at the front of the stage. Twenty Cantatas were all on the drums, and I'd picked narrow beam ellipsoidals just to introduce a different beam into the show and to pick up certain toms and cymbals.

"I then added 10 colourchangers so that I could colour the kit all the same if I so wished, and on top of the ellipsoidals I had about 80k of drum wash - so I was not short of power.

"One thing about the show which I think was quite unique was the use of three colourchangers in each spotlight, and this worked out really well. With two colours and white in each, the colour changes are really

fast.

"At the console the last 30 channels of the QM is linked in parallel with a Rolacue 30 way and the Gel Jets are in these channels. The reason for this was because at the beginning of the tour I had someone operating the spotlight colour changes on the Rolacue and I slowly introduced the spot cues into the memory on the QM500. Now all the spot changes are done from the QM and the Rolacue is basically a back-up.

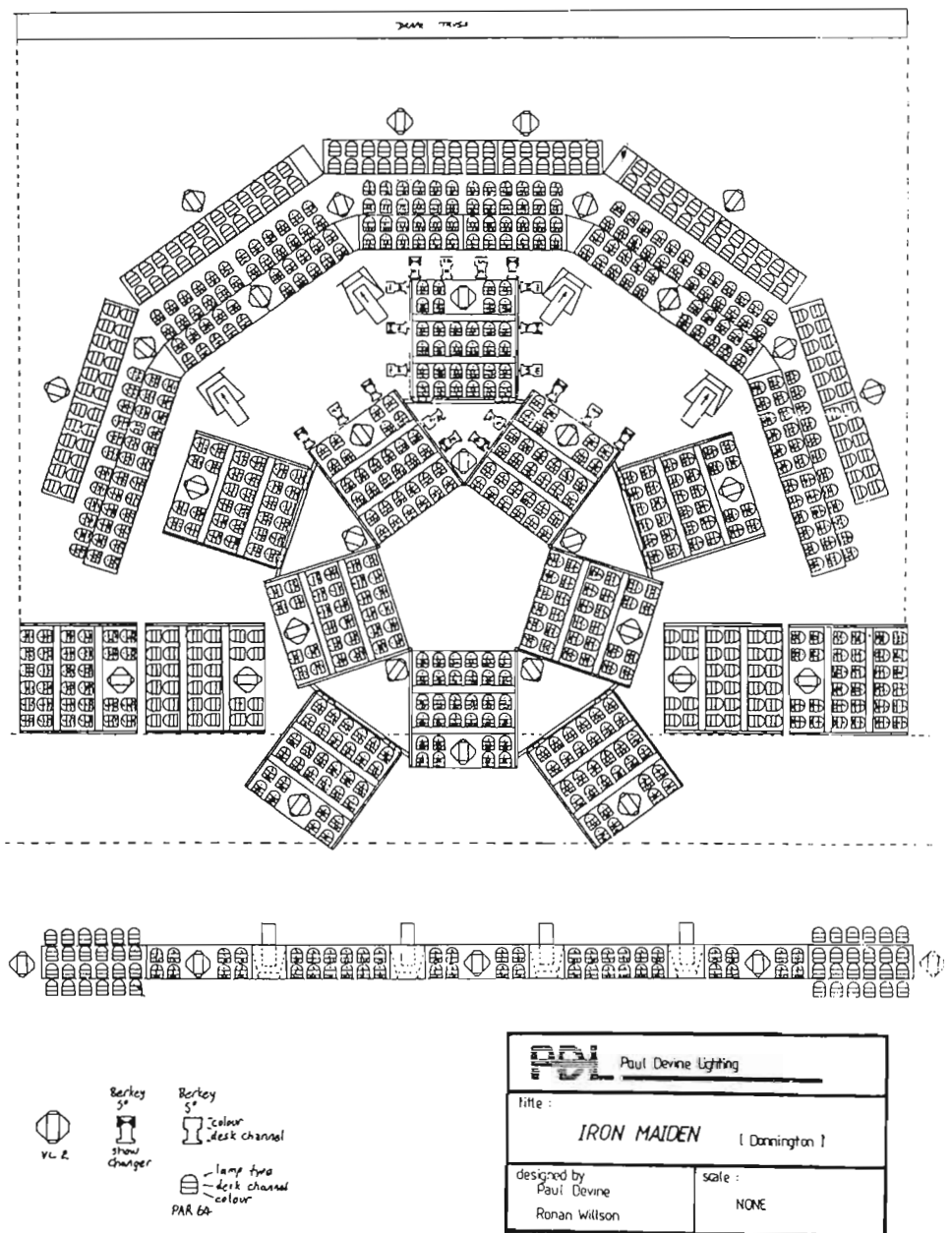
"The Gel Jets have worked well because all you have to rely on the operators to do is blackout and come in again, and of course to follow. They are particularly good when you come to something like a small drum run in the same cue as your drum lights, when you can change the spot colour for just a few beats before backing out again.

"The Q-Patch is very handy because during

the show I could change patches utilising the 10 modules of 110v single pars, being able to assign them in many different ways.

"Of course, the biggest toys of the tour - and I don't get to play with them - are the Vari-Lite VL2's, which are run by Warren Flynn. We have worked well together, and try hard to integrate the Vari-Lites with the Pars. They are used to light the cyc, the stage set, and to pick up band members on specific spike marks. They are also used to light the drums, and we use most of their gobos at some point during the show, creating some great visual effects.

"Warren also only moves them when it goes with what is happening at the time, and to achieve the maximum impact for that particular piece of music. There is definitely no movement just for the sake of moving them!"



Lighting plan for Iron Maiden at Castle Donnington.



**Iron Maiden at Castle Donnington - design by Paul Devine and Ronan Willson.**

Following Castle Donnington, Iron Maiden move over to Europe, with Monsters of Rock due to appear in over a dozen countries on a trip that lasts through to October 6th.

From there it's to "who knows where", but the caravan continues on well into December, when no doubt Paul Devine will be back home for a well-earned rest . . .

**Iron Maiden at Donnington**

2 x linked Avolites QM500 90 way consoles, 1 x Avolites Rolacue 30 way, 1 x Avolites 180 channel Q-Patch, 6 x Avolites 72-way racks (10 modules at 110v), 36 Gel Jet units, 20 Cantatas, 10 scroll changers for Cantatas, 8 Orbiter spotlights on truss and 4 Xenon Super Troupers all with 3 Gel Jets in each, 11 Mole 8-lights with scroll colourchangers, 896 Par 64's, 80 Vari-Lite VL2's, 1 Artisan control console, 4 x Rosco smoke machines controlled from console, various Thomas trussing.

Design: Paul Devine and Ronan Willson

Lighting companies: Meteorlites Productions and Vari-Lite.

Stage set: Brilliant Construction.

Console operators: Paul Devine, Warren Flynn.

Lighting crew chief: Mike Humenuik.

Lighting crew: Kevin Cassidy, Phil Alge, Jim 'Dangerous' Greenwalt, Ian Twell,

Bob Niering, Nigel 'Skippy' Monk.

Stage set crew: Keith Livermore, Chris Lang, Mark Berryman.



**Castle Donnington 1988 - the full panoply.**



**Paul Devine with Vari-Lite operator Warren Flynn in background.**



**Monsters of Rock in full cry.**

# ON TOUR

Keith Dale

## John Rinaldi The BET Experience Bristol Exhibition Centre

BET, or British Electrical Traction, is one of the U.K.'s major service industries with subsidiaries operating in cleaning, plant hire, publishing and other miscellaneous services. Recently, for the benefit of their shareholders and staff, they staged an exhibition of the company's activities in Bristol's Exhibition Centre.

The exhibition spread over four halls with visitors entering through hall number one. This was constructed to represent an airport lounge, a major part of BET's activities. Here visitors were offered a drink and given a ticket before travelling on to 'The Experience'.

The Experience consisted of a winding corridor off of which was sited a number of bays. Each bay was fitted with an A/V module outlining different BET activities.

After travelling through The Experience in hall 2, visitors entered hall 3 where each of BET's companies displayed their products and services in a general exhibition format. From there visitors entered hall 4 for lunch followed by a presentation and cabaret.

The show designer was John Furneaux of Furneaux-Stuart, production was taken care of by Upstream Event Ltd, and staging and A.V. was provided by Staging Post. Set construction was by Newton Display Group.

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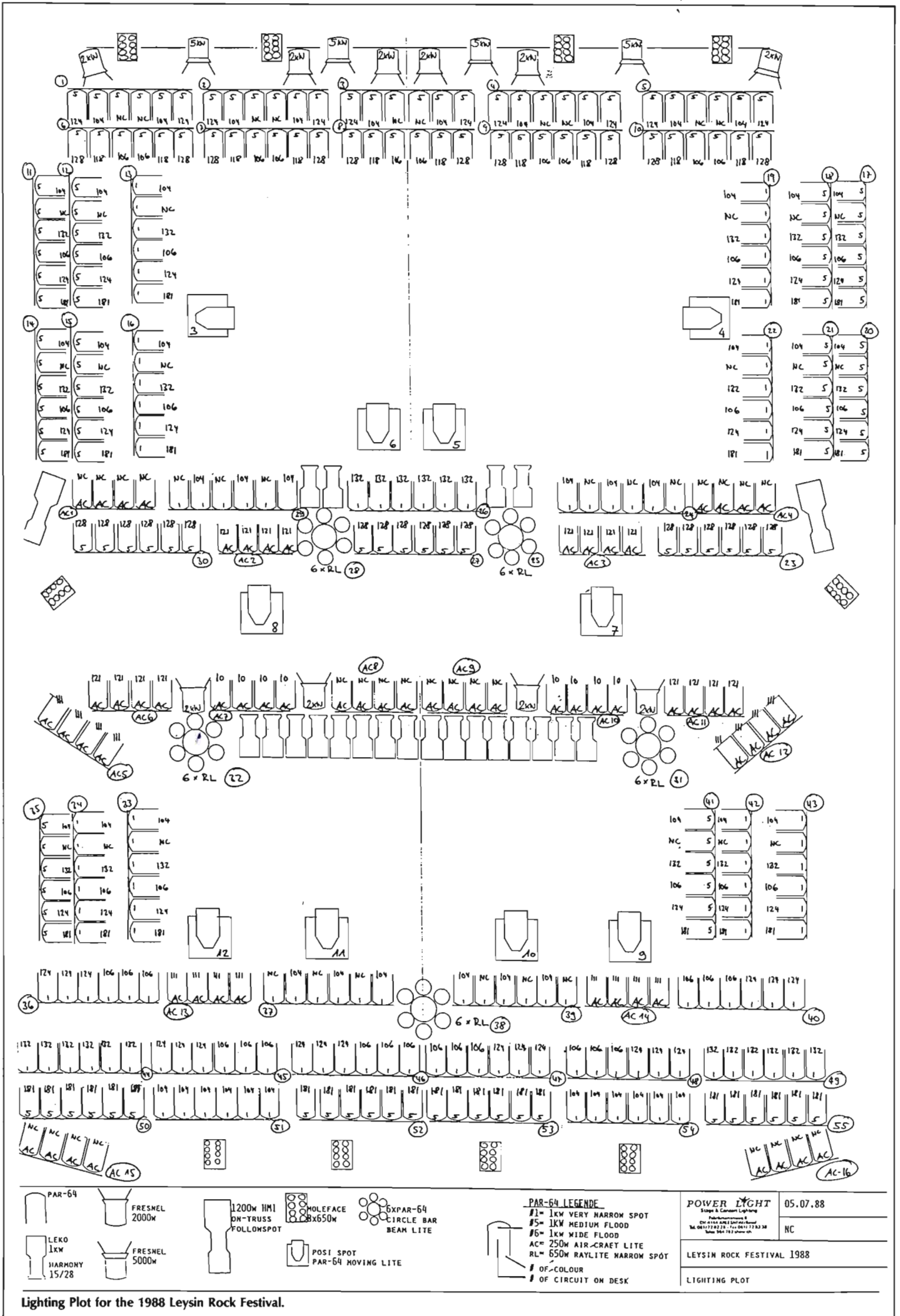
## Midnight Design Militant Rally Alexandra Palace

For this auspicious event Midnight designed and supplied their 'Black Box' message writing unit. This 192 channel unit was developed by Midnight's Mike Townsend and 'Custard' and is used to 'write' messages on whatever it is 'hooked up' to. For the Militant Rally it was connected to two 32 bars, each containing 6 Raylights via 2 x 60 way Avolite racks, 2 x 72 way Avolite racks and 1 x 40 way EntRack. The bars were situated in a wall behind stage and were used to flash up E signs during the money raising campaign and display the totals.

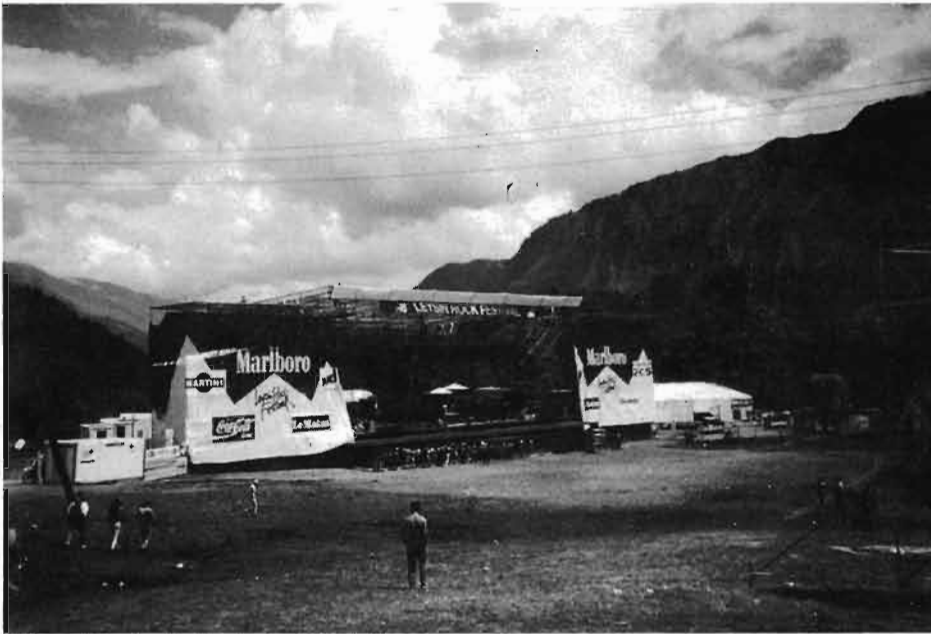
After the Militant Rally the black box and wall of Raylights was left on stage for the duration of the Capital Music Festival. Throughout this event the 'wall' displayed patterns whilst the various bands were on



The Christians (above) and UB40 (right) in concert at the 1988 Leysin Rock Festival, high up in the Alps (see Power Light story page 55).



Lighting Plot for the 1988 Leysin Rock Festival.



Alpine setting for the Leysin Rock Festival.

stage and announced the many PAs.

Stage Lighting for the Militant Rally and Capital Music Festival was supplied by Big City Lights, and Mantascope provided the GE video projectors either side of stage. Production manager for the Militant Rally was Midnight's Dave Bryant. I heard someone provided a live telephone link to Trotsky's grandson in Mexico (are they serious?).

Midnight Design can configure the 'black box' to control most types of dimming and lighting equipment. It can be hired along with many other interesting effects and control equipment by telephoning Mike Townsend or Custard on 01-603 9831.

## Power Light Handels Leysin Festival

Power Light Handels, the Swiss-based lighting company, is owned by Nicholas de Courten and 'Felix'. The company has two divisions, Power Light Handels, the wholesaler that looks after the exclusive interests of Thomas, Phoebus, Rosco, Verlinde, Genie Industries, Zero 88 and Celco in Switzerland, and Power Light Production, the lighting hire company.

Power Light Production work closely with Audio Rent, the Swiss sound company, shar-

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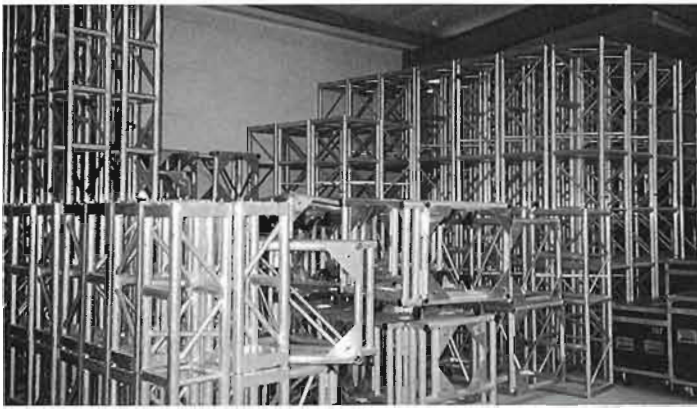
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Above and right: the Power Light stores in Basle, Switzerland.

people throughout the world.

Amongst the various trade shows Power Light are car launches for Mercedes, Toyota, Subaru, Austin Rover, BMW and Mitsubishi and shows for some of the top names in fashion. On the touring front Power Light have toured with Nazareth, Nana Mouskari, Udo Jugens and Krokus. At the same time as the festival Power Light were also working on a TV production in a large stadium, equivalent to Wembley Arena, as well as working on a show with Bryan Adams in Locarno.

The majority of the international bands brought their own lighting designers, but those that didn't were lit by Power Light's own staff. One advantage for Power Light, being Swiss, is that they are able to speak French, German and English, and this helps considerably when dealing with a multi-lingual festival such as Leysin.

The Leysin Festival is situated high up in the Alps. As such it offers a spectacular location

for a festival but is subject to quick changes in the weather! Whilst it can be fine in the early evening this is no guarantee that heavy rain and winds might prevail later on. This was the second such festival, but the first for Power Light, and the line up of both national and international bands included Monkey's Touch, Manu Dibango, Youssou N'Dour, Invite Surprise, Los Lobos, Elli Medeiros, H.F. Thieffaine, Serge Gainsbourg, Zucchero Fornaciari, Gypsy King, Bertignac et les visiteurs, The Christians, Status Quo, UB40 and Inxs.

#### Equipment List for Leysin Festival

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Raylights 650W

48 Par 64 Raylights on 8 circle-bars of 6 lamps for effects

8 series of ACL Par 64 250W 28V (bars of 4)

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10 Thomas 8-lite units 8 x 650W, Par 36

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10 Strand Cadenza 12/22 profiles, 2000W

Celco Series 2, 30 channel control

Celco dimmers 20A per channel

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4 x Strong Xenon Super Trouper 2000W (FOH)

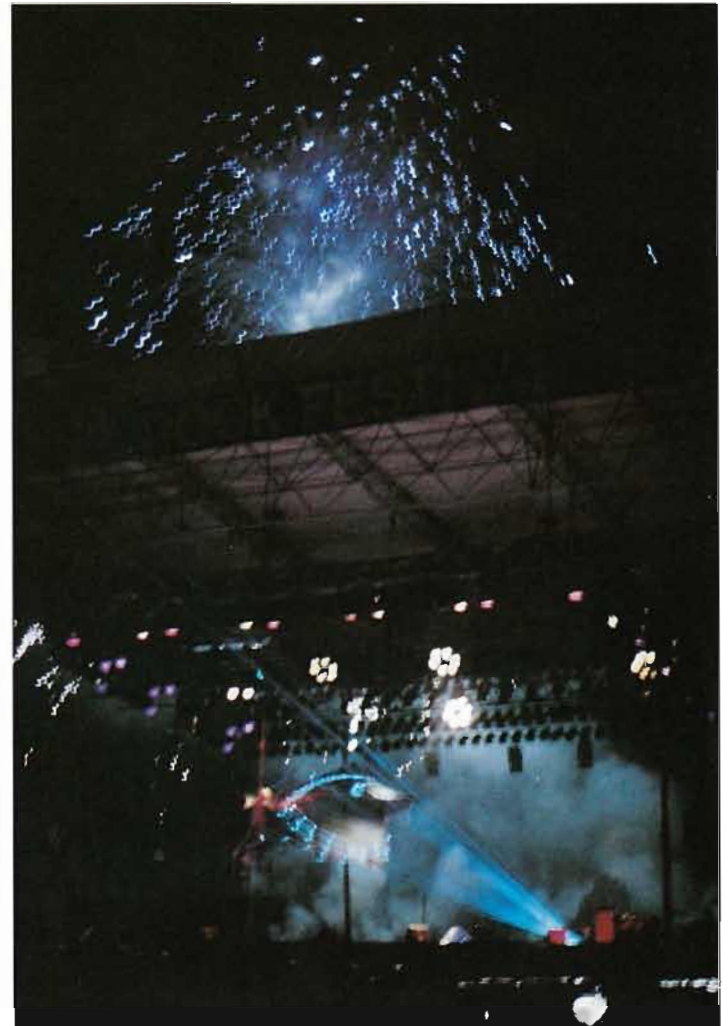
2 Pani HMI 1200W (on truss)

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Los Lobos at Leysin.



Lasers and fireworks were all part of the show at the Festival.



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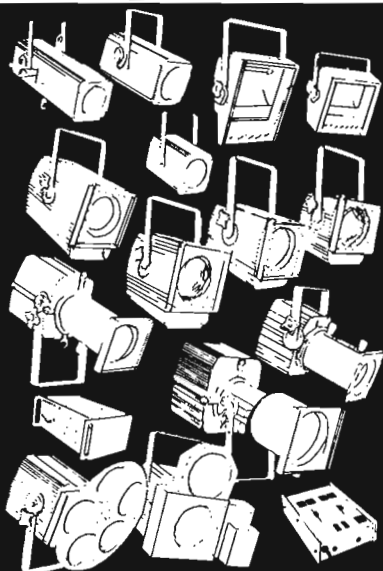
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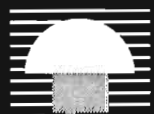
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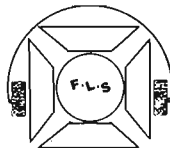
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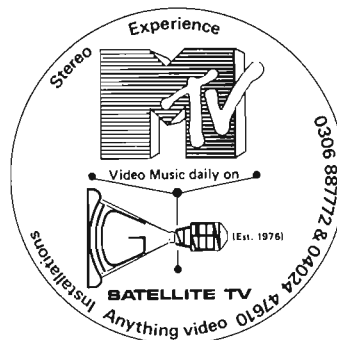
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