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STUDIO SOUND

AND BROADCAST ENGINEERING

A LINK HOUSE MAGAZINE

STUDIO DESIGN

STUDIO SOUND
AND BROADCAST ENGINEERING

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STUDIO SOUND
AND BROADCAST ENGINEERING

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(ABC audited)

Trouble by design

For most months of the year, *Studio Sound* has a featured subject area. Where appropriate we publish a survey of available products within that subject area and most certainly gear several of the features towards that topic. The topics are selected up to 18 months in advance and so they are usually selected 'blind'. Invariably nearer the time we regret that it is not possible to push the topics a few months later so that we could cover a couple of exciting angles that would fit so well under that topic. Perhaps it would always be so given the way that our industry is geared towards perpetually changing technologies.

This issue is no exception. Studio Design is an all encompassing header where the most important innovations look like happening in 1990—or so we are led to believe. It is certainly possible to manipulate audio signals for recording, editing and processing to a far greater degree within the digital domain rather than the analogue. With faster digital processing there are new possibilities and we should not be surprised to see new applications of old ideas within studio design—ideas that were just practical without high speed digital processing. We will see increasing development of mechanical and electronic assistance for the studio designer or indeed the designer of any acoustically important space. These are the areas that we can only touch upon in this issue. Full proof of a design concept takes far longer than a piece of electronic design as the variables are greater and the reasons why it may or may not work involve almost all the possible laws of physics that can be imagined.

A further point is the way that all the disciplines are now merging. Studio design is now inseparable from monitoring which is deeply entwined with working practises which is interconnected to mixing console design which also affects the acoustics. The interior design of the facility often also falls to the acoustic designer as does lighting which also involves understanding of the type of work to be undertaken which means becoming closely involved with the marketing aspirations of the studio. In fact attempting to look at any area of audio related activity in isolation is becoming near impossible.

This does not however mean that we have ignored design. We look at developments with diffusion systems; a new audio measuring tool; the monitoring series continues; and the prefabricated modular approach to studio construction.

Although the studio designer has one of the most high profile jobs within the industry it has to be one of the demanding professions and certainly not one that should be lightly aspired to. The ability to successfully translate the sometimes vague requirements of the owner, the vaguer constrictions of the budget, to meet the intended deadline despite the changes in specification and maybe even location, to create an environment to the satisfaction of a changing mind, to defy the laws of physics as requested, to get paid on time and make a profit—and perhaps to still remain on speaking terms with the client at all is done—this needs more than a mere mortal. If the truth be told, it is this that is perhaps the real story of studio design but it is almost impossible to tell—at least this month.

Cover: Abbey Road Studio 3 designed by Sam Toyoshima/Acoustic Design Group—studio area (upper) and control room at night with AMS UA8000 console. Inset: studio area Tent Records designed by Neil Grant/Harris Grant Associates.

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And of course we're following up last year's Rock Festival with hot established acts, breaking talent and a whole lot more.

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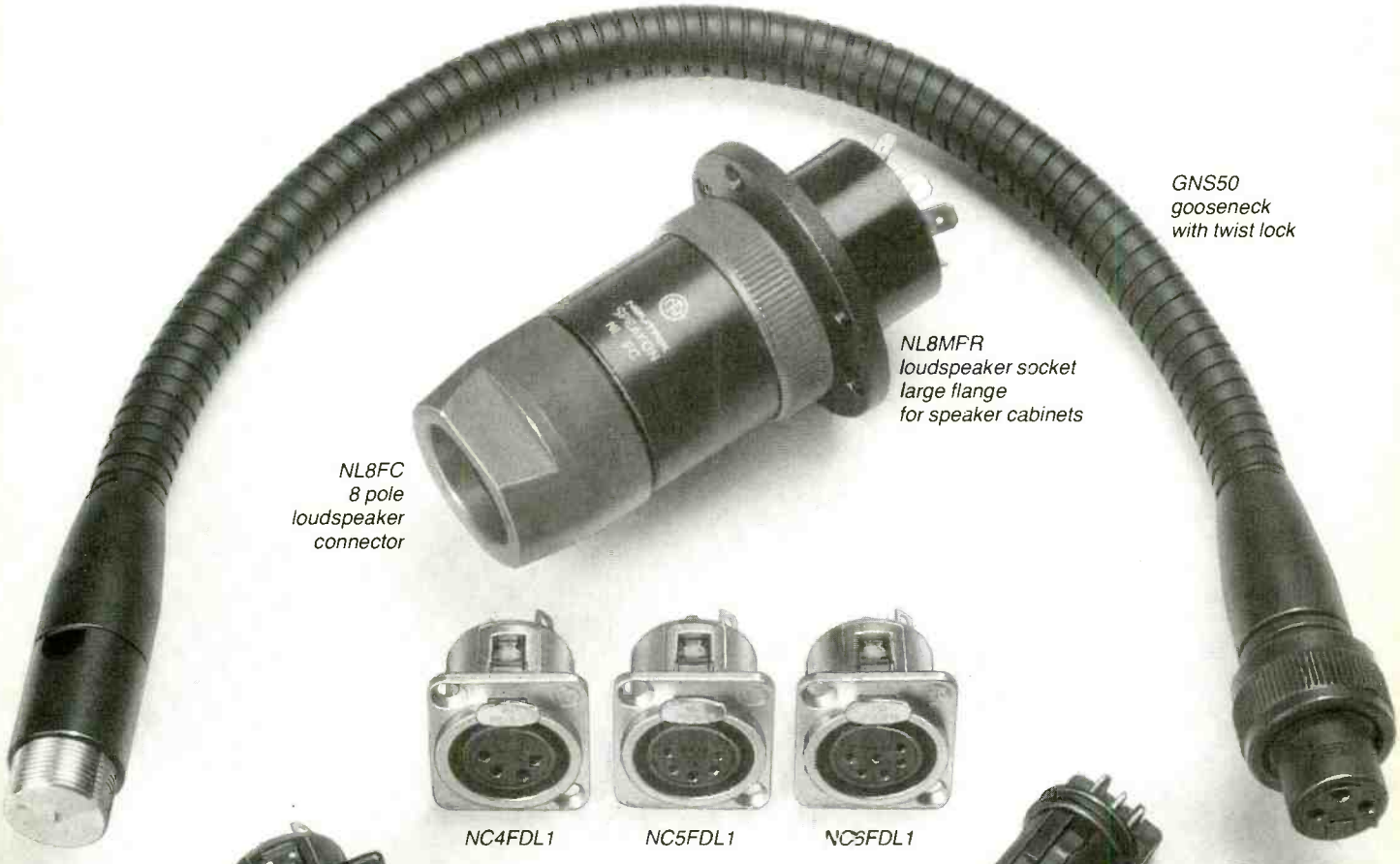

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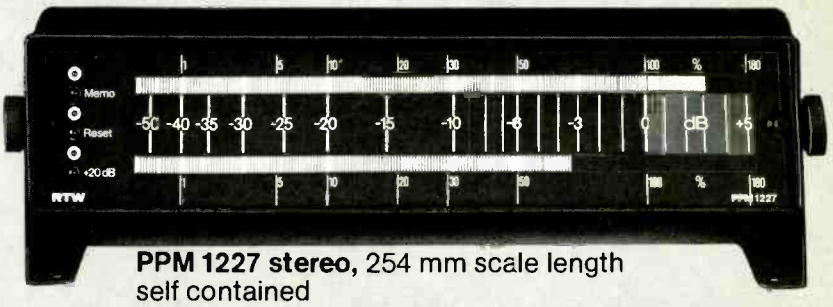
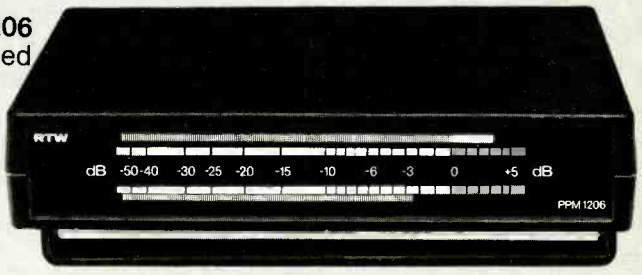
Audio Peakmeter

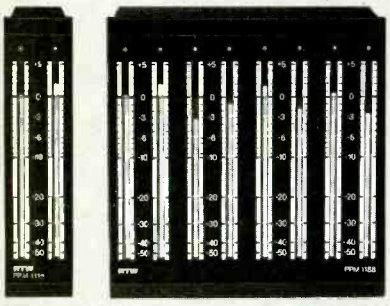


PPM 1227 stereo, 254 mm scale length
self contained

Model 1206
self contained

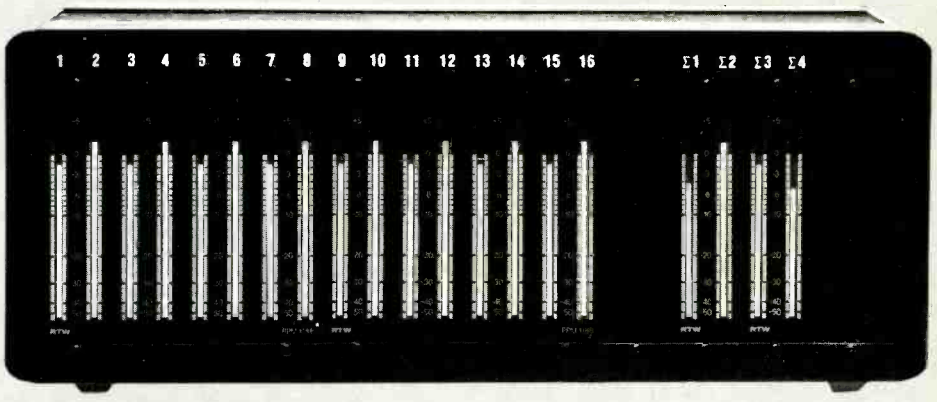


Peak programme meters
for monitoring the peak level
in analog and digital audio



PPM 1118
2-Channel
Module

PPM 1188
8-Channel
Module

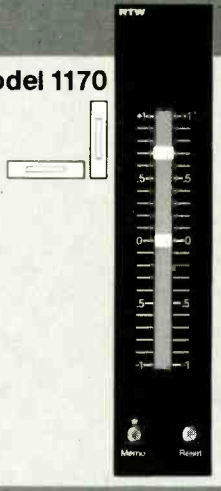


Multi-Channel Unit 16–4 and 24–4

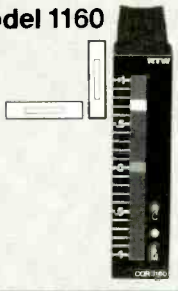
RTW Correlator

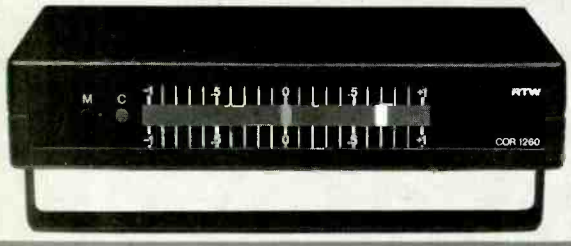
Compatibility meter
displays the phase correlation
of stereo recordings

Correlator Model 1170



Correlator Model 1160





Correlator Model 1260
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MOZART by AMEK is a significant step forward for console technology. No other combination of first-class audio signal paths and integrated computer control exists elsewhere, and in such an irresistible price category.

In the past few years the studio environment has become very complex. Not only more tracks, but the introduction of retriggered synths and the use of large amounts of effects has created a need for a console which far exceeds the capabilities of conventional mid-80's products.

MOZART's SUPERTRUE automation system allows real-time and off-line control not only of faders and mutes but of numerous switches per input module. Auxiliary sends, Eq, Insert and other functions can be switched in and out as the mix proceeds; or complex switching operations can be set up and triggered by SMPTE from the Event Sheet. Some of the other events include a complete MIDI-triggering system and a facility for loading user-definable fades between two timecode points, however long or short. The advanced Mix Editor system includes Merge and Splice functions.

MOZART has 32 output busses and up to 16 auxiliary busses according to the choice of input module. All busses are balanced. The console has 12 stereo effects returns and frames are available for 40, 56 or 80 inputs. Equalization and sonic performance are to the standard set by AMEK.

MOZART presents a range of facilities which are unique. It opens a new range of opportunities for the modern recordist to reach the boundaries of his imagination.

AMEK

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Telephone: 061-834 6747. Telex: 668127. Fax: 061-834 0593.

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THE TECHNICS DAT RECORDER IS HERE.

The Technics portable DAT recorder would have been an admirable choice for the Admiral's Cup.

While the yacht sways and heaves, the last thing a journalist needs is an unwieldy tape machine.

The Technics SV-260 portable DAT recorder's small size is due to a 15mm head drum.

The quality however is heavyweight and on a par with a deck-type DAT recorder mainly due to MASH ADC and XLR balanced Cannon connectors.

Like the U.S. America's Cup team, it goes really fast forward and like them is quick to rewind in the event of an error.

Using the portable recorder is plain sailing in dramatic productions and audio research, where DAT picks up the smallest vibration.

Docked in a studio, the SV-360 DAT deck is equally impressive.

Like the portable, it offers all the flexibility of tape with the sound quality of C.D.

It can be used on its own or as a back up system in a recording studio.

It can also be used alongside our already well-established C.D. players and turntables which have become classics in the studio.

Out of the studio, the DAT deck is equally effective on location.

Where it is often used for outside broadcasts.

Its popularity with the professionals is due to full digital in and out terminals, analogue sampling of 44.1Khz for C.D. mastering and hard wired remote control.

It's 4 DAC 18 bits also delivers higher fidelity.

Something yacht crews could learn a lot about.

Technics

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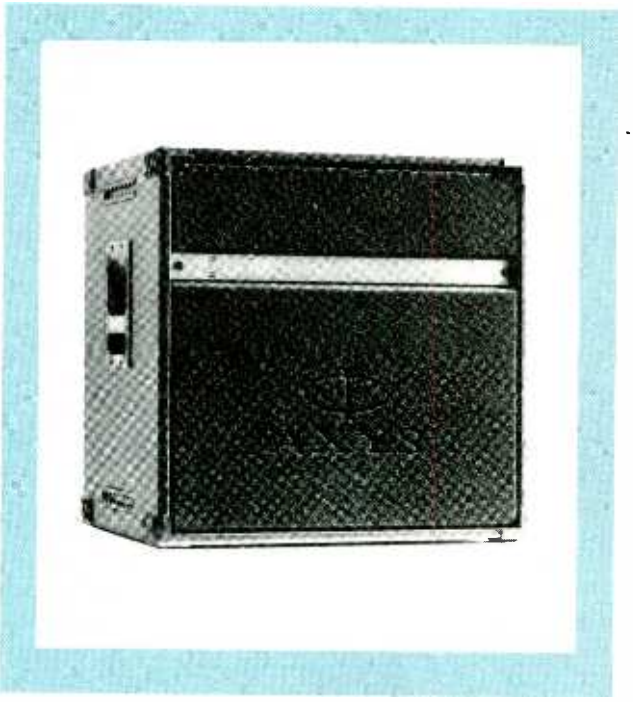

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Studer's hard disk future

Studer International in Switzerland have bought American company Integrated Media Systems (IMS), an acquisition that brings the IMS hard disk recording system *Dyaxis* into the Studer product line.

The IMS Organisation have changed their name to Studer Editech Corporation (SEC) and will be based at Studer America's Nashville, TN, location. SEC plan to continue developing the *Dyaxis* system with close co-operation from Studer in Switzerland, as well as developing new multichannel versions with expanded digital signal processing and a serial control interface, which will allow *Dyaxis* to slave to many video editing systems.

Lee Cochran, president of SEC, was looking forward to the new corporation's long term prospects, "Much of the future in professional music recording, broadcast and post-production industries lies in the digital domain. The next 12 months will be an exhilarating time as we continue to provide state-of-the-art digital systems with the support and co-operation of Studer."

In the UK, the *Dyaxis* workstation and all future products will now be available through Studer's distributor FWO Bauch, tel: 01-953 0091.

News from the AES

There is a broad spectrum of subjects to be covered in this year's session of British AES evening meetings and more details will be available on each nearer the time. To help future planning the dates, speakers and titles are listed below.

1989

November 14th
Room Acoustic Simulation
Richard Small
December 12th
Noise Pollution
Ken Dibble

1990

January 9th
Satellite Distribution of Audio
Chris Hibbert
February 13th
Digital Audio in the TV Studio
Paul Evans
March 20th
To be Announced
April 10th
Amplifier Differences
Paul Miller
May 8th
DAT Timecode
Sony
June 12th
Active Acoustics
Philip Newell

The first lecture of our new season is **Free Field Simulation of Room Acoustics** by L R Fincham, A Jones, R J Wilson and R H Small of KEF Electronics Ltd on Tuesday 14th November. "The lecture is a progress report on Eureka project Archimedes, a psychoacoustics research project aiming to use experimental results from free field simulation of room acoustics to improve sound reproduction systems. The experimental setups and procedures will be discussed, together with the use of a multichannel realtime DSP engine to simulate loudspeaker directional characteristics and room boundary absorption." This will be held at the IBA, 70 Brompton Road, London SW1 starting at 7.00pm with coffee at 6.30pm.

As this issue is published the **87th AES Convention** is about to be held in New York between October 18th and 21st. (Please note alteration to the dates.) As usual this should be the major event of the pro-audio calendar.

We have just received the revised edition of John Watkinson's book **The Art of Digital Audio** priced at £39.95 and a new book **Stereo Sound for Television** by Francis Rumsey at £12.95. These can be obtained from the address below.

For further details on any of the above or information on joining the AES, please contact: **Heather Lane, AES British Section, Lent Rise Road, Burnham, Slough SL1 7NY, UK. Tel: 0628 663725. Fax: 0628 667002.**

Exhibitions and conventions

October 25th to 28th Broadcast '89, Frankfurt, West Germany.
November 7th to 9th Computer Graphics '89/Desktop CAD '89, Alexandra Palace Exhibition Centre, London. Contact: Katherine Lovatt. Tel: 01-868 4466.
November 7th to 9th, Digital Information Exchange, Private Members Suite, London Zoo. Contact Nick Hopewell-Smith. Tel: 01-381 1991.
November 28th to December 3rd Sound Expo/China '89 Shanghai Exhibition Centre, Shanghai, China.

1990

March 13th to 16th. AES 88th Convention, Centre de Congres, Montreux, Switzerland. Contact: AES Exhibition Director, Herman A O Wilms, Zevenbunderslaan 142/9 – B-1190 Brussels, Belgium. Tel: (2) 345 7971. Fax: (2) 345 3419.
March 30th to April 3rd NAB, Atlanta, GA, USA.
April 22nd to 25th Vision and Audio International, Earls Court Exhibition Centre, UK. Tel: 01-776 0709.
June 6th to 8th. APRS 90, Olympia 2, London, UK. Contact: APRS Secretary. Tel: 0923 772907.
September 21st to 25th International Broadcasting Convention, Metropole Conference Centre, Brighton, UK. Contact: IEE Secretariat. Tel: 01-240 1871.

People

- **Stirling Audio**, UK, have employed three new sales and service personnel. Nigel Scutt has joined as a specialist in Lexicon products and system design. Robin Parnaby, Keith Sherry and Simon Flynn have joined Stirling/Syco technical support.
- Chas Rowden has joined **AMS** to manage their London sales office based at Primrose Hill, NW1.
- **Solid State Logic** have announced the appointment of Michel Yves Gueguen as managing director of their French subsidiary, Solid State Logic Sarl.
- Carl Marchisotto has been appointed president and chief executive officer of **Dahlquist Inc**, Hauppage, NY, USA. He will direct the sales for the company's expanded *DQ* line of phased array speakers.
- Amanda Driver, formerly studio manager at Basement Studios, London, has been appointed to the same position at **Berwick Street Studios**, London.
- **Complete Video**, Covent Garden, London, have appointed Roger Troup as their new general manager. Troup rejoins the company after six months in Australia.
- **Molinare Studios**, London, have appointed Abigail Wells as sales, marketing and production manager.
- Geof Irons has been appointed manager of **Tape One Studios**, London. He comes from Goldcrest Films.

PAEG boycotts Montreux AES

At the second full meeting of the Professional Audio Exhibitors Group (PAEG) held at the meeting room, London Zoo, an initial list of non-exhibitors for the Montreux AES was issued. Support has also been pledged from some US companies who regularly exhibit at AES in Europe.

The following companies have agreed to boycott the Montreux exhibition: Allen & Heath, Amek/TAC, AMS, BSS, Connectronics, DDA, Expotus, Focusrite Audio Engineering, HHB Communications, Harris Grant Associates, Hill Audio, Hilton Sound, Klark-Teknik, Martin Audio, Neve, Philip Drake, Saturn Research, Solid State Logic, Soundcraft, Soundtracs, Stirling Audio and Turbosound.

Only those companies who have decided to boycott Montreux will be entitled to join the PAEG, which was set up in May with a clear mandate to present the views of previously exhibiting companies to the exhibition organisers. The list of non-exhibitors will be circulated to companies who exhibited at this year's Hamburg AES, and updated at regular intervals to include new members.

Alison Brett of Soundcraft and Graeme Harrison of Hill Audio have been appointed as board members to replace Iain Roche and David Bissett-Powell.

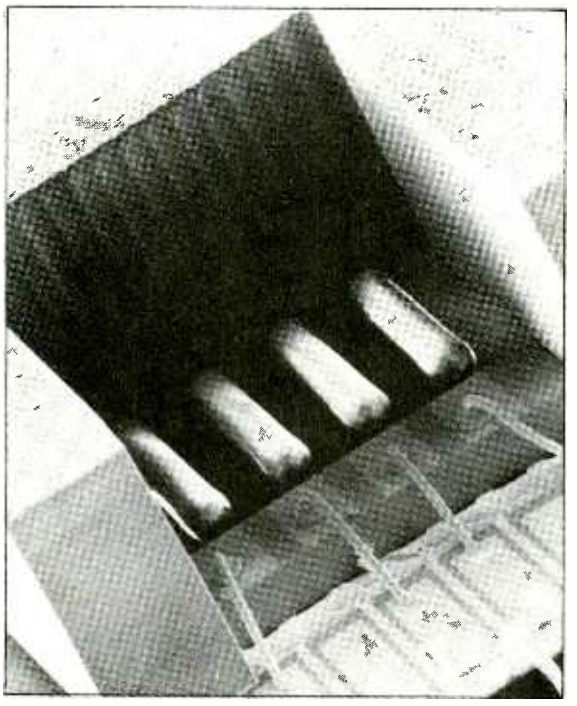
Apple vision

At the recent MacWorld Expo in Boston, MA, USA, Apple's chief executive officer, John Sculley, was outlining some of Apple's ideas and directions for the future. Sculley: "We at Apple intend to expand our midrange products, the *SE-30* and *IIcx*, and bring prices down so that high performance can be offered at lower prices. We intend to make entry-level machines–the *Mac Plus* and standard *SE*–available at much cheaper prices, so that many more PC users can afford a *Mac*." However, Sculley promised that Apple would not be ignoring the high end user: "We will produce some extremely powerful 'workstation' systems. In short we intend to broaden our base. *Mac* software will run across the entire product line."

Addendum

Within the contracts section of the September issue we implied that Soundcraft had already installed *3200* consoles in several facilities. This should have indicated that Soundcraft had received orders from the studios listed.

Apologies for the confusion caused.



FAST LEAVE: magnified several hundred times is the transmitter section of IBM's experimental optoelectronic computer chip set. The four large 'rods' in the recess are optical fibres about the same thickness as a human hair. On the 'ledge' before each fibre, connected to an electronic line, are four efficient, almost microscopic lasers that convert the electrical signals from a computer into light signals at about one billion light pulses per second. The optical fibres would gather the light from each laser and send them on their way to another computer.

Agencies

• Pro-audio distributors Audio Systems Components are to distribute the stand-alone radio code clocks made by **Junghans Uhren GmbH** of Schramberg, West Germany. Audio Systems Components, 1 Comet House, Calleva Park, Aldermaston, Berks RG7 4QW, UK. Tel: 0734 811000. Fax: 0734 819813.

• **Amek Systems** have appointed Sonotechnique as exclusive distributor for Canada. Sonotechnique, 2885 Rue Bates, Suite 300, Montreal, Canada. Tel: (514) 739-3368. Fax: (514) 739-8739.

• Canford Audio, Tyne & Wear, UK, have recently been appointed the main UK dealer for the **Comrex** range of frequency extending equipment. Canford Audio plc, Crowther Road, Washington, Tyne & Wear NE38 0BW, UK. Tel: 091-417 0057.

• PRECO have been appointed distributors of **CRL** audio processors in the UK and Eire.

In brief

• **Mark IV Industries** have acquired the assets of Electro Sound Inc, a division of Electro Sound Group. The Electro Sound audio tape duplication hardware division will become part of the Mark IV stable of companies that already includes Gauss, manufacturer of high-speed cassette tape duplication systems and equipment.

• **Disctronics** Inc, Australia, a manufacturer of optical disks, and **Design Science** of California, USA, have announced that Design Science will manufacture and market a line of PC-based CD, *LaserVision*, CD-V and CD-ROM disk analysers, which were developed by both companies.

• A new company, **Action Stations**, has been formed to meet the demand for contract engineering services for radio broadcasters, recording studios and all professional users of audio equipment in the UK. Action Stations, London. Tel: 01-281 7281.

• **Electronic Music Studios** (EMS), Cornwall, UK, have won an award from the Institute of Social Invention for producing a machine that enables handicapped people with minimal movement to control sounds from a synthesiser. The EMS *Soundbeam* MIDI controller comprises up to four linked ultrasonic echosounders, connected to a synthesiser, that detect the presence and range of any part of the body entering the beams up to 6 metres away. Wider applications could include the performing arts and education. For more information contact Robin Wood, EMS, Trendeal Vean Barn, Ladock, Truro, Cornwall TR2 4NW, UK. Tel: 0726 883 265.

• **Gig Sounds** music stores of Catford and Streatham, South London are holding a competition for budding musicians. Original compositions not more than four minutes long are to be sent to their store in Catford. Among other prizes the winning entries will be compiled and sent to major record companies. All entries will receive a free assessment sheet and should be in by November 15th. Gig Sounds, 22 Rushey Green, Catford, London SE6, UK. Tel: 01-690 8621.

• Over 120 applications were received for this year's **PRS John Lennon Award**, and after careful consideration the judges have decided that they cannot recommend any to receive the award due to the disappointing standard of the entries and lack of originality. The future of the Award is now in doubt.

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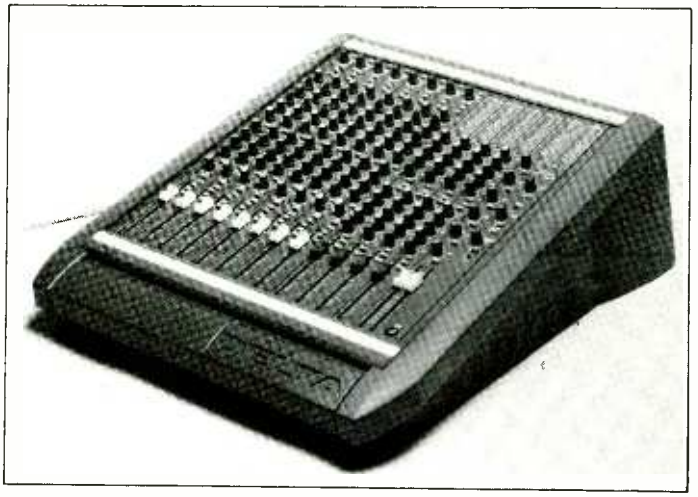
Soundcraft 200 Delta mixing console

Soundcraft Electronics have introduced a new compact console to replace the *200B* series. Following in the tradition, the console is designed for multiple applications including recording, theatre and sound reinforcement. The chassis construction is now just a single piece with the rear connector panels now integrated with the module itself easing service/module replacement, etc. It is now possible to fit individual group modules as well as a separate master section so that console configuration is far more versatile.

Frame sizes are 8-, 16-, 24- and 32-input with an 8-channel rackmount also being available. There are four input module types: standard (3-band EQ with swept mid); deluxe (4-band EQ and post-fade line output); stereo (with RIAA preamp option); and Dual Line (which offers two line input channels on each module, which, with the right combination of modules, could allow up to 24 inputs in an 8-channel frame). Separation between left and right buses has been improved with the use of a new active panpot design



that allows any bus to be used as a mono output with a claimed 25 dB improvement over other designs.

Level metering is 20-segment bargraph switchable peak/average ballistics on both group and master modules with peak LED on channels. All switches are now illuminated. Styling has also been changed with moulded arm rest and side panels that also double as carrying handles.

Price is described as similar to the previous series *200B*.

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

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

Clarostat motorised pots

Clarostat have introduced a miniature motorised potentiometer for remote control and channel memory applications. The pot is ½ inch square and is driven by a motor of the same dimensions. The complete assembly includes up to four stackable sections and a geared motor with a claimed life exceeding 1,000 hours. A slip clutch option provides manual override of the motor for individual adjustments to the pot. The housing is a dust free design with stop torque of 4 psi and a mechanical rotation of 295°. Three different style gear motors are offered with rotational speeds determined by the number of controls driven. The motors are described as low noise and require a nominal 12 V supply.

Clarostat Manufacturing Co Inc, 1 Washington Street, PO Box 1507, Dover, NH 03820-1507, USA. Tel: (603) 742-1120. Fax: (603) 742 0481.

UK: Clarostat Europe, Elm Road, North Shields, Tyne & Wear NE29 8SA. Tel: 091 2961451.

ASC SuperTrap

The Acoustic Sciences Corporation has added an 11 inch *Super Trap* to its range of *Tube Trap* acoustic control products. The *Super Trap* is a development from the original 11 inch version and offers extended bass response and an enhanced damping of standing waves into the 70 Hz region. It is specified for rooms with 8 ft ceilings to control floor-to-ceiling resonances that can be accentuated by greater use of sub-woofers, etc.

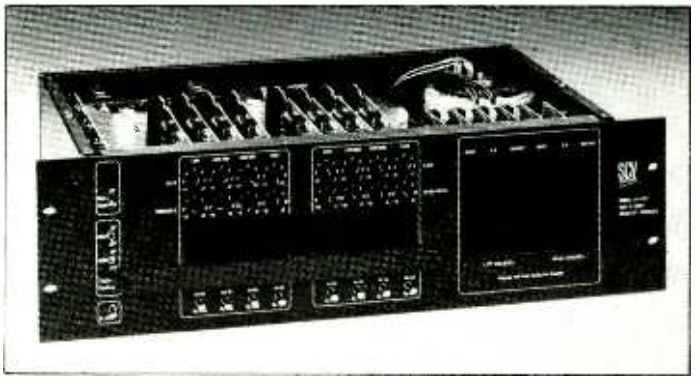
ASC describe the unit as having a built-in sound diffusion panel that adjusts to scatter mid and high frequencies while the acoustic design is such that it achieves self-regulating LF absorption. The units are available in standard lengths of 3 and 4 ft or to custom lengths. Exterior finish is fire-resistant fabric available in a range of colours.

Acoustic Sciences Corporation, 385 Lawrence, PO Box 1189, Eugene, OR 97440, USA. Tel: (503) 343-9727. Fax: (503) 343-9245.

UK: Quested Monitoring Systems, 59 Maltings Place, Bagleys Lane, London SW6 2BX. Tel: 01-731 7434. Fax: 01-731 3280.

SCV dynamics controller

The *SCV* model *AT422* is a dual 4-band dynamics controller with applications in disc and CD mastering, broadcasting, sound reinforcement and specialised recording requirements. Each of the two channels is fully independent though they may be stereo coupled. Each channel splits into four bands—low, low mid, high mid and high. Each band has its own limiter, compressor and gate with individual bypass switching; gain and threshold settings on knobs but with other adjustments on concealed screwdriver pots. Other features include an output peak suppressor, selectable pre/de-emphasis, 30-segment bargraph vu/peak metering, electronically balanced inputs and transformer balanced outputs.



SCV Audio, BP 50056, 186 Allee des Erables, Paris Nord II, 95947, Roissy Ch de Gaulle Cedex, France. Tel: (1) 865.44.74.

UK: Shuttlesound Ltd, Unit 15, Osiers Estate, Osiers Road, London SW18 1EJ. Tel: 01-871 0966. Fax: 01-870 9300.

USA: SCV Inc, 414 North Sparks Street, Burbank, CA 91506. Tel: (213) 761-9760.

Lexicon LXP-5 processor

Lexicon have announced a unit complementary to the *LXP-1* digital reverb in the form of the *LXP-5* Effects Processing Module. The *LXP-5* is a half-rack package with over 190 preset and user-programmable sounds. Five digital effects can be created simultaneously together with three octaves of pitch shifting, a wide range of delay sweeps, chorusing, flanging, EQ, ambience and reverb. All control parameters are adjustable through front panel controls or through MIDI control and all can be modified in realtime.

Also from Lexicon, new software for the *MRC* MIDI Remote Controller allows control of up to 20 *LXP-5*s (or *LXP-1*s or *PCM-70*s) in any combination.

Lexicon Inc, 100 Beaver Street, Waltham, MA 02154-8425, USA. Tel: (617) 891-6790.

UK: Stirling Audio Systems Ltd, Kimberley Road, London NW6 7SF. Tel: 01-624 6000. Fax: 01-372 6370.

The Mill, Cookham

New ownership • HSH

New name • The Mill

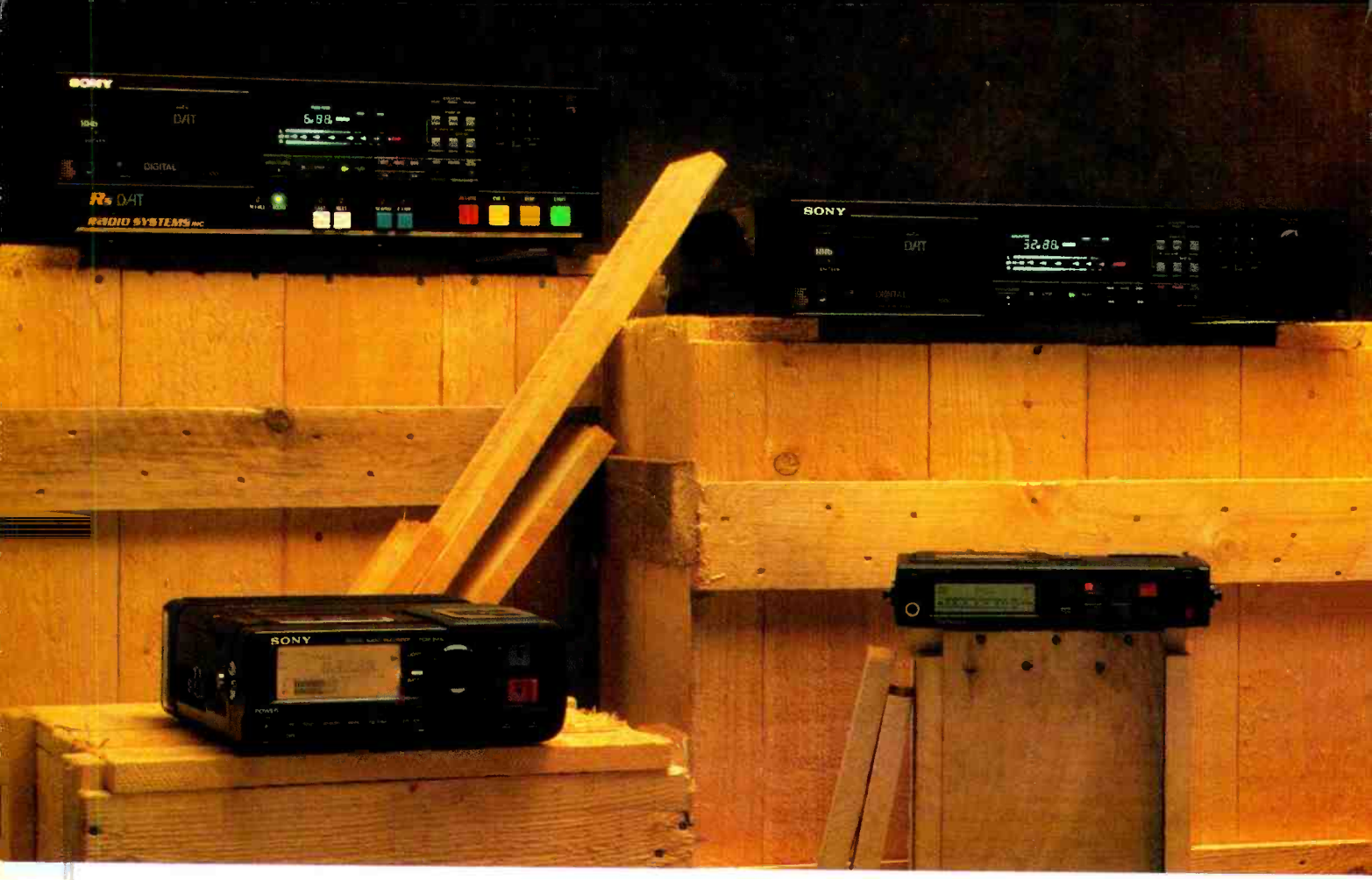
New console • Neve VR

When HSH recently acquired the Mill Studio, Cookham they needed to invest in a console with the technical superiority to take them well into the nineties.

They chose the 72 Channel Neve VR with Flying Fader automation and Recall.

Neve

NEVE ELECTRONICS INTERNATIONAL. A Siemens Company. Cambridge House. Melbourn. Royston. Herts. SG8 6AU. Tel: 0763 260776. Fax: 0763 261886. Telex: 81381



DAT. We think you should seri

We've made the Sony DTC 1000ES the industry standard, but we're committed to offering choice. The world's most extensive selection of DAT equipment, from the only serious DAT manufacturers – Sony and Panasonic/Technics.

Take portable DAT recorders. We now stock four different models, including Sony's TCD-D10 and the new TCD-D10 'Pro'. Another newcomer is the Technics SV 260A, which combines excellent professional features with the best-sounding recording quality we've yet heard from a DAT portable. While our range of studio recorders has been augmented by the new Technics SV 360, the Sony DTC 1000ES, modified by HHB to record at 44.1kHz as well as 48 kHz, needs little introduction.

Broadcasters are now enthusing about RSDAT – the latest device to demonstrate the flexibility of the DTC 1000ES. Converting and interfacing all audio and operational functions to broadcast standards – it brings cart-like control to DAT sources. Sony's PCM 2500 is especially versatile,

HHB COMMUNICATIONS LIMITED, 73-75 SCRUBS LANE, LONDON NW10 6QU PHONE 01-960 2144 TELEX 923393

ously consider the alternatives.

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HHB's knowledge of digital recording is legendary. So is the company's advice and service support. And while we back the best names in DAT technology, we also support our DAT range with Europe's largest selection of accessories. That means a full choice of DAT tapes, tape storage units, head-cleaning tapes, batteries, power supplies and stereo microphones, as well as 19" racks of our own design.

In fact, there's so much to show you in our stunning new demonstration facility, we couldn't possibly fit it into this ad. That's why we've published a new edition of our Digital Audio Times, containing full details and specification data. So send for your copy of HHB's definitive DAT bible now, or phone us on 01-960 2144.

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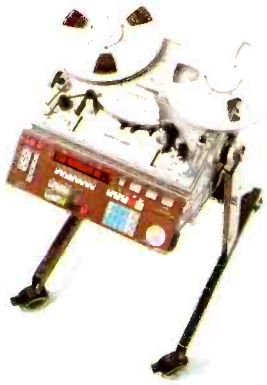

The Nagra T-Audio is so at home in a video environment it can almost be considered as a video recorder. Of course, it is merely one of the finest *audio* tape machines available.

Nagra has a long established reputation for excellent design and precision construction of compact tape recorders and the T-Audio follows this Nagra tradition, and adding a full time-code capability. The in-built time code generator/ reader and internal synchroniser offers a remarkably fast lock-up capability.

In fact the lock-up is so fast in comparison with other ATRs, that the overall daily time-saving make the Nagra T-Audio the ideal Video Recorder.

For literature, technical specifications and details of the interfaces that are available for most video editors, contact Hayden Pro-Audio or your local agent.

THE VIDEO RECORDER

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U.S.A. Nagra Magnetic Recorders, N.Y. 10036 New York. Tel: (212) 840 09 99 Fax: (212) 302 16 27
Italy Nagra Italia SRL, 00144 Roma Tel: (06) 591 09 32 Fax: (06) 591 09 32
France Nagra France SARL, 75019 Paris Tel: (1) 42 06 61 60 Fax: (1) 42 08 89 20
West Germany Nagra Kudelski GmbH, 8000 Munich 90 Tel: (089) 697 12 07 Fax: (089) 691 19 64
Canada Arri/Nagra, M8Z 3Y8 Toronto Tel: (416) 252 42 00

Hayden Pro-Audio

CHILTERN HILL
CHALFCNT ST. PETER
BUCKS SL9 9UG
TEL: (0753) 888447
FAX: (0753) 880109

Digidesign Sound Tools updates

Digidesign have released *Sound Designer II Version 1.1*—the most recent update to the audio editing portion of the *Sound Tools* digital recording and editing system. New features include stereo time compression and expansion (previously mono); faster SMPTE chase and lock; enhanced sample rate conversion with new rates of 37.8 kHz and 18.9 kHz for CD-I (Interactive) formats; and SCSI support for the Akai for high speed sample transfer.

Sound Tools also now includes the new *Sound Access* application. This is a *Macintosh HyperCard* stack and XCMD that allows the user to trigger stereo 16 bit sound files from the *Macintosh* hard disk using *HyperCard* script commands. Audio playback occurs as a background operation allowing other connected computer operations such as animated graphics.

The version of *Sound Designer* is free to registered users of the program.

Digidesign Inc, 1360 Willow Road, Suite 101, Menlo Park, CA 94025, USA. Tel: (415) 327-8811.
UK: Sound Technology plc, 6 Letchworth Business Centre, Avenue One, Letchworth, Herts SG6 2HR. Tel: 0462 480000. Fax: 0462 480800.

Allen & Heath SC Plus

Derived from the *SRC* range, Allen & Heath have introduced a new range of modular consoles. The *SC Plus* is available in three frame sizes with 16, 24 or 32 inputs with a choice of three input module types: standard, sweep EQ or stereo. There are a wide range of options including a 4×4 matrix output, which will increase the versatility of use. LED indication is provided for mute, signal present, peak level and PFL.

Allen & Heath, 69 Ship Street, Brighton BN1 1EA, UK. Tel: 0273 24928. Fax: 0273 821767.
USA: Allen & Heath (USA) Ltd, Five Connair Road, Orange, CT 06477. Tel: (203) 795-3594.

In brief

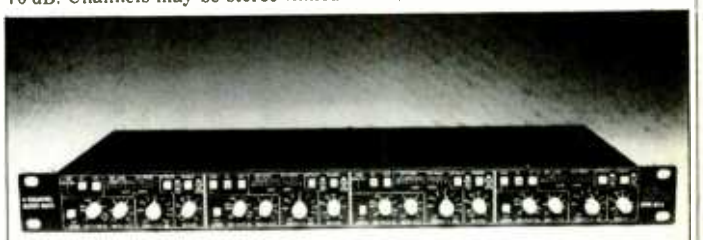
● The **Sound Ideas** sound effects library have added a new series of sound effects known as *Hollywood–Series 4000*. This is a collection of five CDs containing 2,200 digitally recorded effects associated with motion pictures. Included are cartoon animation sounds such as boinks, zips and pops, horror effects and a wide range of Foley stage sounds, etc. The complete contents are referenced to the Sound Ideas master catalogue as with the other series.

Sound Ideas, Ontario, Canada. Tel: (416) 886-5000, (US 1-800-387-3030). Fax: (416) 886-6800.
UK: FWO Bauch Ltd. Tel: 01-953 0091. Fax: 01-207 5970.

BSS DPR-504 multichannel gate

New from BSS is a 4-channel noise gate in a 1U rack. The *DPR-504* gating channels are all fully independent with each offering vu peak LED metering of key level, gate open indicator, parametric key filter (frequency and Q), combined hold and release adjustment, selectable auto/fast attack modes and selectable attenuation ranges of 20 or 70 dB. Channels may be stereo linked as pairs and external key access is provided for each channel. Control circuitry is based upon that developed for the *DPR-502* dual MIDI noise gate.

BSS Audio Ltd, Unit 5, Merlin Centre, Acrewood Way, St Albans, Herts AL4 0JY,UK. Tel: 0727 45242.
USA: EDC, 611 Broadway, New York, NY 10012. Tel: (914) 567-1400.



MacWorld—items for the recording industry

There were things shown at the MacWorld Expo in Boston which are likely to affect all of us in the professional recording community. It's just a matter of when. MacWorld is one of the major Apple *Macintosh* dedicated events of the year, with the *Mac* gaining a reputation as a useful audio (and multi-media) tool there were bound to be important developments.

Talking first MIDI, then *Mac* and sound, Dave Oppenheim—who wrote the current 'hot' *Mac* MIDI sequencer program, Vision, for his company Opcode Systems—was extremely enthusiastic about the new MIDI Manager and MIDI Driver software that Apple have just released to developers to use with their MIDI programs. This software allows you to make internal data links between several MIDI programs, which you can run concurrently under Apple's 'MultiFinder' program. You could merge the output of two MIDI programs like Vision sequencer and DigiDesign's Q-sheet, so that both sets of MIDI data would be transmitted via the same data port from the *Macintosh*. Or you could have Opcode's synth Editor/Librarian software for several synths all linked together to form one 'master' ed/lib program, and send patches to your synths while the Vision sequencer is running.

Apple have very sensibly decided to provide these standardised routines for all *Macintosh* MIDI programmers to use, just as they have provided hundreds of other standardised routines for use with wordprocessors and the like. This is very good news for MIDI users because there will be a much higher degree of compatability between programs from different manufacturers on the *Mac*.

Each morning Apple executives took turns to present some of the software and hardware already available and some new directions for the future.

John Sculley (Apple CEO) made heavy use of a program called MacroMind Director ('a Multi Media Presentation Tool') to demonstrate and present ideas to the assembled crowd. It allows you to put together a combination of text, graphics, pictures, animations and sounds to form a sequence of these events, which can be played back from the *Mac*. Typically, the 'sounds' might have been recorded by an 8-bit sampler called *MacRecorder*, and saved as a *Macintosh* SND resource for use within the presentation. These sounds could be dialogue, sound effects, or music.

MacroMind Director also has MIDI capabilities. You can send start, stop, song position pointers, and continue messages to control external MIDI-controllable effects units or mixers, or whatever, in sync with the action on screen. And Director can also output its on-screen information to a VCR, using a genlock card, which can be obtained for the *Mac II*. So we now have what John Sculley referred to as 'DeskTop Media'.

Voice activation using the *Macintosh* was also being demo'ed at the show. A piece of software called the Voice Navigator with a microphone and an interface to the *Mac* now allows any small group of people to 'teach' the program to recognise any individual's spoken commands, and use these to activate other software functions, such as Play and Record commands in Vision sequencer, or Cut and Paste commands in a word processor, or whatever!

One of the most exciting pieces of software demonstrated was developed by *Macintosh* consultant Max Whitby and *Macintosh* Programmer Mark Wilson of the BBC Radiophonic Workshop for the BBC Interactive Television Unit in close collaboration with Apple. This is MediaMaker, a program written in HyperCard, which also allows users to create their own multimedia sequences synchronising moving pictures and graphics, or 'captured' moving video frames direct from camera or VCR, with dialogue, effects, and music.

Sources can include Video 8, video disc, CD-ROM, and any *Macintosh* colour graphics, and, of course, digitised audio via MacRecorder 'snd' resources, or via synchronised audio Compact Disc from Apple's CD-ROM drive, and digitised video and graphics 'samples' taken from any existing video or graphics sources.

Warner New Media have just started to release CDs with MIDI data encoded as well as the normal audio data. This is possible because there is room on the subcode data within the standard CD format, which is capable of storing around 30 Mbytes of information. This extra information could be text, graphics, or, now MIDI data. JVC have started manufacturing a CD-G (Graphics) player, which also has a MIDI data output socket. This player, the JVC *XL-G512NBK*, costs under $500 in the US and a European version is in the process of being launched. The listener/viewer might see pictures of the instruments being played, the lyric line being sung, a foreign language translation of the lyric, the musical score, notes and information, or whatever. Talking Heads already have an album on release called *Naked*, which contains graphics that can be played back on your TV from one of these CD-G players. Other albums from major artists are currently in preparation.

WNM see these CDs being used in the home in combination with a synth module such as the Roland *MT32*, and/or a computer sequencer on which you could re-record the 16 channels of MIDI data and remix or revoice the parts. WNM will also be encoding these discs with graphics, using these to display the MIDI channels and instrument details, as well as lyrics. Now the MIDI data, once transferred to a MIDI sequencer on the *Macintosh*, for instance, could be saved as a standard MidiFile and transferred to a music notation program, such as Coda Software's Finale, and then the music parts could be printed out.

WNM were also showing another new CD disc format. This second format will carry both CD-Audio and CD-ROM data on the same disc. The newer CD-ROM players, such as the one currently available from Apple, can replay both types of data. The idea is that the user can download the CD-ROM data into a *Macintosh* computer, and then control replay of the CD-Audio data from the *Macintosh*. A series of discs called Audio Notes is being released in this format. The first is based around Mozart's *The Magic Flute*.

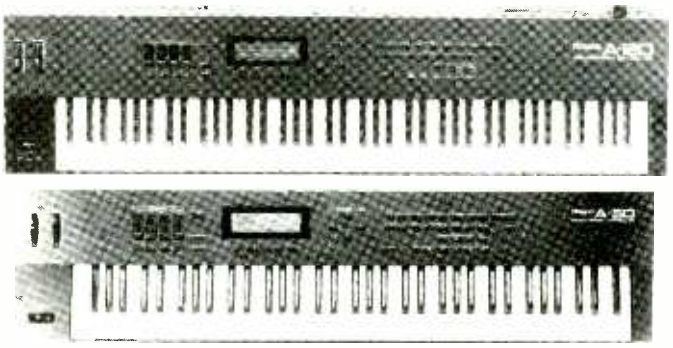
The Audio Notes' discs also contain MIDI data for the main themes from the opera. This is a truly interactive system, with dialogue narration and text providing musical analysis and historical information, translations of the lyrics from the original German (which appear on the *Macintosh* screen in sync with the sung performance), and even a musical glossary that allows you to click on this to hear an example of music played at this tempo.

As a *Macintosh* and MIDI consultant, I offer a troubleshooting service over the phone to people working in studios throughout London. Now Farallon, the company who make the *MacRecorder* system, have come up with a piece of software called Timbuktu Remote. Using a modem to link up my computer at home with one in a studio, I could now take direct control of the studio's computer and bring everything up on my screen at home, sort any problem out, then return control to the studio's *Mac* operator. Of course, troubleshooting is only one possibility. I could edit MIDI sequences, sound data of various types, synthesiser patches, samples for the *S1000*, and the possibilities just start to explode!

How about watching TV or a video at the same time as working on the *Mac*, a new board for the *Mac II* allows you to do just that! You can either have the video picture appear in a small window somewhere on the *Mac*'s screen, or you can use the picture as the screen background to whatever program you are working on. And this will work with PAL as well as NTSC! The board is made by Computer Friend Inc and is known as *TV Producer*. And with Genlock, and video overlay, and Chroma Key facilities, allowing video input and output to and from programs like MacroMind Director, this would be an essential part of the new multimedia setup.

Mike Collins

Roland A-80 and A-50 mother keyboards



The two models both have polyphonic aftertouch, four overlapping split zones and 128 memory locations for setups. The *A-80* has an 88-note weighted-action keyboard, and the *A-50* has a 76-note synthesiser-style keyboard.

There is a backlit 240×64 dot LCD featuring eight lines with 40 characters each. There are 25 'screens' available in the display to allow you to monitor all the functions.

The user may define and store separate velocity, channel aftertouch and, in the case of the *A-50*, polyphonic aftertouch curves to allow very comprehensive control of expression on any sound modules or instruments connected to the keyboard. Four separate zones may be assigned to the keyboard to allow transmission on four separate MIDI channels and each zone can contain independent velocity and aftertouch curves, program change numbers assignable to each channel, and a variety of performance controller functions. Zones or split points can overlap one another or may be layered across the entire keyboard and zone solo or mute may be switched on or off during performance. Two sets of pitch bend and modulation controls, the standard Roland type as well as Moog-like wheels, are provided. Bulk dumps of your MIDI device memory data may be stored to internal RAM or onto RAM cards via the mother keyboards. Thus your entire MIDI system can be reconfigured exactly the way you want it at any time.

The keyboards each feature four MIDI outputs, each capable of transmitting on 16 MIDI channels independently. Each have a Thru socket and two MIDI In sockets which may be used to merge incoming data. There are four assignable sliders and four assignable switches on the front panels, and any combination of four expression pedals or four footswitches can be used to control user-defined MIDI control change numbers such as sustain pedal, panning or portamento. There is also a panic button to send out All Notes Off and Sustain Off messages.

Comment: Mother keyboards make much more sense now that there are so many rackmount MIDI devices available. These two new keyboards from Roland represent the latest generation of such keyboards with extensive control features built-in. The *A-80* will appeal to those who prefer a piano-type action and the *A-50* will appeal to those who prefer a synthesiser-type feel to the keys.

UK: Roland (UK) Ltd, Amalgamated Drive, West Cross Centre, Brentford, Middlesex TW8 9EZ. Tel: 01-568 4578.

USA: Roland Corp US, 7200 Dominion Circle, Los Angeles, CA 900-40-3647. Tel: (213) 685-5141.

ADO Atari ST music desktop accessories

These Atari *ST* accessories from ADO will run simultaneously with any GEM sequencer, such as C-Lab, Steinberg, MasterTracks Pro, etc.

MPLAN 24 is a 24-track, 16-song, track planner. It prints and saves, and features track and song copy functions and is useful for multitrack tape or sequencer track information.

PC128 is a remote patch changer and viewer. Providing patch changes for 128 sounds on each of the 16 MIDI channels, it has the unusual feature of displaying the previously entered names of the sounds. Song setups can also be saved and recalled from disk, allowing single operation song patch change setups.

Comment: These desktop accessories should prove invaluable to studio users who often need tracksheets and session notes, as well as instant availability of patch changes and song setups.

UK: ADO Distribution, 4 Auckland Court, London SE27 9PE, UK. Tel: 01-761 0178.

Casio ProTech range

The *VZ-8M* synthesiser is an 8-note rackmount polyphonic module with autopanning facilities.

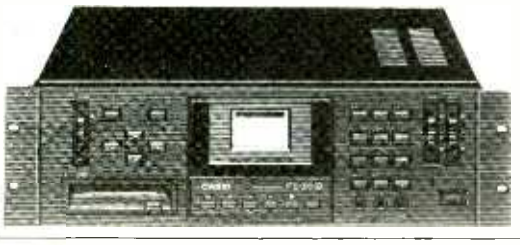
The *FZ-20M* rackmount sampler is an upgraded version of the popular *FZ10M* sampler with much greater memory capacity.

The new *DH-500* digital horn is aimed at the professional player. It has improved MIDI specifications, digital reverb, delayed vibrato and variable breath sensitivity, and provides a very affordable entry to the world of professional wind synthesis.

Comment: As memory needs grow ever larger to allow longer sections of music to be sampled and then 'spun in' on many of today's recordings, the *FZ-20M* will be a welcome addition to Casio's range of professional samplers for studio use. The *VZ-8M* offers an interesting alternative digital synthesiser to rival the currently popular models from Roland, Korg, Yamaha, and Ensoniq. The new Digital Horn provides a cost effective entry to MIDI wind synthesis and the *DH-500* compares well with the models on offer from Yamaha and Akai.

UK: Casio Electronics, Unit 6, 1000 North Circular Road, London NW2 7JD, UK. Tel: 01-450 9131.

USA: Casio Inc, 15 Gardener Road, Fairfield, NJ 07006. Tel: (201) 575-7400.



Emulator III Version 2.2 software update

The update comes on a floppy disk and includes a user manual addendum. New features include a 20-band digital equaliser, which works exactly like an analogue graphic equaliser allowing a 12 dB cut or boost; there is also a digital compressor, which is a digital simulation of an analogue compressor having many different uses including limiting, noise reduction or musical compression/expansion. Functions include variable threshold, compression ratio, and attack and release times.

The dynamic digital filtering feature allows the *EIII* to digitally process samples thereby changing the harmonic content of the sound over time. The filter is a digital implementation of a swept, 2-pole filter which features variable resonance and lowpass or notch configurations.

The 2.2 update also offers improved stereo phasing capabilities.

Software *Version 2.2* is free of charge to all registered *EIII* owners.

Comment: Significant new sound processing capabilities have been added to the *EIII* in this software update, taking its functionality another step along the way toward total 'audio workstation' status. The E-mu system is now positioned midway between the lower priced keyboard and rackmount sampler systems such as the Akai *S1000*, and the much higher priced *Synclavier* systems.

E-mu Systems Inc, 1600 Green Hills Road, Scotts Valley, CA 95066, USA. Tel: (408) 438-1921.

UK: Syco Systems (UK), Kimberley Road, London NW6 7SF. Tel: 01-625 6070.

Studio Sound's Music News is compiled by Mike Collins.

Blood, sweat and tears.

MLSSA-A NEW APPROACH TO ACOUSTIC MEASUREMENT

Studio designer Andy Munro describes a new acoustic measurement system

Acoustic measurement as applied to the recording industry has always been the object of considerable controversy due to the highly subjective nature of the topic itself. The earliest experiments by Sabine in the 1930s led to the assumption that sound decay in a given space was of uniform rate and independent of position. It was recognised at a much earlier stage that the decay rate was frequency dependent but nobody ever had the means to measure what was going on.

A gentleman called Helmholtz became famous in Munich by arriving at the local opera armed with a cart load of overblown sample bottles but before he could discover that the hall had a frequency dependent acoustic character they had taken him away for questioning. The authorities, however, soon discovered that the bottles made a great improvement to musical performances and they respectfully called them Helmholtz Resonators. A similar train of events took place at the Barbican concert hall in London a few years ago and I understand the consultant is now out on bail.

It has to be said that the development of acoustic measurement techniques has not been rapid and that the publication of theory has vastly outweighed the evidence of practice.

Loudspeaker development has resulted in many improvements of dynamic performance but often at the expense of a balanced, natural sound.

Mathematical theory can prove conclusively that a linear system can be defined in its entirety by its impulse response. It is beyond the scope of this article to describe the relevant theory but more to describe the inherent difficulty in achieving meaningful results when measuring and interpreting the impulse response.

Firstly, it is extremely difficult to obtain impulse measurements using genuine impulses as the source. The short duration of such signals and the high crest factor mean that it is impossible to inject much energy into a system without driving that system into non-linearity, which would invalidate the measurement. This results in a poor dynamic range when working in an acoustic environment other than a test chamber.

Secondly, the use of an FFT analyser with such signals results in a system which is virtually blind to time-related behaviour of the device or environment under test. It has been said by several eminent scientists that this methodology is unsuitable for practical acoustic analysis.

Until recently there were two methods for obtaining detailed acoustic measurements, which maintain the frequency and phase relationship of the acquired data. One is the dedicated Time Delay Spectrometry Analyser as developed by the late (and great) Richard Heyser, and the other is the more widely known dual-channel FFT analyser, which is familiar in the research world.

TDS is best known as part of the Techron *TEF* (Time, Energy Frequency) measurement system as developed by Crown Inc in the USA. A combination of digital and analogue circuits are driven by a combined three-processor computer producing a sinewave sweep tracked by a synchronous filter with a time offset adjustable to the transmission time of the system under test. The resulting data may be processed and subsequently stored on disk.

There is now a new, commercially available, two-port measuring system that seeks to combine the ability to carry out extremely complex analysis with the convenience and portability of the IBM *PC* standard environment. It is named *MLSSA*, or Maximum Length Sequence System Analysis.

Maximum length sequences are a computer generated form of pseudo-random noise, which exhibit all the advantages of pink or white noise plus the opportunity to synchronise with a data acquisition device.

MLSSA is a single-channel analyser that does the work of conventional 2-channel analysers. It is primarily a software based instrument, which can be harnessed to any compatible PC MSDOS computer with standard expansion capability. The single hardware card consists of a fully programmable signal generator giving line output of pseudo-random noise (MLS), narrow pulse or step function (squarewave). There is also a programmable anti-aliasing filter and variable bandpass filter for data processing. The system may be used for digital sampling and other processing applications.

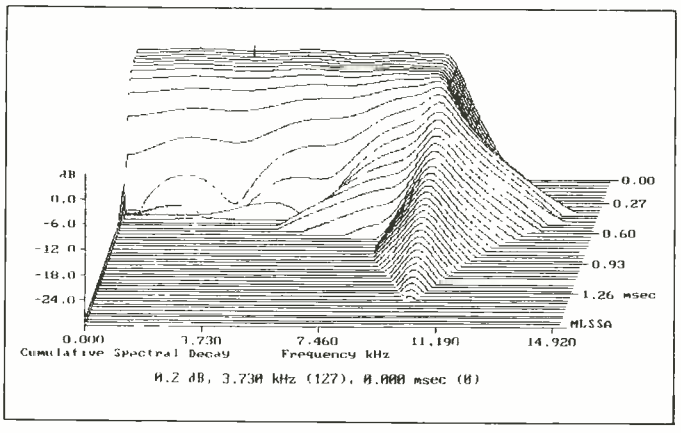


Fig 1: Response characteristic and transfer function of an anti-aliasing filter

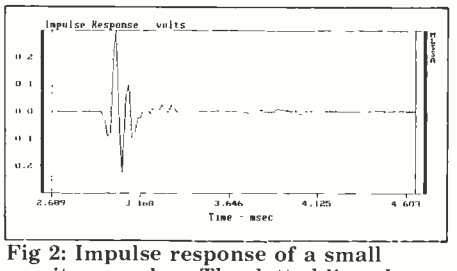


Fig 2: Impulse response of a small monitor speaker. The dotted line shows tweeter overlaid with bass

The MLS technique measures the impulse response—the most fundamental description of any linear system. A maximum length sequence, unlike conventional noise sources, is both predetermined and periodic. This drastically reduces the computing power and error factor associated with dual-channel FFT methods.

Once the impulse response is captured no further measurement is required. The transfer function is obtained by applied, preprogrammable FFT analysis from which all frequency and phase related information is derived. In the time domain the impulse response contains all the information required to calculate Energy, Time Curves, Schroeder Integration, RASTI and STI. By using FFT and special time offset programmes it is possible to display such three-dimensional information as Time Energy Frequency, Cumulative Spectral Decay and Wigner Distribution.

Again it must be stressed that all these classic measurements are obtained from a single burst taking at most a few seconds! As the data acquired can be filed directly to disk together with all the setup files, all the information ▷

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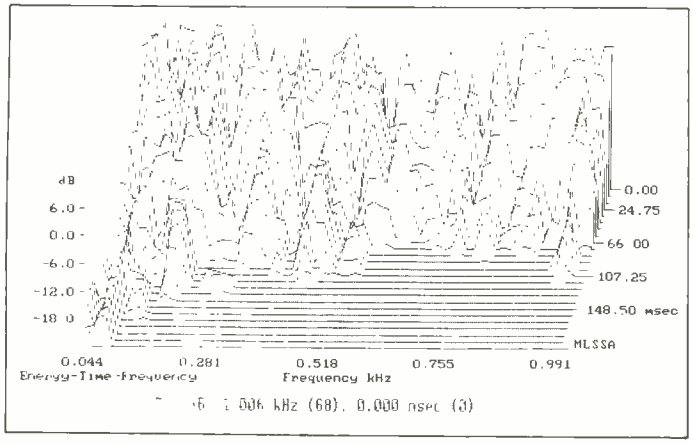


Fig 3: Entire waterfall response of a small control room

obtained can be processed at a later time. This method is made even more advantageous by the fact that post-processing of the data does not require the use of the dedicated expansion card and may therefore be carried out on any decent PC compatible.

Resolution

As with all measuring systems there are fundamental trade-offs between time and frequency resolution. The fact is that at 50 Hz the minimum time required for measurement of the signal is 20 ms. This results from Tr.Fr=1, which is a physical law.

Time resolution is a limitation of all systems but the frequency resolution may be limited by other factors relating to reduced bandwidth or FFT size. The MLS signal may be extended to a maximum of 32768 points. As frequency resolution is the reciprocal of the measured impulse response it is possible to obtain resolution of 1 Hz with a single measurement of 10 kHz bandwidth. By comparison dual-channel FFT and TDS analysers have a typical capability of 1024 points requiring zoom and restricted bandwidth measurement.

Software

The *MLSSA* is an integrated system developed by Doug Rife of DRA Laboratories*. Pseudo-random noise is not a new development in itself and has in fact been used by several eminent pioneers of acoustics; in particular Laurie Fincham at KEF.

M R Schroeder wrote a definitive paper on the subject in 1979 and there are paper references going back to W D T Davies in 1967. What was not generally available until recently was the computing power to make MLS/FFT measurements outside the research laboratory.

DRA has combined the inherent advantages of MLS with a complete package of algorithms for standard acoustic tests. The general familiarity with menu driven *PC* software and MSDOS has resulted in a very friendly system that is equally at ease in a development environment or at home testing the hi-fi system with a laptop portable.

Applications

MLSSA has been programmed with a large number of algorithms giving access to all the standard acoustic tests in current use. In addition, the Scope mode allows normal bench test work to be carried out on electronic equipment. **Fig 1** shows the response characteristic and transfer function of an anti-aliasing filter. **Fig 2** shows the impulse response of a small monitor speaker with the HF and LF drivers overlaid. The difference in amplitude is due to linear energy distribution, which can be reduced by restricting the bandwidth of the measurement. **Fig 3** displays the entire waterfall response of a small control room showing the basic delay characteristics.

Summary

MLSSA is a new addition to the world of sound measurement. Time will no doubt judge the ultimate contribution to the advancement of acoustic science but I personally have no doubt as to its potential and usefulness.□

***DRA Labs, 607 Westnettletree Road, Sterling, VA 22170, USA. Tel: (703) 430-2761. UK:** Munro Associates, Warehouse D,' Metropolitan Wharf, Wapping Wall, Docklands, London E1 9SS. Tel: 01-480 7121.

Beyer 380 endorsement

Dear Sir, Your April issue carries an article by Pat Stapley ('Beat Mics'), which reports evaluations of several mics used for bass drum pickup, including the Beyer *380*. I found this mic—the only bidirectional moving coil mic being made anywhere— with its neodymium magnet and large, ultra-light *Hostaphan* diaphragm, to be a convincing and inexpensive substitute for a large ribbon mic. (Demonstrating the principle of reciprocity, this diaphragm appears to be identical to the one used in Beyer's top-of-the-line headphones.)

The overall character is rather ribbon-like: the high end response drops about 4 dB starting about 4 kHz. The farfield response shows a very smooth low end, with a gradual drop of about 6 dB/octave below 90 Hz. The *380* will probably become known as a 'bassy' mic because it will most often be used for close miking, where the entire curve below 1 kHz is elevated tremendously, due to proximity. The elevated output, noted by Alan Parsons, is perhaps due to the severe proximity effect (+24 dB at 15 Hz at a distance of 2 cm, relative to output at 1 m) typical of a true bidirectional. Beyer's advertising, describes the *380* only as a bass drum mic. (I've used this mic successfully on a number of different instruments but never for bass drum.)

Regarding overload, which Jon Kelly mentioned, the *380* was designed for high SPL 140 dB for 0.5% THD at 1 k, which is very good performance. Still, when used very close to a bassy sound source, one should beware of overload. Mic preamp inputs may require padding, of course.

In an effort to smooth the fig-of-8 pattern at high frequencies, I have experimented with modification, removing entirely the housing and all damping material. The result, used for distant pickup, looks like something from 1930 but provides obviously improved sound: slightly brighter highs and a less boxy sounding bottom.

Yours faithfully, Doug Pomeroy, Pomeroy Audio, 193 Baltic Street, Brooklyn, NY 11201, USA.

Electro-Static Discharge

Dear Sir, When I took my first class in basic computer knowledge, the instructor told us about ESD and the havoc it can cause when computers are installed in a room with a carpet. This class was directed to educators in a large school district, and this instructor not only taught us the basics for getting around a computer, but he also came up with some care and maintenance tips in order to be able to do some self-diagnosis and some simple adjustments before calling the computer technician and paying a certainly costly labour charge.

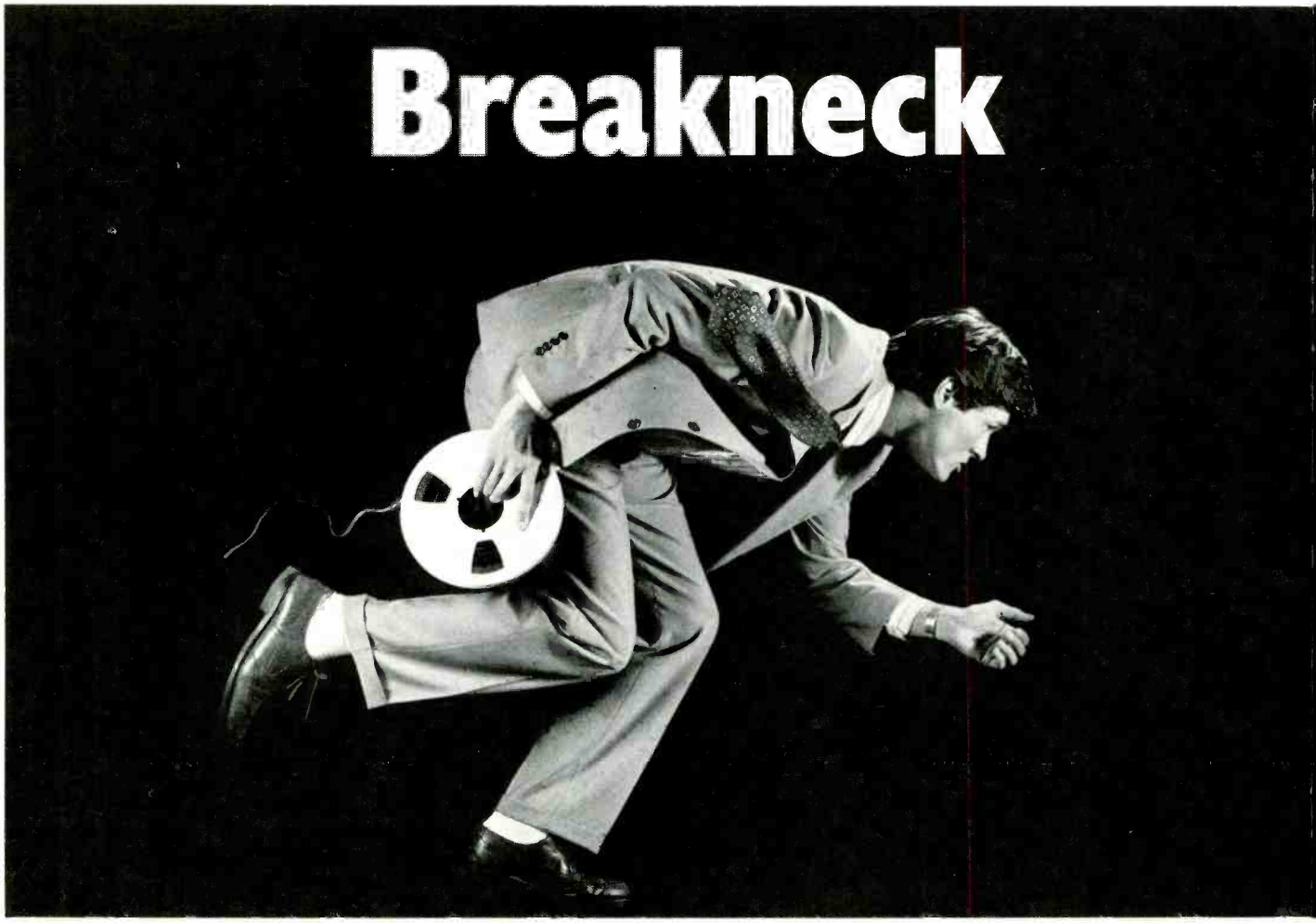
He explained that carpet collects excess electrons as your shoes rub across the carpet and sets you up for a nice discharge when you touch the computer, which makes a nice ground.

Carpet will have a very high amount of excess electrons particularly after it has been shampooed because of the detergent residue left in it as well as when it is quite dirty. Although the carpet cleaner shampoos and then sucks up the detergent residue, he/she almost never rinses the carpet; at least, I have never seen a carpet cleaner rinse a carpet. This is like washing your clothes in detergent and then spin drying them without rinsing them. Your clothes will have a great deal of detergent residue left along with the loosened up dirt. It is necessary to rinse the carpet to remove the detergent and the rest of the dirt.

Possibly you have heard of adding vinegar to the rinse water in order to get rid of the lint that will cling to the clothes and to reduce the static that often remains in the nylon/polyester and woollen materials. As you may recall, vinegar is an acid with an HO factor and will neutralise the detergent, which is a base and has an OH factor by attracting and absorbing the excess electrons.

Finally, in order to prevent further build-up of excess electrons in the carpet, I would suggest rinsing a second time with a solution of concentrated fabric softener 10:1.

You must bear in mind though that these two extra rinses will cost more or, in order to save money,



you could do it yourself if you have the time and energy.

My instructor recommended spraying the carpet with the fabric softener solution of 10:1 as you observe static (ESD) build-up in between shampoos.

And of course, always ground yourself on something metal before you touch your computers, or anything else with a grounding problem.

In any case, these suggestions require extra time and a little more money but in comparison to the cost of replacing fried ICs and circuit boards, the expense is minimal.

'An ounce of prevention...' however, the most prudent suggestion is to get rid of the carpet and make do with hardwood or vinyl flooring, which in the studio is not always acoustically practical.

Yours faithfully, D L Reddick, Oriana Enterprises Ltd, 2550 West 55th Ave, Denver, CO 80221, USA.

Equalisers: the proximity effect

Dear Sir, Although a regular reader of *Studio Sound*, I am not involved with the recording industry. I am in fact concerned with the reproduction of recordings. Having noticed how the standard of recordings has receded when compared to yesteryear, I agree with the theme of your article 'Equalisers—the proximity effect', July issue. Clarity, instrument separation and voice forwardness is not as good as it used to be, in spite of the greater frequency range from recordings nowadays.

My own task for the past decade has been getting sound reproduction in the cinema equal to that in the modern home. The first target was a fresh design for cinema speakers (achieved long before the Americans with *THX* boasted of being first for 30 years!). This was followed by MOSFET amplifiers. Then the most difficult task: a processor that was able to feed through a sound quality which matched the quality from the new speakers and amplifiers. Here was where I was to learn how right you are in the theme of that article.

Electronics and instruments, plus all the EQ you can muster, just do not match the response of the human ear.

Three years ago that wisdom became obvious to me, resulting in most of the then existing development being scrapped. Most basic circuit principles were 'out of the window' and I started again, designing by ear.

The re-development is now complete, with some of the most peculiar circuits and component values that you could come across. What a sound though! With listening to live orchestras and adjusting the circuit to match the sound, in the final stages of development, designing by ear has worked wonders. Our film sound has now improved so dramatically that the public are praising the film music as better than from CD at home. While Peter Handford, a top film recordist, takes his wife to see his films at a cinema with our sound.

Yes, I have still put in equalisers, although only bass-mid-top. It is not the usual circuit though, this one is again designed by ear. It is also usually close to level in most locations. Insertion of this stage alone between tape or CD and any amplifier stages on home hi-fi, makes a world of difference in cleanness, quality, separation and frequency range accepted by the ear. While CD, which has been to me, (and many others) very tiring to listen to after two or three tracks, is noticeably cleaner—yes cleaner(!) and comfortable to listen to continuously.

I wish Ted Fletcher luck with his attempts to get the recording industry to clean up their act, with restraint on EQ, etc.

Yours faithfully, Keith Tricker, Cinesales Ltd, The Mill, Alpheton, Sudbury, Suffolk CO10 9BG, UK.

Studio Sound welcomes letters. They should be addressed to the Editor, Studio Sound, Link House Magazines, Dingwall Avenue, Croydon, Surrey CR9 2TA, UK.

Pink Noise.

Pink noise and realtime analyzers are quite suited to defining the frequency response of room absorption. Any statement concerning their use, however, in measuring a particular loudspeaker set-up seems less feasible, since the typical measurement position is usually located far into the diffuse field. The recipe is quite simple: take a linear loudspeaker system that displays a predictable response even in a complex set-up. Or use a sophisticated measurement procedure – a method which may be interesting from the technical point of view, but practically speaking still leaves something to be desired, doesn't it? Telephone+49-7191-62063, Bob Kelly, W-Germany.

d&b audiotechnik

Autumn '89

Solid State Logic

Audio for Vision

Lucasfilm. One of many facilities now using SSL systems for creative audio production with film and video

(See Page 4)

Impressão Digital Studios in Rio de Janeiro, Brazil. The first SSL in South America.

(See Page 2)

Also Inside:

Digital Audio Data Compression

Rack Mount G Series

BBC's First G Series

Japan & Canada

BBC's First G Series

The BBC has installed its first G Series console in Studio 5 of its Maida Vale complex in London. The SL 4056 G Series has 48 mono and 8 stereo channels and a G Series Studio Computer. It is being used for recording and mixing sessions for both the Radio One and Radio Two networks.

The G Series console is part of a major redesign and re-equipment programme which takes account of the latest trends in music production. An enlarged control room enables musicians to patch electronic instruments directly through the console.

Martin Bravery, Project Manager, BBC Radio Projects comments. "We can now carry out 48 track mixing for the first time. Most of our engineers are already familiar with SSL consoles and they are delighted with the additional sonic and operational benefits provided by the G Series desk."

Four other SL 4000 consoles are operated at Maida Vale. With the installation of this latest desk, the BBC now has 17 SL 4000 consoles at studios throughout the UK. The latest G Series is the 23rd SSL console supplied to the BBC.

▲SL 4056 G Series in Studio 5, BBC Maida Vale, London with Project Manager, Martin Bravery.

SSL Flies Down To Rio

▲The 64 square metre control room at Impressão with SL 4056 G Series console.

The first world-class recording studio in South America has recently opened in Rio de Janeiro, Brazil. To underline its status, Impressão Digital Studios has installed a complete range of sophisticated recording equipment. This includes an SL 4056 console with G Series Studio Computer and Total Recall™, and 2 Studer A820 24 track tape machines. The studio houses the first SSL console we have supplied to the sub-continent.

Impressão is owned by leading South American producer, Mazzola, who has produced over 35 gold and platinum records and has an impressive track record of hits with Polygram, WEA, Ariola and CBS. Mazzola is one of the most popular producers in South America and has worked with many of the best South American acts.

In addition to being used by Mazzola for his own productions, Impressão will also be available to external clients. Several top international artistes have expressed great interest in the studio which already has an encouraging level of future bookings.

Mazzola, who mixes all his own productions, chose the SL 4000 G Series because, as he explains, "I was so impressed with SSL systems I had worked on at studios throughout the world. Whether it be for tracking or mixing, the ergonomics and sound of the desk are great. The new G-Series microphone pre-amps and equalization give a smooth sound and the SSL is unrivalled for mixdown."

SSL at the TEC Awards

SSL consoles are a feature of America's most respected studios. This is evidenced by the nominations for Outstanding Recording Studios in the 1989 TEC (Technical Excellence and Creativity) Awards.

Every nominated studio in this category of the Mix Magazine sponsored awards is an SSL equipped facility.

The nominated studios are: A&M Recording, Hollywood; The Hit Factory, Power Station and Skyline—all in New York; and Chicago's Streeterville Studios.

In addition, Effanel Music, New York, which has an SSL equipped mobile, has been nominated in the Remote Recording category of this year's TEC Awards.

SSL has also had the OI Digital Production Centre nominated for the Console Technology Award.

Encore for SSL

In 1979 Kendun Recording in Burbank, California bought the first SSL console in the USA.

Ten years later the same studio, now known as Encore Studios, has again chosen the latest development in audio recording technology. This is an SL 4064 G Series with 56 mono and 8 stereo channels, complete with G Series Studio Computer and Total Recall™. The console has been purchased to serve the increasingly sophisticated recording needs of Encore's clients.

Freelance engineer Barney Perkins, who works almost exclusively out of Encore, with artistes such as Anita Baker, Cameo and Jennifer Rush, influenced the decision to go G Series. He wanted a console that produced a more defined sound that could later be creatively adjusted.

"Computer assisted engineering and fully automated consoles like the G Series have become critical recording trends over the last decade." Perkins explains. "The SSL computer is an excellent aid in the recording and mixing process. It lets me do so many things to make recording even better."

"The biggest advantage of the G Series," Perkins adds, "is the way it relates to what I hear. With other consoles I have to struggle to get the sound I want. The G Series console creates spaciousness without extra noises or unwanted frequencies and, to me, the SSL achieves this far beyond other consoles. It lets me hear the music as it really is and then I'll take it from there."

The console has already been used on the 'Lethal Weapon' soundtrack with David Sanborn and Eric Clapton. Current and future projects include a digitally recorded Cameo album and a forthcoming album for Anita Baker.

The original console which was purchased in 1979 has been sold to another studio where it is still providing sterling service.

G Series in USA and Japan

◀ *Larrabee Sound, Hollywood, one of the industry's premier mixing studios, has celebrated its 20th anniversary with the installation of an SL 4072 G Series. Pictured mixing tracks for Smokey Robinson's latest album are producer Taavi Mote (front) and Larrabee Sound owner, Kevin Mills.*

▲ *Tokyufun Recording Studios, a new state of the art three-room facility in Tokyo, has recently opened with G Series consoles. Each control room is identically equipped with SL 4064 G Series consoles and Sony PCM 3348 tape machines to provide uniform sound control.*

Rack Mounted G Series

G Series electronics are now available in a range of 1U 19" rack mount units under the Logic FX trademark, which can be used to extend the capability of existing SSL systems or to bring SSL G Series performance to consoles made by other manufacturers.

The first two Logic FX products are the G383 Dual Mic Amplifier and Equaliser, and the G384 Stereo Compressor.

Logic FX G383

The mic amplifier section accepts a transformerless balanced input and has variable input impedance and gain controls. Phantom power supply, phase reversal and Insert Send and Return facilities are provided.

The 4-band parametric equaliser can be switched in or out of the signal path and features 12dB/octave HF and LF sections with variable cut-off frequencies and boost/cut controls.

Logic FX G384

The G384 is a Stereo Compressor with balanced inputs/outputs. Features include external side-chain input switching and a switchable Auto Fade VCA control facility with a variable rate, which may be set between 1 and 60 seconds.

The compressor can be switched in or out of the signal path and has controls for ratio, attack, release, threshold and gain make-up. A meter is provided to indicate gain reduction.

ScreenSound

First Systems Installed

SSL's acclaimed ScreenSound digital audio-for-vision editing suite has gone into full production. Systems are now being supplied to audio and video post-production facilities throughout the world. The first systems have already been installed at Molinare SA, Madrid; new London video facilities house Pearson & Roff; and Nederlandse Omroep Bedrijf (NOB)–the Dutch broadcasting organisation. Further orders and deliveries for clients in the UK, Europe, Canada, the USA, Japan and Australia are scheduled over the coming weeks.

The success of ScreenSound at international exhibitions and demonstrations has been matched by the enthusiasm of the first operators. Bruce Gray of Molinare's Audio & Digital Department in Madrid, typifies the response: "ScreenSound has been installed in our 24 track audio dubbing suite where it is used in conjunction with our 48 channel desk. In the two months we have had ScreenSound it has proved to be an excellent editing system and it has generated a great deal of interest from clients. We have so far primarily used ScreenSound for digital audio editing on commercials and here it has already proved to be a really useful part of our set-up."

Particular ScreenSound features which Bruce Gray has found praiseworthy are, "the ScreenSound automation system which is a big bonus for mixing; the facility to carry out accurate edits with ease; and the pop-up menu pages. The zoom facility which enables you to zoom in on the audio waveform for critical edit point location is especially useful."

ScreenSound is the digital equivalent of a complete audio-for-vision editing suite that in conventional terms would consist of a stereo analogue and digital record/playback machine, vari-speed multitrack, unlimited audio library source, synchroniser controller, film style flatbed editor, tape storage medium and an automated mixer. The system uses a bitpad tablet and pen and full size QWERTY keyboard as the operator interface, with system menus and functions being displayed on a video monitor.

Using the three main operating modes–Desk, Store and Library–an operator can record and access soundfiles, mark, edit and position cuts, alter crossfades and offsets, autolocate, and mix sound clips to picture.

Recent ScreenSound enhancements include full VTR/VCR or film reproducer machine control and the addition of further sound reels. ScreenSound now offers 16 sound reels, of which 8 can be worked on simultaneously.

ScreenSound provides the ideal digital working environment for audio editing, mixing and recording for off-line video and film post-production and audio-for-video editing applications.

As the system has been designed for ease of use by the operator, it allows users to make the best use of their creative skills.

▲ *ScreenSound's tablet, pen and video monitor interface in a typical off-line editing mode*

◀ *The first SL 6000 G Series at Post Logic, Hollywood*

SSL Systems for Film and Video Post-Production

In addition to ScreenSound Solid State Logic produces three distinct console series for post-production applications. These are the SL 4000 G Series, the SL 5000 M Series and SL 6000 G Series.

The SL 4000 may be used for mono and stereo video and film track laying, mixing and over-dubbing. Film panning may also be specified, further extending the system's film sound-track mixing and scoring capabilities.

Because the SL 5000 M Series is based on a modular cassette structure, systems may be specified for a wide range of audio, video, television and film post-production requirements. Over 60 different cassettes are available, allowing systems to be configured for a multitude of applications. Dedicated custom consoles for specialist applications requiring mono, stereo and film release format outputs may therefore be constructed to exactly match a client's needs.

The SL 6000 offers mono or stereo track laying, mixing and overdubbing facilities and is especially suitable for video and television post-production.

All these SSL consoles may be fitted with the company's G Series Studio Computer and Total Recall™ automation systems. The SL 5000 M Series also offers the option of Instant Reset™ allowing complete console set-ups to be stored and reset.

Recent post-production installations include an SL 6056 at NBC Television's Post-Production Department in Burbank, California (NBC's nineteeth SSL console); an SL 5448 at Fox Television's Hollywood posting centre; an SL 4040 at Century III Tele-productions, Orlando, Florida; an SL 4040 at TV Ontario, Canada; two SL 5556 and SL 5316 systems at the BBC TV Centre in London; and an SL 5648 and a pair of SL 5432 systems at Danmarks Radio, Copenhagen.

Following the introduction of the SL 6000 G Series earlier this year, the first systems have now been installed. An SL 6064 operating at Post Logic in Hollywood is the first. This console has been customised to provide the option of one, two or three man operation, allowing it to be used for a wide variety of

▲ SL 56124 M Series at Walt Disney World

Recent installation at Todd AO/Glen Glenn, New York ▶

◀ Effanel Music mobile

◀ Alan Taylor Head of Sound at Films of Bristol, with their SL 6032 E Series

SSL At the Movies

The success of SSL systems for film compilation and mixdown has been confirmed by box office ratings. Recent block-busters 'Indiana Jones and The Last Crusade' (Lucasfilm) and Ghostbusters II' (Todd AO/Glen Glenn) were both mixed on SSL consoles, while other successful SSL movies include 'Burbs', 'Oliver & Co.' and Cocoon: The Return'.

The soundtrack for this year's smash hit 'Batman' was also produced on an SSL system. Prince used an SL 6056 E Series console at his Paisley Park Studios for the 'Batman' soundtrack using improved G Series modules to give the sound extra depth. Indeed, Prince liked the G Series sound so much that he is now upgrading his console to full G Series specification.

The popularity of SSL systems for film mixdown, especially the SL 5000 M Series Film Post-Production system, has been endorsed by orders for SL 5000 systems from three major US film production companies.

Joining the ranks of international film studios such as Lucasfilm, Todd AO/Glen Glenn, Disney/MGM, Pinewood Studios, Mosfilm and Bavaria Film, are three of Hollywood's most prestigious companies.

Foremost among the new purchasers is Universal City Studios which has ordered a three operator SL 55128 M Series with 80 channels and Instant Reset™. This is to be installed in Universal's Alfred Hitchcock Theatre.

A further three operator console – an SL 55112 M Series with 68 channels and Instant Reset™ – has been purchased by Buena Vista Studios for its Dubbing Stage C in Burbank.

Buena Vista is part of the Walt Disney organisation and this is the third SSL film console purchased by Disney companies in the last 12 months. An SL 56124 and an SL 6040 having been installed at Walt Disney World, Florida.

Independent Los Angeles production house, JDH Sound, has also ordered a three operator console. JDH's console is an SL 55100 M Series with 72 channels and G Series Studio Computer with Total Recall™ and Instant Reset™. All three consoles feature joystick film panning and on-board recorder controls.

SL 4000 for US Independent Mobile

Effanel Music, New York, has become the first independent audio/video mobile facility in the USA to install an SSL console – an SL 4040 E Series with 38 mono and 2 stereo channels, and G Series Studio Computer. Other than Effanel, only US broadcasters NBC and Turner Broadcasting offer such advanced, automated consoles.

The Effanel console is installed in a 45 foot air ride trailer and operates in conjunction with a pair of Otari MTR-90 24 track tape machines with 48 tracks of Dolby SR noise reduction.

The desk is being used for both live broadcast feeds to clients such as NBC and for recording multitrack audio for music video projects.

Randy Ezratty, owner of Effanel, chose SSL because, "Overall, the console captures the usable clarity that exists in a live recording more than any other console I have ever used. At the touch of a button all processing is in line. With the SSL all the signal processing you need is right there on the board. With the console you have the freedom to experiment."

applications from simple track laying to complex dubbing.

The second SL 6000 G Series has gone to the Canadian Broadcasting Corporation's post-production facility in Toronto. CBC's SL 6048 is being used for on-air stereo broadcasting in addition to its 'post' role.

Post-production systems currently on order include three SL 6040 G Series for Sveriges Television in Gothenburg, Lulea and Sundsvall; an SL 5448 for Video Dubbing Suite 2 at TVS, Southampton; and an SL 4040 G Series for Prosen, Tokyo.

SL 6000 – "A Great Success"

Films of Bristol, the recently formed film, video and audio facilities company based in Bristol, England, has installed an SL 6032 E Series Stereo Video System in its Audio Post-Production Room.

The 24 channel audio mixing console is being used for final post-production mixdown for film, video and radio programmes.

"The desk has been a great success," said Richard Cobourne, Operations Director of Films of Bristol. "We have already used it on multi-lingual productions and lots of cartoon and animated productions. The flexibility of the console routing and the ability to mix music, dialogue and effects separately has proved invaluable. On top of these benefits the desk has an authentic sound, the EQ is first class and the dynamics are superb."

Alan Taylor, Head of Sound at Films of Bristol commented, "My first thoughts were that the console was too sophisticated for our needs, but I soon revised my opinion. Its versatility and flexible routing make it a very creative desk on which to work. I use the VCA facility and the subgrouping a great deal. Also the option of using the monitor faders as extra inputs is fabulous, as it means I can have 48 channels if I need them."

Major Italian Broadcaster Chooses SL5000

Five identical SL 5444 M Series Audio Production Systems, with 24 mono and 8 stereo channels, have been ordered by Videotime SPA, the largest private television group in Italy.

Videotime is owned by the Fininvest Group television division and provides live and recorded programmes for the Group's television networks–Canale 5, Italia 1 and Rete 4–from three production centres in Italy.

The first of the consoles has been installed in Studio 7 in Videotime's Cologno Monzese production centre in Milan. The remaining consoles are destined for Studios 4, 5 and 14 at the same centre, and for a new Outside Broadcast Vehicle.

Videotime are the fourth largest private television group in the world, with over 20 studios and numerous OB vehicles. They are highly respected throughout the broadcast industry. In 1988 Videotime produced over 4,500 hours of television programmes including variety shows, drama, sport, cultural programmes, plus news and information programming.

Their choice of the SL 5000 M Series for their Cologno Monzese production centre is a first for SSL in Italy and has attracted considerable attention from other broadcasters–both in Italy and worldwide.

Other SL 5000 M Series TV Production consoles recently installed in Europe include an SL 5656 M Series with 32 mono and 8 stereo channels for Swiss TV's Studio 2 in Zurich. This joins an SL 5672 M Series with 48 mono and 8 stereo channels in Studio 3 and an SL 5548 with 28 mono and 6 stereo channels in Studio 4. All the consoles feature SSL Total Recall™ and Instant Reset™ systems. The sound studios at SRG (Schweizerische Radio und Fernsehgesellschaft) are now all equipped with SL 5000 M Series Systems.

▲SL 5444 M Series Console at Videotime's Studio 7

Other European broadcasters operating SL 5000 M Series consoles include the BBC, London; HTV, Bristol; YTV, Leeds; RTE, Dublin; Danmarks Radio, Copenhagen; NRK (Norwegian State Broadcasting), Oslo; Bayerische Rundfunk, Munich; Radio Bremen and Paris Omnisport Production Broadcast.

First Norwegian SL 5000 M Series

The Norwegian Broadcasting Corporation (NRK) has installed its first SL 5000 M Series Audio Production System. The console, an SL 5544 M Series, has 32 channels and is equipped with SSL's Total Recall™ computer system. It is installed in NRK's Radio Drama Studio, K21, in Oslo, where it is being used to produce live stereo radio drama.

NRK has a lengthy tradition of producing radio drama theatre with over 50 years experience of such production. The department produces over 120 dramas per year and is one of the largest producers of children's radio drama in Europe. A wide range of productions, both large and small, are undertaken by the department, which has a large staff of experienced and skilled drama recording engineers.

Aage Sandaker, the Head of Drama Section, and Sture Bakke, Senior Drama Engineer, are extremely pleased with the new console. Aage Sandaker commented, "In competition with other console systems which we have evaluated, the SL 5000 M Series was the only system which gave us the flexibility we were looking for. The system's cassette module structure gave us the opportunity to configure and specify a console which met our special needs in radio drama production. We also appreciated that SSL offered excellent training back-up for both operators and maintenance technicians. The cooperation and service we have received from both SSL and their Norwegian distributors, Siv Ing Benum A/S, from the specifying and placing of our order through to the production of our first on-air drama has been excellent."

Radio Bremen Takes To The Road

North German regional broadcaster, Radio Bremen, has installed an SL 5000 M Series console in a brand new audio OB truck. The mobile's SL 5548 desk has 32 mono and 4 stereo channels plus SSL's Instant Reset™ computer system. The new mobile forms part of an expansion of radio OB operations by Radio Bremen. It will also be used in conjunction with the television arm of Radio Bremen as required.

The new OB truck, which was constructed by Monitora–a prominent German installation contractor–is primarily being used for general production and remote recording of classical music concerts and music events. However, it is also being used for live stereo radio transmissions via five of Radio Bremen's FM channels.

Rolf Klapschinski of Radio Bremen said, "The console has been a great success. The operators have found it to be highly flexible and very easy to use. In particular the advantages of VCA grouping, Instant Reset™, and the flexibility of the output routing have proved invaluable."

Major broadcasters operating SL 5000 M Series consoles in mobiles include US network ABC Television and Radio Telefis Eireann, Dublin.

ABC's MVC-2 mobile was used to produce all the television audio from the 1988 Olympics in Calgary, while the RTE mobile was used to broadcast the 1988 Eurovision Song Contest from Dublin.

Digital Audio Data Compression System

SSL has formed a new subsidiary company, Audio Processing Technology, to market a digital audio data compression technique pioneered by Dr. Stephen Smyth of Queen's University, Belfast.

The **apt-X™ 100** Real-Time Audio Data Compression System is the first product of the new company. **apt-X™ 100** compresses 16 bit digital audio to a 4 bit sample code with no subjective loss of quality. The system has a wide variety of applications in areas such as audio transmission and storage, satellite and land based broadcasting, cable audio distribution and ISDN telecommunications.

The **apt-X™ 100** system accepts mono or stereo analogue signals, converts these to 16 bit digital audio, then compresses these to 4 bits per sample for tranmission or storage. Upon recovery, the compressed signals are converted back to 16 bit by the system, prior to digital to analogue conversion.

The system automatically adjusts to sample frequencies up to 48kHz, with the resultant bit rate equaling 4 times the sample. For example, with a 32kHz sampling rate the data rate is 128kbits/sec per audio channel with an audio bandwidth of 15kHz, but at 48kHz the rate is 192kbits/sec with an audio bandwidth of 23kHz. A wide range of sampling rates can be used, so it is possible to use the system in applications which require only a limited audio bandwidth with lower sampling and data rates. For example, a 7.5kHz audio bandwidth sampled at 16kHz produces a data rate of only 64kbits/sec.

Using Sub-band Adaptive Differential Pulse Code Modulation techniques, the **apt-X™ 100** system exploits the natural redundancies in audio signals by combining the benefits of digital companding with sub-band coding and linear prediction to take advantage of inherent time and spectral redundancies. The system splits the signal into bands with the degree of quantisation in each band varying according to the input signal energy. The result is real-time compression of audio signals to 4 bits per sample with no subjective loss of quality.

High energy regions of the signals can, therefore, be coded more accurately than with PCM, giving a lower coding noise floor. The

very low coding delay (1.8ms at 32kHz sampling) allows, for example, an off-air signal to be used for foldback.

The system is also extremely error-resistant. At a rate of 1:10,000 there is no subjective degradation and it is still possible to hear the program content at a rate of 1:10! System security is very high, because an exactly matching decoder algorithm is required for the system to operate. Even greater protection can be provided by using an algorithm with a customised signature. Network commands, station idents etc, can be inserted in the compressed audio data stream without increasing the transmission bandwidth.

The **apt-X™ 100** system is a low cost, high quality data compression system which provides reduced bandwidth requirements, lower bit rates and greater channel capacity than current PCM systems.

Research continues to further extend the capabilities of the system. Our target is to achieve a similar audio quality from a 2 bit system (64kbits/sec/channel for 15kHz audio bandwidth) within the next 12-18 months. Systems installed now are intended to be upgradeable by simple replacement of the **apt-X™ 100** component.

apt-X™ 100 is a Trade Mark of Audio Processing Technology Limited

Japanese Digital First

The first 01 Digital Production Centre to leave SSL has been installed at leading Japanese video facilities house, Video Sunmall. The Tokyo based video and audio post production facility

is using the 01 in its Audio Suite, which is a fully fledged recording studio. Here it operates alongside the studio's 48 channel SL 4048 G Series console.

The 01 is being used by Video Sunmall primarily for mastering and editing purposes. Mr. Namakata, Chief Engineer, said, "We are honoured to be the first operators of the 01. It is a fabulous machine. As we become more experienced with it, we expect to find new technical and creative ways of realising its potential."

The 01 is a totally integrated stereo digital mastering system. It comprises an edit suite, 8 channel digital stereo mixer with extensive signal processing (including digital assignable EQ and dynamics sections) and a hard disk store giving two hours of stereo audio storage.

The system's simplicity of operation and familiar console and editor control surface have been universally praised. Further, its ability to provide high quality digital audio through all stages of mixing, signal processing, editing and sequencing have received enthusiastic endorsement from engineers and producers at exhibitions and demonstrations throughout the world.

Shinto Blessing for SSL Japan

SSL Japan opened in April following a traditional Shinto blessing at its Tokyo premises. This new subsidiary company will co-ordinate all Far Eastern sales and service operations, excepting Hong Kong and China. SSL is already recognised by Hideo Tanaka, Chairman of the Japanese Association of Professional Recording Studios as being "a major part of the Japanese recording industry."

Takeo Asano, Managing Director of SSL Japan, is well known as the former head of the SSL division of Studer Revox, Japan. He oversaw the spectacular success of the SL 4000 following its introduction in 1982. Envisaging "increased sales and service support", he will be assisted by key personnel who have also transferred from SRI. This will maintain continuity for SSL's clients in the Far East.

Described by SSL Chairman Colin Sanders, CBE, as "an important step in the continuing growth of Solid State Logic," SSL Japan will consolidate the company's already excellent reputation. Over 120 systems are now in operation and eliciting a strong response throughout Japan, Korea and Taiwan.

▲ *Takeo Asano and Shinto priest at the opening ceremony for the new SSL Japan office.*

New Canadian Subsidiary

Emphasising our long term commitment to the Canadian recording, broadcast and post-production industries, a new SSL subsidiary has been opened in Toronto.

The new sales and service centre, which commenced operations in June, is headed by Vice President/ General Manager Gerry Eschweiler, formerly with Mitsubishi Pro Audio. "I know this increased support for Canadian facilities will be warmly welcomed," said Gerry, "The new office will enable us to improve our support for the increasing SSL client base across Canada. It will also provide greater opportunity to demonstrate SSL products to potential Canadian users."

The move has been applauded by existing clients such as Chris Bell of TV Ontario, who commented, "It's great to see a leading manufacturer make this sort of commitment to Canada." Gil Moore, drummer with Triumph and owner of Metalworks Studio, adds, "This is yet another example of SSL giving the Canadian recording industry its serious consideration."

▲ *Gerry Eschweiler (right) with Tim Lyons, Technical Services Engineer and Lenore Sicari, Office Manager.*

SSL People

To strengthen the formulation of SSL's marketing policies, Colin Pringle, previously Head of Marketing has been appointed to the board as Marketing Director. Based at the company's Oxford headquarters, his appointment will ensure a cohesive and informed international marketing strategy.

Piers Plaskitt, formerly Vice President of SSL Inc., has been appointed Chief Executive Officer. In his new role Piers takes overall charge of US operations and will develop even better sales and service support and improved administrative capability.

Michel Yves Geugen has been appointed Managing Director of French subsidiary, SSL SARL. Based at the Montigny le Bretonneux office, Michel brings a wealth of knowledge and business flair proven in senior positions at IBM France and IBM Europe.

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MODULAR ACOUSTICS

Janet Angus investigates the pros and cons of modular acoustic techniques by talking to KFA Design

Studio design is a consistently changing 'ideal' but it is not only design that has seen changes; traditional construction techniques have been challenged by the availability of what is known as a 'modular' approach. Although this has been available for some years from various companies, it has never been on enough of an individual basis for most commercial recording studios to consider. When KFA set up their studio design business three years ago it wasn't on their minds to do anything radically different. A series of happy coincidences meant that they had access to a vast expanse of warehouse in North London. It seemed easier at the time to set up a production line for component parts rather than transport building teams to and from the various projects they had underway.

However, managing director Mick Fitzgerald's background is in the construction business so he has management skills that can see past the designs to the practicalities of implementation. He also feels, through his role as a record producer, well equipped to understand studio clients' needs.

KFA have risen from nothing to their current position with 12 studios under construction in their factory. The 'modular' approach's strongest appeal to the client would appear to be that most of the disruptive work is carried out in the comfort of the KFA factory, allowing the facility to carry on working throughout a great deal of the construction process. The only downtime is incurred during installation. This naturally means minimum loss of income while the building work is going on.

From Fitzgerald's point of view it means that he can exercise stringent quality control without the difficulties involved in simultaneously managing several sites. Working in the factory is also naturally more efficient as the tools and technology are all available in an ergonomic environment. Another benefit is that several components can be worked on at once and by pre-assembling rooms in the factory any prospective problems can be identified.

The use of a Computer Aided Design system has minimised mistakes that Fitzgerald emphasises, are so easy to put right in the factory—little things that would prove difficult if only discovered during the finishing stages of on-site construction.

It all sounds a bit too good to be true. Surely the cost of assembling a studio twice must be greater? Fitzgerald explains that not every facility will be fully erected in the factory. Many rooms have similar features with tried and tested standard components and, because of the CAD system, they know they will fit. Only the bigger studios, or complicated/unusual designs will be fully pre-assembled. For example, KFA is currently constructing a £2 million studio complex for an undisclosed French client. The entire construction will be up and running and fully tested in London prior to shipping (when a 25-man construction team will move onto the site).

On the other hand there are clients like George Peckham of Porky's mastering and cutting facility. KFA are in the middle of building their second room for him, which has proved to be fairly awkward (due to enormous space restrictions with odd pillars and RSJs, etc, in the way) and this will be pre-assembled in the factory, as was the cutting room they built for him 18 months ago. This has turned out to be for KFA's own peace of mind rather than Porky's as Peckham can never quite find the time to go and see it.

"Porky's was the first we assembled completely off-site," Fitzgerald remembers. "It was quite a tight brief with a tight budget and he had all sorts of problems. The studio is on Shaftesbury Avenue right in the middle of London, with train noise and a shop upstairs. There were RSJs suspended down all over the place; we had

Studio construction using the modular approach at KFA's factory in London

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◁ problems getting the air conditioning out to the exterior walls, which were 50 ft away. It was a subterranean hole really."

In spite of CAD, KFA are only human. They overlooked the studio access and found that their pre-assembled wall panels were too wide to get in. "So we removed a pavement light in Shaftesbury Avenue with some hilarious consequences, which you can't publish."

One of the earliest projects was for Livingston, London, which has close associations with KFA especially since the factory is on their site. KFA built Studios Three and Four, and despite being next door, the bulk of construction work was carried out in the factory for sheer convenience. This really marked the beginning of KFA in any serious shape or form.

"The biggest problem with studio builds seemed to be controlling what was going on at the sites. Because of the need for total quality control you spend your life going round checking what the chippies are doing. So we thought 'wouldn't it be good if we could do an MFI-type kit'. Next we thought, let's set up a factory—half of the Livingston complex was standing empty—next thing you know we have built nine studios in our first year.

"We were very naive about the modular approach to start with, thinking you just bolted together some panels and they would work. It takes a lot of experience to be cost effective and maintain consistent standards. We have since invested heavily in R&D—the latest being in the broadcast field.

"The modular thing was developed in stages. First the outer shell, then the speaker sections, then outboard racks and so on. Everything is made and fitted in our workshop. Nowadays there will be as many as 300 design drawings for a studio; it is a huge kit of parts.

"We wanted to control production quality as well as minimise the disruption factor. Most clients feel that a lot of sawing, banging, crashing and walloping disrupts the sessions in their other rooms. It is also much more efficient; for example we have just manufactured 150 wall panels in the last three days. The interior acoustic panels are built in several component parts, all in traditional materials."

Clients are presented with a set of 10 drawings showing floor layout, wall panel sections, ceilings, interior details of acoustic panels, internal fittings, electrical fittings, air conditioning and acoustic doors, windows, etc.

"Everything is manufactured by us. We did buy windows and doors once but they didn't fit and cost an arm and a leg. We buy the wood in as logs now. Quite honestly I got fed up with being let down. We have our own electricians, air conditioning site—it is a totally turnkey operation."

There are 35 permanent staff ("five in the office thinking, and 30 producing") increasing to as many as 90 depending on demand.

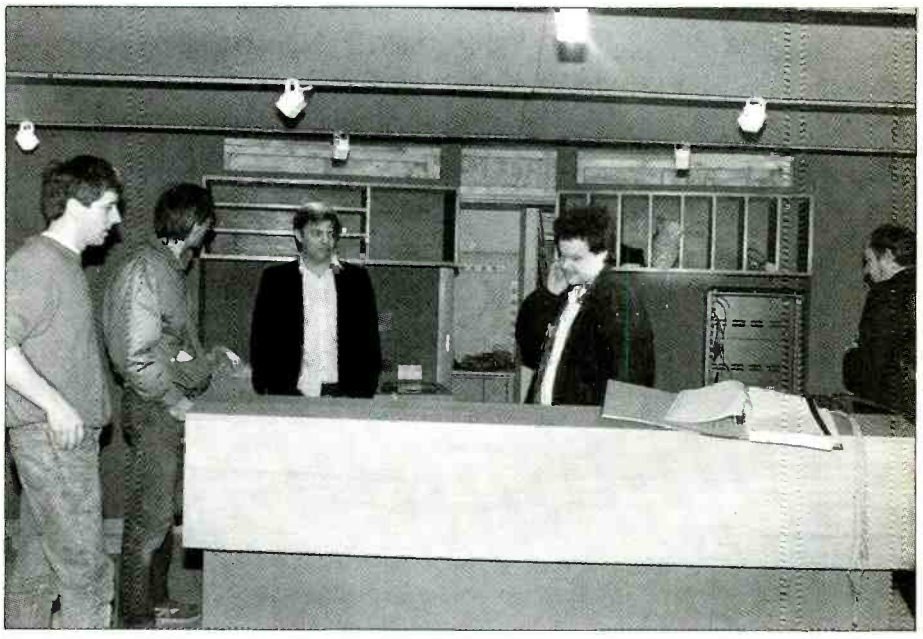
"Working this way the site time is predictable and controllable. The modular thing is purely for convenience of installation. We don't sell it as a concept, we are simply selling studio designs and that happens to be the way we work. A lot of people talk about the fact that you could conceivably dismantle it and take it with you but I don't see that as being seriously desirable although we have recently made two sales on short leases, so who knows?"

Acoustics are tailored by resident physicist Paul Berg. "A lot of people talk about the 'mysticism' of acoustics," says Fitzgerald, "there isn't any; it's pure physics. You have to control standing waves in a room, so you make sure that room is right. You can go on about 20 Hz rooms, 25 Hz rooms, which philosophy is right—endlessly. But a room has to be so that a recording doesn't get coloured, that's all. So you use panel absorbers and trapping as required depending on the space. One thing I don't do is diffuse—I don't believe in it.

"Paul Berg designs the acoustics of each room, depending on shape and size. Together we work on the feel as it is not simply a case of getting it flat; it has to feel right."

Master Rock studios was the first major independent studio client, and owner Steve Flood must take the credit for being the catalyst for KFA's working practices. It was his expressed desire to have the bulk of construction carried out away from his studio, which sparked the whole thing off.

"Steve Flood is very technical, very demanding and has the most amazing energy. He wanted a studio but didn't want it built with traditional brick/blockwork because it was being constructed only 2 ft away from his existing studio, which mustn't be disrupted.



Porky's mastering and cutting facility in London was the first to be completely assembled off-site at the factory

"Steve gave us a lot of input in helping develop the system and we worked together as a team for 12 weeks."

Steve Flood recalls the prospect of extended downtime with horror: "If we had used heavy construction techniques the downtime would have been horrific. The entire studio would have turned into a building site. As it was we closed for five days and in fact we ended up selling three of those to someone who didn't care about the building work going on.

"It's also cleaner; there are all those kinds of advantages. The implementation of good prefabrication techniques and the fact that it all bolted together on to rubber seals meant that there was no working noise. The work was quick with no nonsense. Traditional builders are noisy and disrupt you totally.

"And it was ridiculously fast; that really is the key. It saves considerably on costs."

Unfortunately, it has not always proved possible to be so unintrusive. What was originally planned as a simple refit at Battery Studios turned into a mammoth construction project as major structural ▷

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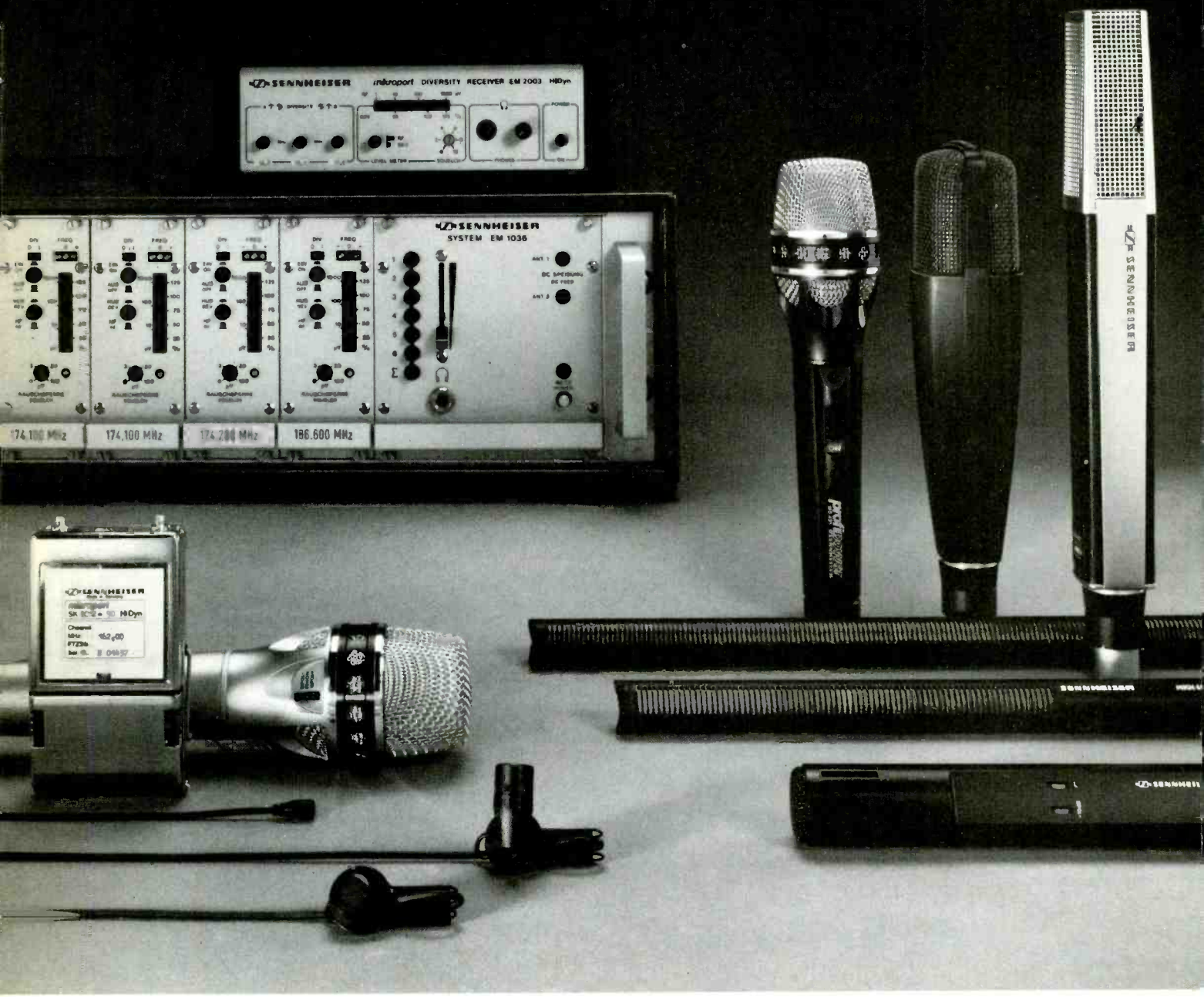

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◁ defects were discovered in the building. Nevertheless, while this was being put right the factory team was able to get on with pre-assembly of the modular components. Although the final site time was six months it had been cut almost in half as all joinery, patio doors, internal fabrication of the dividing walls, etc, were completed off-site.

More recently KFA has gone into the realms of 'off-the-peg' studio kits with the launch of the *Box* at APRS '89.

"It started as a joke really. We wanted something to show at APRS and it was built really as an exhibition piece, but we took orders for three or four even before the show began.

"We had had lots of requests for a pre-production room in which you could do things you didn't want to take up a whole studio to do, but it had to sound like a control room. The criteria were price; reasonable isolation; good internal acoustics; that it should look acceptable and be nice to work in, ie air conditioning and nice lighting. There has been huge demand for these criteria and we have sold 16 *Boxes* since June."

This also provoked interest from the broadcast sector during the show and hence the company's subsequent investment in broadcast R&D, culminating in IBA approval of the broadcaster's version of the *Box*. The only thing they baulk at is the name—it's not quite grand enough for impressing those who control the purse strings at the larger broadcasting corporations. They have in fact had requests not to refer to it by name in meetings.

The package comprises a floating floor, wall panels, ceiling panels, internal acoustic panels, internal decoration panels, air conditioning, lighting, carpets, hardwood acoustic doors and windows plus installation. Its RT meets the IBA code of practice; bottom end isolation is quoted as 36 dB at 63 Hz, and midrange as 65 dB at 1 kHz.

"We didn't plan the *Box* for the broadcast market, it just happened. We offer a standard box (4.2×3×2.3 metres (normal room height)). With 400 community radio licences recently issued in the UK we anticipate, and are experiencing, heavy demand. Controlling the room nodes in a small environment is not easy and the broadcast market observes strict IBA codes; it has been hard work to comply with these but worth it in the long run."

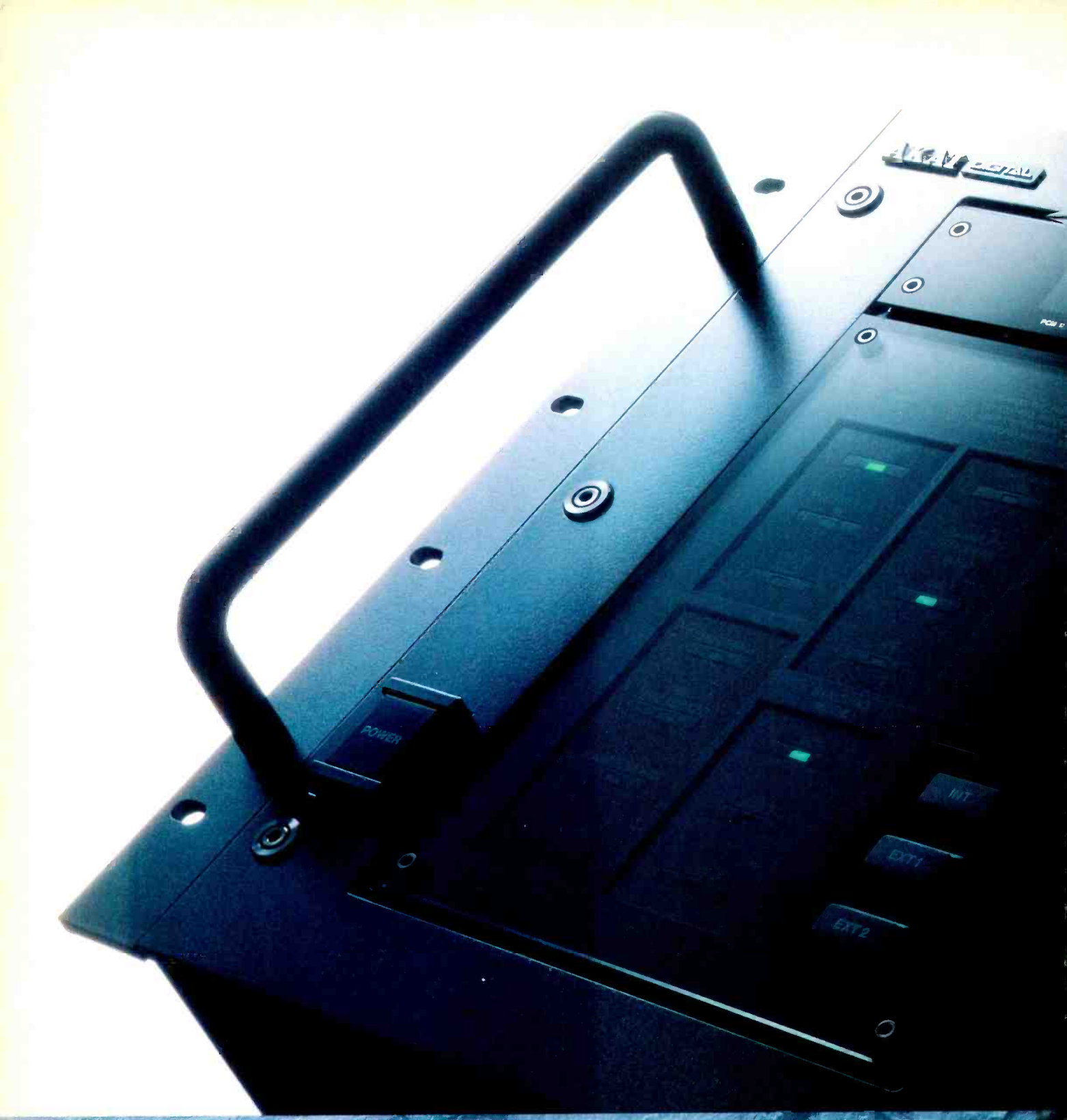
One of the hazards of working with clients such as the new community radio stations is that they are not necessarily experienced in these things. For example, WNK radio was all set to go ahead with construction on the ground floor of their building. The night prior to commencement of the project Fitzgerald attempted delivery of a large number of components. Unable to obtain a key he offloaded into the car park some £30,000 worth of equipment and parts only to be contacted by telephone that evening by the client. 'Oh sorry, we've changed the building.' What?! 'But it's OK it will still fit'.

"When we saw the new building it turned out they were now on the first floor, which needed RSJs, etc, the access was bad and all those other problems, but he was right, we were able to fit the pre-assembled studio in with 6 inches to spare.

"But that's all contract management which we do as a matter of course."

Time brings experience and apparently an ability to cope with the most hair-raising experiences, as any studio specialist knows only too well. In KFA's case they feel the problems are lessened by the fact that they can remove themselves to the relative sanity of their factory and set about working them out.□

At Livingston one of KFA's studios is almost complete



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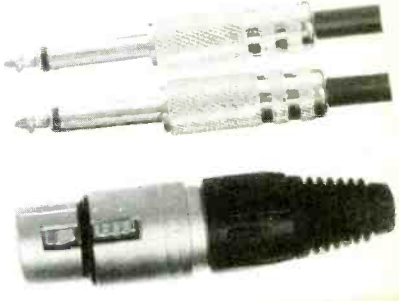

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DIFFUSORS AND THE MATHEMATICS OF CHAOS

Pete Ridsdale interviews Neil Grant to reveal the secrets of Diffusors

Diffusors, Abffusors and Triffusors are three relatively new tools available to the acoustic designer. However their successful use requires a solid understanding of what they can do and how to use them. Further, their application does not suit all design approaches. The first practical implementation of Diffusor theory for studio design was by Peter D'Antonio whose company RPG Diffusor Systems Inc was central in turning theory into a practical product.

Several years on there have been considerable developments in the technology of Diffusors—both in their design and use. One of the most experienced users of these products is designer Neil Grant of Harris Grant Associates. Although UK-based, HGA are active internationally with recent projects including Peter Gabriel's Real World; CBS Rooftop in London; Swanyard in London and New York; Rhinoceros in Sydney, Australia; BBC Maida Vale 4 and 5, and a film music studio for Harold Faltermeyer in Germany. HGA have worked in close collaboration with Peter D'Antonio for the past five years and have a sister company, RPG Europe Ltd, as part of the Discrete Research Group holding company but independent from the US company.

Neil Grant; "The very first RPG Diffusors ever installed in a control room in the UK were installed in Studio Two at Odyssey in 1984. Two of the most sophisticated examples anywhere today are at Rhinoceros Studios and Real World. Peter D'Antonio and I have evolved various modelling techniques for these surfaces over a period of years as well as experimentation and implementation. Using this knowledge and data we've managed to improve all the time. The whole surface at Real World for instance was computer modelled. We had foreknowledge of the way that it would work and we turned out to be right. We're currently looking at taking on board the techniques of full two-dimensional diffusion at certain frequencies but this will require a lot of research and development.

"The structures are becoming more and more complex; more and more intricate mathematically but step by step we're improving room acoustics all the time. We're lucky to have had clientele who, though they may have had very specific ideas of what they wanted a room to look and feel like, have just said to us 'Make it work'. We've had a free hand, therefore, to develop very sophisticated structures. Buster Pearson at Tent Records (Five Star's private studio) just took it for granted that we knew how to design a control room. He said 'I want a control room big enough to take this equipment and to cost this much and completed within a year'. So we had a completely free hand within these parameters to define the nuts and bolts of what makes the room work and in each new project we have continued to push on the basis of what we have learned before and we are consequently taking the art further and further."

What about the possibility of DIY Diffusors? Grant: "The RPG systems themselves are patented; the maths behind diffusion are in the public domain. There's nothing to stop you, if you know what the mathematics are, from creating your own surfaces but you'll have to go back to scratch to know which sequences work well and which sequences do not produce good diffusion. A bookcase full of books for example will provide some element of diffusion but it will behave unpredictably—as with any chaotic boundary the problem is you can't predict which frequencies are going to diffuse efficiently.

"To attempt to do a complete analysis of a room like my office is beyond conventional Newtonian maths. You cannot do it—and this is a simple little room. It's also non-linear; this room will behave in one way at this sort of level but at another volume level it would behave very differently. I don't know how much you know about Chaos theory and non-linear maths but there is no way that you can solve as complex a set of non-linear differential equations as is required. They are insolvable. What is so important about taking an RPG device off the shelf is that I know how it works and I know what will happen when I put it in the wall. It's a known quantity. I know the effects that I want to achieve and I've got the building blocks with which to do it.

"There are whole numbers of series that we have worked with and the series is related to the bandwidth of the Diffusor and the density of the reflexions that you want to create. The principal sequences that we have been using are based on sequences around the numbers 7, 13, 19 and 43. The sequences all work differently and, of course, we're only talking about a single dimension of diffusion. A horizontal Diffusor will diffuse as a hemi-disc, it only has that one mode of diffusion. A two-dimensional Diffusor would diffuse both vertically and horizontally.

"If we have a Diffusor based on a 7 sequence across 600 mm we have a Diffusor that has a relatively limited bandwidth—it defines the upper bandwidth at which the device starts to become a reflector. As we go up in the number of wells, for example the 43 sequence is across a 1200 mm space and you obviously have much narrower wells. The device will diffuse over a broader bandwidth up to a higher frequency and will produce a greater density of reflexion too. In other words the decay tail will be much fuller and will be smeared over a greater period of time. Another point there about diffusion is that hemispheres—what used to be called poly-cylindrical surfaces, or indeed any kind of jagged or splayed surfaces—are not Diffusors. They are scatterers. The output wave will still be phase related to the input wave and if they recombine with the original you will still get comb filtering.

"One of the primal properties of a true diffusing surface is that the output is no longer phase related to the source and they're not related to any of their neighbours either. The output of a Diffusor is across a full 180°; the output of a poly-cylindrical wall could all be in one direction. We can predict the input and the output—the transfer function if you like—of the Diffusor for a given input wave. So the well width governs the upper frequency cut-off point; the well depth governs the low frequency cut-off.

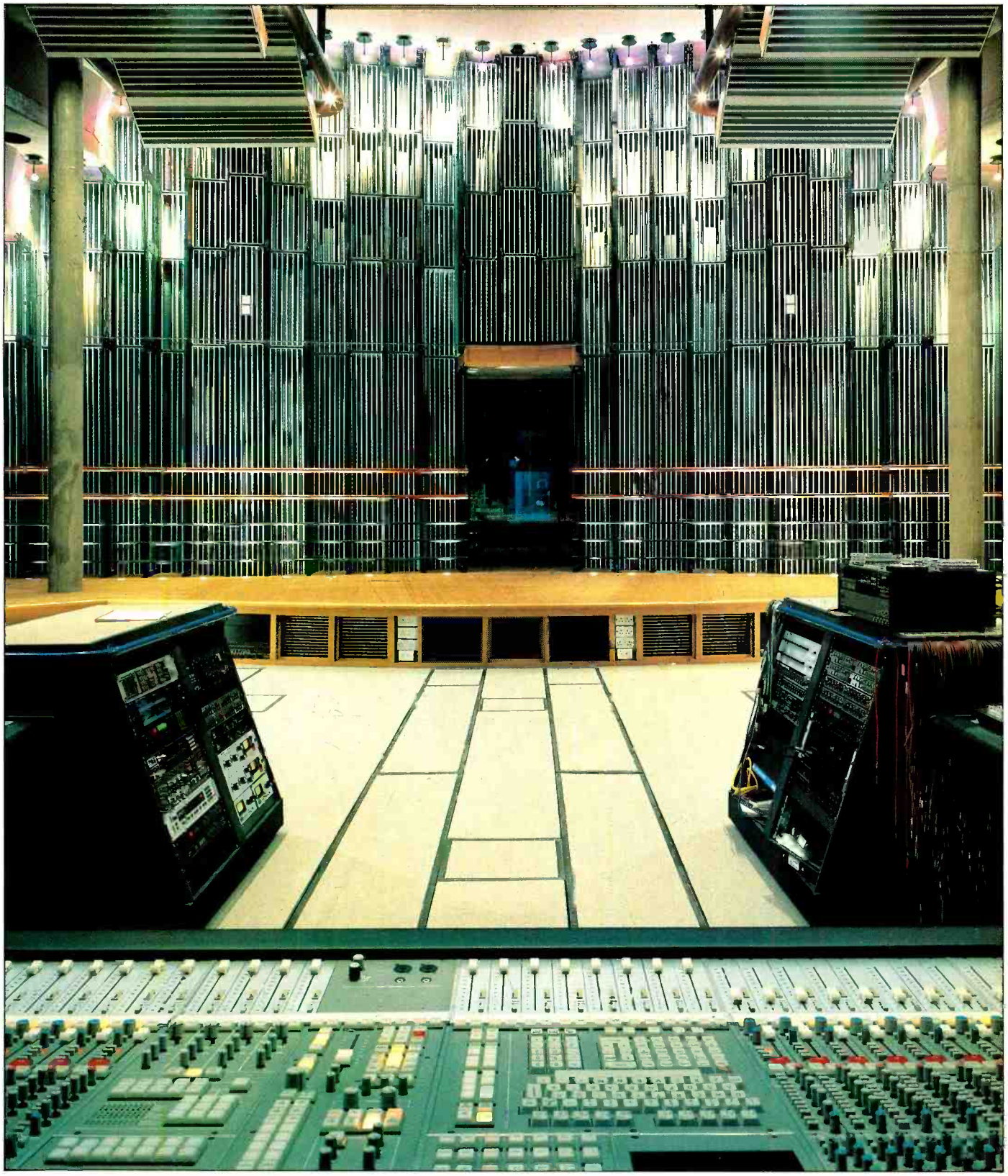
"We have Diffusors that range from the *734W*, which has a depth of 250 mm, to larger devices like the *1925W* or the *4311*, which have 400 mm depths and will crossover to a low frequency Diffusor that can be up to 2 metres deep. It's linked fundamentally to the wavelength that we're attempting to modify. You can also use and mix different devices. It can be very useful if you have a wall that doesn't produce too rich, too long and detailed a diffuse tail. If you want a wall that has punch it may be more useful to have returns from a shallower and more basic diffusing surface than otherwise. Again if you want a varied feel and special texture for the rooms that you're in, I think it would be equally tedious to go into a room that had *4311* Diffusors on all the walls and ceiling. You would have one gorgeous, rich diffuse sound but wherever you went it would be the same."

It would seem that the general design trend at the moment in the Harris/Grant camp is towards 'variability in the studio' and 'acoustic transparency' in the control room. Taking the first point first; a good example of variability would be Five Star's 'home studio' where the entire back wall of the studio consists of Triffusors. These are prism-shaped devices that can be hand rotated on their vertical axes. One face is an Abffusor, another a Diffusor and the third is a plain, flat, hard timber panel.

"You can have the wall fully absorbent, fully diffuse or fully reflective or a combination of those as you choose. There are Diffusors hanging from the ceiling and on the side walls as well, so if you set it up with reflective surfaces you're increasing input into the side-wall Diffusors and ceiling Diffusors. If you set it up as fully absorbent you remove the long reflexions back down the room. The idea is that you can vary the acoustics of the entire space not only by changing the way that the surface behaves to first order reflexions but also in what way those reflexions are input to the other acoustical surfaces in the room.

"We're absolutely delighted to find that by having just one wall variable in this way we can change appreciably the feel and function of the whole room. The important thing here is that we're not just attempting to change the decay time of the room.

"Traditionally, variable acoustics have been merely a system for changing the decay time of a room. As you progressively expose absorbent surfaces and pull down the decay time the room becomes drier. One of the problems with this is that you need to change an enormous amount of the surface area of the room to have an appreciable effect. It's no use just having a few rotating cylinders here and there; the difference in the decay time is very subtle and is a first order effect. If you set up the Triffusor system so that the back wall is entirely absorptive then the decay time will decrease slightly as you'd expect. However, we are also removing a whole wall's worth of reflexions into the side walls and the ceiling so you have a first order effect which



Rear wall of 'control room', Real World studios in Bath, UK

changes the decay time slightly but you also have a second and a third and a fourth order effect in that the input to each wall is removed. The Diffusors on the side walls no longer get half their input and the whole tonal texture of the room changes. It's not just the fact that it's got a bit drier.

"We find it extremely encouraging that people are saying to us that they want to have valid, variable acoustic environments in their facilities because 4 or 5 years ago it was 'We would like a large control room and an area to sample in'; the studio was perceived as redundant other than as space to provide an element of isolation where you could get good signal-to-noise for sampling. That is changing."

Moving from studio to control room: "A control room is a highly specialised environment designed to support an image in a particular way. You're in a situation where you want the room to disappear. These rooms are designed to support the monitor system but in a transparent fashion. The returns from the rear and side wall structures all come back, in the case of the Five Star room, within the Precedence Zone; within the 30 to 40 ms that are required for the ear to reintegrate seamlessly everything with the initial sound. That makes these rooms very efficient.

"Peter D'Antonio was the first to point out that in a conventional early control room, where all surfaces, and especially the rear wall, are effectively dead, you turn the monitor system on and the energy is soaked up around the perimeter. What he calls 'the open tap'. This is analogous to buying yourself an extremely expensive water supply; turning the tap on, ▷

◁ pulling the plug out and watching the water go whistling past; the once-past-the-ear syndrome. We don't do that at all because our side and rear walls return that energy back to the mix position in a very specific and controlled way. We have the plug in the bottom of the basin if you like and that is why, not only does that room support a genuine three-dimensional image but that image remains stable over a wide area. You have to accommodate not only an engineer who is sitting at the console position but you have to accommodate the production staff, the musician who's in there and the owner. We're having to deal with eight or nine people in these rooms and we're consistently providing them with a stereo image and a sense of ensemble; they're within the musical event.

"In a conventional room, if you move off the centre point you're listening to mono effectively. You sit at the centre position at the console and get your head in exactly the right position and receive a very brittle image; a thin vertical line. It doesn't matter if it's an audience you're listening to, or a voice, or a piano, there is always that thin line in the middle. If you move your head at all the image snaps across to the monitor you're moving towards. Now, I would contend that that is not an image that you're listening to. It's a 2-channel artefact. A piano has size and breadth and reflexion structure, lumps and warts and rattles and it's a big object. When I sit and listen to it I expect to hear a big object. I don't expect to hear this fine little line down the middle. I also expect that when I move my head the piano stays where it is and this is not unreasonable. You only get that effect in a control room that supports a true diffuse soundfield. In a control room that is working on the once-past-the-ear principle—that is effectively non-reflective around its rear boundaries—you don't get a stable image. This is a very fundamental difference. It's also linked partly to the way that monitor speakers work. There's been an on-going trend towards less directional monitor systems. We're working at spreading the critical information that you pick up locational cues from across as broad an area as possible. This, of course, leads to other problems as it's very difficult to retrofit a low Q system into a once-past-the-ear control room. You need a system that has a high Q, that is highly directional. When you install a high Q directional system into a room with a diffuse soundfield you're possibly still going to leave cold spots around the perimeters because you just can't spread the energy broad enough."

Harris Grant Associates began purely as an acoustics consultancy but have become progressively involved with all aspects of studio design in order to achieve a high level of acoustic integration. This has led, among other things, to the design of the *Boxer* monitoring system. The system has recessed and spring mounted speakers that weigh 160 kilos each.

"The 'son-of-*Boxer*', the replacement for the entire *Boxer* range is in design at the moment. One of the things that we're looking at is wave guide structures for the mid-range and high frequency units so that we can more precisely adjust directivity of the mid and high frequency units to suit the rooms that we're going into, rather than just spraying the energy out in as broad and as general a way as possible. Because we know what the geometry of the rooms are, we can tailor very precisely where we want that energy to go. We've bought some software specifically to model those effects and to be able to design waveguide systems on the baffles for this new generation of monitors. It's another step in further integrating room and monitor together. We're also integrating the speakers within the filter and amplifier networks rather than just buying an amplifier and hanging a speaker on the end of it. We're integrating the speaker as a transfer function within the electronics of the driving system. Also, the way that the speaker radiates, as a transfer function within the boundaries of the room that we're working. It's an on-going development to integrate all the various bits and pieces together. Traditionally you've gone to a monitor system supplier and he will have bought most of his units straight off the shelf from a speaker supplier and he will buy his amplifiers from somewhere else, the crossovers from somewhere else and you will put all those bits into a room that someone else has designed around a console and a technical installation that somebody else designed. Diffusor systems have provided us with a stable, broad sound-stage and we have integrated all the other elements back in to provide for that sound-stage."

One of the major differences between a Neil Grant design and the more traditional approaches is the way that low frequencies are dealt with. Don't expect to find a hanging baffle in one of Neil's rooms.

"The ubiquitous hanging baffle is a panel which hangs freely in a void space. It is usually made of lightweight fibreboard with a bit of roof insulation tacked to either side or in some cases a bit of extra mass and some Rockwool. I'm not aware of any detailed mathematical analysis why this device should absorb low frequencies. I have not been convinced by anybody's explanation, technical or otherwise (and I've listened to quite a few) as to why it does. I've never accepted it. This is not a low frequency absorber.

"I have disks full of data from rooms that use these devices. I have a detailed American analysis on their use as ceiling absorbers in large scale spaces, which shows very poor low frequency absorption, in addition to all my own data. I also have Rockwool's data, which again confirms the fact. You increase the surface area of absorbent material by putting these devices into your rooms and consequently you greatly increase the mid and high frequency absorption behind these rear walls and side walls but you really do next to nothing for low frequency absorption. For all the claim that these are anechoic rear walls, low frequencies just go straight in, find the isolation shell boundary and come straight back out again.

"When we consider what we want to do within a room the whole business revolves around reflexion control. This is perfectly valid at low frequencies as well. When you examine the fine structure, the modal structure, of the room you'll find that at some points you will get a dramatic drop in pressure and at some points a dramatic rise in pressure. Lower frequencies combine and recombine in and out of phase with each other in exactly the same way that mid and high frequencies are returned from side walls, combine and recombine with the direct sound from the monitors, in and out of phase and produce comb filtering. Because we want to extend the soundfield, the sound-stage if you like, in as broad and even a fashion as possible we've looked at extending Diffusors down in frequency so rather than attempting to attenuate the boundary and thereby increase the ratio of direct to diffuse low frequencies we are breaking down the boundaries with diffusing structures so that the low frequency energy is returned back into the space but in a non-phase coherent way. In other words we're trying to modify the modal structure of rooms using the low frequency Diffusor . . . and ▷

BBC Maida Vale studios in London, UK

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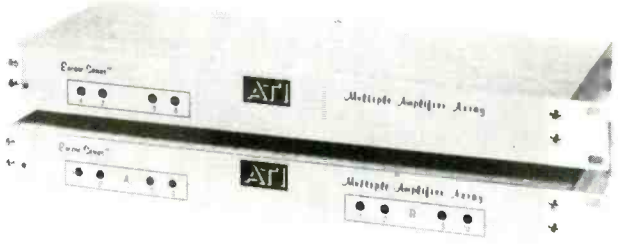

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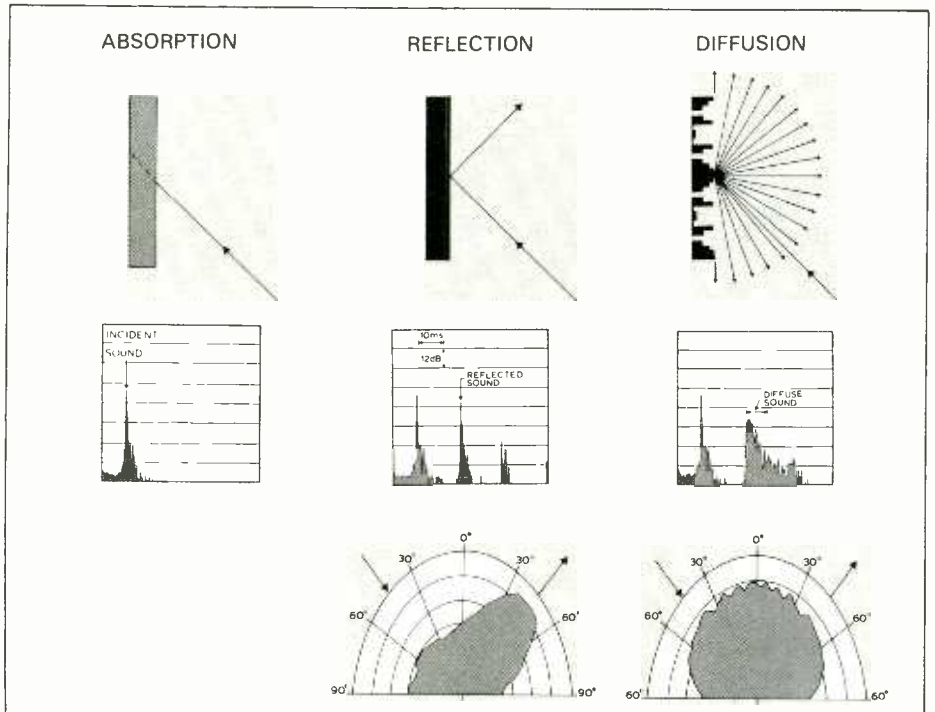

Diffusion for beginners

Diffusors are typically made of wood or some other hard material and resemble a series of irregular 'pigeon holes', the slots or wells being of identical width but of different depths. The sequence of these wells is derived from a mathematical sequence known as the Quadratic Root Modulus. Any sound hitting the Diffusor will be laterally re-radiated into the room in a diffuse 180° hemi-disc. This has the subjective effect of making a small room sound larger than it is. An Abffusor is a Diffusor made out of absorptive material, which gives it super-absorbent qualities across 180°. A look at **Fig 1** reveals what happens to a sound in time and space when it hits the three main kinds of surface.

with some considerable success.

"The lowest frequency we've achieved so far is in the Rhinoceros [Studios] Diffusor in Sydney, which we measured as being functional to below 40 Hz. The Real World Diffusor had a design centre of 70 Hz and we believe that it's functioning to a lower frequency. It's very difficult to measure these things other than to map the low frequency pressure response through the room, which we have attempted to do. (Paper presented at NY AES.) It's purely down to real estate. The low frequency performance is related to the depth of the Diffusor so you have to make the device deeper and deeper in order to control lower and lower frequency responses within the room. The Rhino Diffusor was about 1.6 metres deep."

Neil is sceptical about over-emphasising the need for very low, low frequency response in a control room. "The argument as I understand it goes that if you now have digital machines that can produce 10 Hz then you ought to be able to monitor 10 Hz. In fact when you look at a system that has a response say down to 30 Hz you'll find that there is sufficient energy in the octave below that to make value judgements on whether you have unwanted low frequencies. If you actually listen to 20 Hz it's not at all a musical or pleasant experience. You're listening at that level to rumble, ambient noise, air conditioning noise, tube or subway noise, trucks passing, buses, etc. What is important is that as the system shuts down it's not shutting down like the filters that are present on tape machines. We're not producing a brick wall effect at low frequencies. For example the monitoring system in Real World was capable of running below 20 Hz. In our naivety we set it up like that. It came up in the mid teens and went absolutely room flat towards 25 kHz. It lasted only a couple of weeks before we had to reappraise how we wanted to listen to those areas. What happened was that we altered the skew of the whole system; in other words the whole system starts to roll over at somewhere around 80 to 100 Hz at a very low rate and then turns down. I believe that if you set a monitor system up in any room—a 20 Hz room or otherwise—that this is the correct approach. Quite apart from the fact that your ears have a different sensitivity to different frequencies. If you look at the equal loudness curves your ears are more sensitive to some frequencies than to others—you have to put a huge amount of energy at 20 Hz into a room before it's perceived as having an equal loudness at 100 Hz.

When I talked to Neil a year ago he spoke with quiet conviction about 'a genuine revolution' in acoustics that has been made possible by number theory and its application to diffusive surfaces. It would certainly seem today that diffusion is becoming more and more a force to be reckoned with in the field of studio design.

"We are working with the maths of Chaos to produce these surfaces. The human ear likes to be in a diffuse soundfield. It is used environmentally and evolutionarily to being in one. It does not like to be in an environment that consists of nothing but a series of early reflexions or very short decay times. That is a stressful environment. The human being has evolved surrounded by chaos and that is the condition that it is comfortable with. A little bit of dangerous chaos is a very powerful creative tool.□"

TENT

From somewhere in Berkshire in the UK, Mike Lethby reports on Five Star's new private studio

In this era of affordable recording technology it's a common enough event for a promising band's first recording deal to include financial investment from the record company in a 'home' recording facility. Demos and rough mixes, the argument runs, can be produced without incurring open-ended commercial studio time; and if all else fails the hardware can always be sold off to recoup some of the advance. But few acts can ever have gone as far as Five Star, who recently announced the opening of their own 'home' studio—at a reported cost of around £2.3 million with facilities that many world class studios would justly be proud of.

The project was masterminded by the group's manager and, in the most literal sense, father figure 'Buster' Pearson.

Mr Pearson Snr has shepherded his youthful flock through a string of top-selling singles and albums. Five Star are about to embark on an extensive 2 year world tour, as soon as the new single and album are completed at home in leafy Berkshire. His Tent empire embraces a publishing company and record label, to which Five Star are currently signed through CBS and Epic. CBS also distribute Tent as a record company.

Photo: Mike Lethby

No-compromise studio

The list of facilities makes impressive reading.

The studio and control room were designed by Neil Grant and house a 72-channel SSL *G* series console, Sony *PCM-3348* 48-track digital multitrack, Studer *A820* 24-track analogue multitrack (with 24 channels of Dolby *SR*), *Boxer 5* monitors and a comprehensive array of digital and analogue effects and signal processing.

The only notable omission at present is the usual list of MIDI devices and attendant keyboards and sequencers. For the group's current recording projects a *Synclavier* system is being hired in and in-house hardware in this area will be developed as needs dictate.

How it came about

For the inspiration behind the whole project, we need look no further than Buster Pearson himself. An astute yet surprisingly self-effacing and affable manager, he has an uncompromising idea of production values insofar as his charges are concerned and—with 30 years' experience as a professional musician and arranger in his own right—firm views about what commercial studios have to offer.

Pearson: "I'd wanted to buy a studio since 1982 but the timing wasn't right. In 1987 I finally decided to do it. I looked at a few studios but they weren't up to what I wanted, so I decided to build this one and I got planning permission for a piece of land by the house. We already had a 16-track demo studio here. But I wanted to have all the time and facilities because I believe in big productions and I need to spend time on a project. For a record company booking studio time all over the world it's hard to get time to do things properly. So we said 'let's have a studio at home and do it the way we want'.

"We used to record in Los Angeles, and we used Mayfair [London] a lot and Maison Rouge [London]. I love to use Mayfair but sometimes we'd want to book time and someone else was in for two or three months. So you can't always get the time at the place you want to work.

"You record moods; Five Star are a young group—a good mood and it pays off. In the 2 hours travelling time we were spending getting from here to the city you can lose that mood. So when people hear the next Five Star album it'll be like nothing else they've ever done, because we'll have the time and the patience to get it done properly.

"A lot of bands have their own studios but they haven't gone as far as this. This is all the way really, because I try to be a craftsman—I love a good production. A lot of Five Star's material is dependent on vocals; they're brilliant, one of the best vocal groups around in their age group. So production control is really important.

"For instance, one of my problems in studios is I think it's terrible to hear the words 'bouncing down'. So that's why we set up a 72-channel—if any engineer says I'll have to bounce I'll tell him to go away because we have more than enough tracks!

"It's very important to have facilities because recording is a very delicate situation. Anyone can make a number one record and anyone can make a Top Ten record, but they're completely different, I've seen a great record go to number one in 5 minutes.

"Another thing I don't like is when record companies send away the master to America and the artist isn't there when he does his remixes; it can take weeks for the remixes to come back and when they come back they can be terrible. I want the facilities to do it here so we can fly in an engineer from the States to remix—we'll never send product abroad again.

"So we'll use the studio from everything through the final mix, recording, mixing and remixes."

The room

Pearson specified the studio's general design and equipment line-up, with advice from engineers and producers with whom he'd previously worked: "They gave me very good ideas," he ▷

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◁ says, "I had a lot of help from very good friends."

The building is completely new and is designed to blend in architecturally with the existing mock Tudor-style house. It is completely isolated acoustically from traffic thundering along the busy road outside, yet admits plenty of daylight into the spacious control room.

Due to the shape of the land plot—and the gargantuan width of the SSL—the control room is set sideways-on to the studio. You look straight ahead from the hot seat into the impressive multitrack room; eyes right for a view of the studio.

How long did it all take to plan and build?

Pearson: "It was August '88 when Neil Grant started to do the planning—less than a year, really; it must be one of the quickest studios built.

"It was very open. We didn't point him in any direction, it was a case of 'let's get it done'. That's why it turned out this way: there was no restriction, no budget, we left it open."

Despite the tight deadline (and the typical problems that always beset the best laid plans) the studio was finished precisely on schedule—two days before the group were due to start recording. Hardware installation was carried out by HHB (the major equipment suppliers), a team from SSL and wiring specialists Brian Hayward, Louise Fitzgerald and Iain Black, with cables and connectors from Kelsey Acoustics.

Pearson: "The finish is really good; we've had some brilliant builders and the best people in the business on hardware and wiring. It's really come together well."

Hardware

At the heart of Five Star's dream studio is an SSL *G* series 4072 console, a 72-channel desk complete with programmable EQ, Events Controller and external patchbay, and MTS machine transport selector—in short, virtually all the extras money can buy.

It also just happens to be the largest *G* series console currently installed in the UK. With a total of 48 digital and 24 analogue tape tracks on hand at any one time, the MTS system will clearly be a bonus in simplifying multitrack synchronisation—interfacing directly, and as far as the engineer is concerned invisibly, with the SSL computer.

Why the mixture of Sony 48-track digital and Studer analogue multitrack for backing vocals?

"Because I don't think digital is a nice format to record a big block of vocals. Sometimes we put down 25 voices on a backing track. We do that on analogue, and drum sounds as well, because we can really EQ them nicely before we transfer to digital. You can EQ much better on analogue than on digital. There's a big difference; you get that 'glow' on the analogue tape, which is very hard to capture on digital because it's super-clean. You need a touch of that analogue sound even when you're mixing onto digital to get a proper balance. So we've got the best of both worlds."

His choice of effects and microphones follows the same thinking—an impressive mixture of the latest digital hardware and some classic vintage items.

Pearson: "I insisted on having some of the vintage valve pieces, which are brilliant; I wouldn't set up a studio without them!"

Continuing the theme of that analogue warmth?

"Especially on vocals—vocal is a very delicate situation, you have to record it at its best. Like the microphones; we have everything that's been invented! It's a very big selection, from the AKG tube mic down to a very, very old valve mic, which is wonderful for vocals.

"Monitoring is *Boxer 5* from Discrete Research with two 18 inch drivers powered by 3000 watts of *Boxer* amplification."

There is little sight of the 5-pin DIN plug in the studio, however, John Barnes—a veteran of Michael Jackson's *Bad* project—is producing Five Star's current recordings using his own *Synclavier* system flown over from the US.

Pearson: "We've used Fairlights in the past but it's the first

time we've worked with a *Synclavier* and it's like having another studio. John's is one of the biggest *Synclavier*s in the world, he's enlarged it to the limit."

The MIDI inventory, he says, will simply grow naturally along with projects as they develop.

Future plans

Will this alluring facility be available to anyone outside the Five Star clan?

Pearson: "Not really—but when we're not using it, it'll be there for special friends to use, someone who wants to mix a big production. It'll be very, very private. Just a few people. We have 24-hour back-up with our own engineer and technician and full back-up from the people who supply everything, HHB and SSL. We may not be a commercial studio but we've spent a lot of money so we expect that service!"

Permanent staff currently include Steve (assistant engineer), Cheryl, who handles studio bookings and Nick, in charge of maintenance. Engineers will be brought in, says Pearson, "as and when we need them".

And for the future. . ."We'll be building a studio in the States on the same lines, and we'll put another one in here as well. I can't take on a lot for lack of management time at the moment, so I'll get other people to run the record and publishing side and the studios.

"We've got a major tour coming up; Five Star have been 7 years in the business and never done a world tour, so it's very important. We're going to Russia, India, Australia, America, Europe, Africa, the Middle East and Jamaica, starting in March. Five Star are known in every country in the world but they've never been there. They're still young and we don't like to jump the gun! There's no hurry—it's just rock and roll.

"At the end of the day, like I said, anyone can make a record, anyone; but not anyone can perform. I've seen bands with a number one record who can't perform to two people. Just because you have a number one record doesn't mean you'll have a number one tour. Anything can happen when it's live; I do believe in that because I'm a musician myself.

"It's a very hard job, if you're going to do it properly and I think people should, instead of having nervous breakdowns. You can't handle success or whatever, treat it as a job. In this game overkill is there, staring you in the eye, you know. If a record is a hit all around the world you have to be there with it all the way. It's a long term situation."□

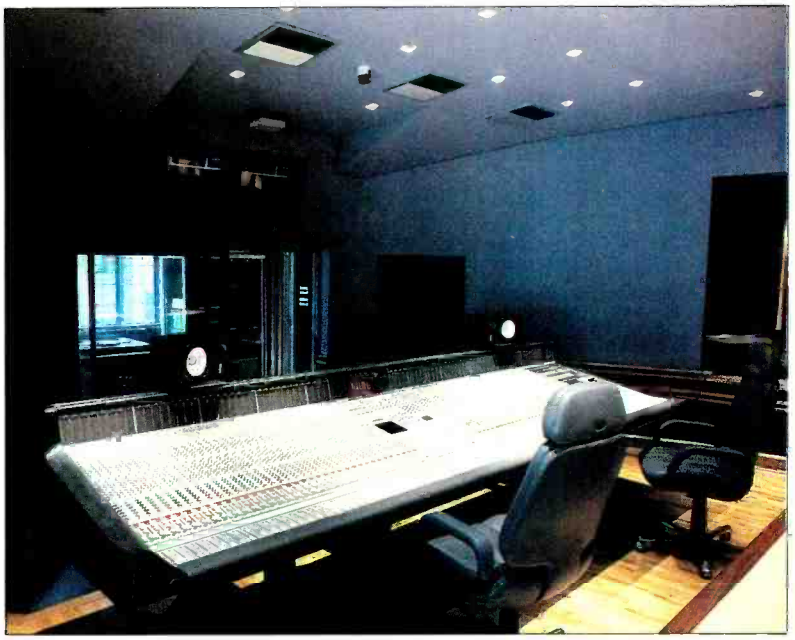

Photo: Mike Lethby

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SOUND RESTORATION OF LAWRENCE OF ARABIA

When it was decided to revive the film story of Lawrence of Arabia in 70 mm film, it was discovered that 20 minutes of the premiere version was missing. Kevin Hilton relates how the edited sections were researched and recreated

In recent years, major film production studios have re-released movies from the '50s and '60s, often to great commercial success at the box office and often in a different version to that seen on initial release. Earlier this year, Columbia Pictures released the result of what has been called one of the most extensive, complex and expensive restoration jobs ever undertaken.

The film is one of the studio's epic motion pictures, seen by many as a classic of the cinema: David Lean's multiple Oscar-winning record of the life of TE Lawrence, *Lawrence of Arabia*. The story of the restoration process is almost as epic as the movie itself, being a two-year labour of love to present the director's original cut.

The project began in 1986 when archivist and producer Robert A Harris, who had worked on the revival of Abel Gance's *Napoleon*, approached Columbia Pictures, proposing that they resurrect the premiere version of *Lawrence* in a new 70 mm print. David Puttnam, at the time president of Columbia (a tenure that was to be short lived), gave the go-ahead, warning Harris that things might not be that straightforward.

When released in 1962, the picture ran at 222 minutes, with additional playout music. By January 1963, 20 minutes had been shed, the story being that producer Sam Spiegel ordered the print to be edited (without consulting Lean); these were the days when cinema managers liked to have two or three showings a day. A further 15 minutes were removed in 1970, reducing and disjointing the film to 187 minutes.

A print of the premiere version of the film could not be found. Columbia did not hold any written continuity. This meant that nobody really knew what was in the 222 minute cut. Harris, his co-producer Jim Painten and their team were in for far worse disappointments than that: the initial prints that were obtained were slightly crushed, worn negatives with failing splices and were only the 202 minute version. The surviving 70 mm prints, one in German, the other in English subtitled in Dutch, were also of this first edit.

When another copy of the magnetic track was delivered to Harris, it was again only 202 minutes long. Although marked as a copy (a protection dub), it was later revealed to be the original recording. But the magnetic oxide was flaking, thus clogging the play heads. On later inspection, it wouldn't run at all. Other versions were in a better condition but only the 187 minute print could be made to the precise spec.

The masters were sent to Metrocolor Labs for examination. The staff reported that these, for some reason, had been edited. Harris later recalled, "They held no more footage than the camera negative. No one could understand why anyone would cut up the negative, no less the protection material."

Searching for the edits

Work continued in New York, with more versions being shipped in to be checked and logged to see if the original version was any nearer. The negative records manager at Columbia, Irwin Rosenfield, had promised more material, which arrived in the form of feet upon feet of unlabelled and unmarked 65 mm and 35 mm negative trims and unused takes. Among all this footage were short strips of black and white dupe with an optical soundtrack, which Harris and Painten didn't recognise. By threading this onto an editing machine the partners saw for the first time some of the missing sections.

This material was then intercut with more recent colour footage, which had the disadvantage of blue sand as it had not been colour-corrected. Film-maker Martin Scorsese (*Taxi Driver, After Hours, The Last Temptation of Christ*) took the position of director for these early sessions, giving advice as to how things might best fit together. Painten's role in the restoration lessened when he was made ABC production executive for the TV series *Moonlighting*. It was at this time that Harris contacted Anne V Coates, who had won an Academy Award for her editing of the film.

With David Lean in Spain setting up locations for his next film, *Nostromo*, Coates was the only person who could shed light on the film's construction.

Painten observed, "Anne Coates is the one person who knew not only how the picture was put together, but also how it had been taken apart."

Coates advised on what should be looked for and made contact with Lean who, on learning about the project, said he would meet with Harris in his New York office to see the first assembly, which gave a basic indication of the finished article. ▷

Commenting on what was yet to be found, Lean asked, "What do you intend to do if you can put the picture together but you can't find the tracks?" Harris replied that he would use tracks from alternate takes or, if all failed, re-record the necessary dialogue. Lean said if this happened, he could reach many of the stars, including Peter O'Toole and Sir Alec Guinness.

Detective work continued to find the original negative. Coates advised that the key shot was one of Lawrence's goggles, which Harris eventually located. Investigating the can of trims further he made a devastating discovery. He was in fact looking at the long-lost camera negative, the film that had produced only a few prints back at the end of 1962. Only one shot from the original negative stayed missing but this was replaced with an alternative. Everything was now ready for the final restoration process.

Towards the end of 1987, Puttnam made his exit from Columbia, to be replaced by Dawn Steele. She was petitioned by Martin Scorsese and another admirer of Lean's, Steven Spielberg, about the vital nature of the work and so ordered that it continue.

Replacing the audio

Now that the visuals had been rebuilt, Lean's comment about the sound became an important factor. Some sound was taken from the black and white dupes and alternate takes but in excess of eight minutes of the film was still without audio—effects, dialogue and music.

Sound editor Richard Anderson took effects from other parts of the film, while the Foley sections, the noises made by people as they move and breathe, were put together by Harris and dialogue editor Jim Christopher at the Goldwyn Sound Facility in Hollywood.

The task of creating stereo where it didn't exist was up to re-recording mixer Gregg Landaker. He took the tracks made by Anderson and made the final 6-track recording. He also had to work on the hissy optical tracks and clean them up to match the enhanced visuals. Due to the recutting, all dialogue was out of sync, even on the masters.

In April 1988, the work on the missing dialogue began. Despite original intentions, it was not possible to arrange a reunion of cast members. The various recordings were carried out in London and the US and then assembled by Landaker back in Hollywood.

Re-recording the script

Peter O'Toole ('Lawrence') and Alec Guinness ('Prince Feisal') were reunited at Mayflower Studios, just off Park Lane, under the direction of David Lean. The engineer on the session and the MD of the studio, Lionel Strutt, remembers that the first we heard about the reconstruction was when he received a call from a "very very American lady" who wanted to book a studio for ADR (Automated Dialogue Replacement): "This is nothing unusual," he recalls, "but when she said it was for *Lawrence*, my reaction was, 'Are you kidding?'"

The meeting between the two actors and the director was nostalgic enough but the feeling was heightened when it was realised that the original cut of the film had been put together in the upstairs of the Mayflower building 25 years ago.

Before the revoicing could start, the script had to be prepared. Although there was still Robert Bolt's original screenplay, changes had been made during filming, with the result that some of the sections did not fit. To get round this obstacle, Harris had found and hired a hearing-impaired couple who lip-read the silent sequences, making it possible to script the scenes.

The London session took four days, with Guinness and O'Toole sitting in Mayflower's large studio, which was once a film preview theatre, watching themselves as they were in the early '60s on a wall-to-wall cinemascope screen.

Using Neumann mics and a Calrec *TT3/4* desk, Strutt laid down the necessary sections, spooling the scenes back and forth on an analogue Magnatex system, while the actors matched the lines with their lip movements.

Obviously the voices had aged since the original recordings were made, notably that of Guinness. Strutt used equalisation and the Publison *Infernal Machine* to change the pitch and texture of the voices to match them with how they had sounded more than 25 years before in 1962.

The most difficult part of the session was laying down the dialogue of Jack Hawkins, who took the pivotal role of General Allenby, Lawrence's commander-in-chief. Hawkins died in 1973; his lines were played by Charles Gray (known as one of the incarnations of Blofeld in the Bond films and more recently as Sherlock Holmes' brother Mycroft), who had voiced Hawkins' lines while he was still alive and his throat condition had made a stand-in necessary.

In the US, Anthony Quinn, as Auda Abu Tayi, stopped over in New York to add his lines, while Arthur Bentley, playing the journalist Jackson Bentley, who helped create the myth around Lawrence, was recorded by Painten on a Nagra in a Savannah TV studio.

At the end of April, the final touching up began. Lean and Coates joined the restorers—the director was able to see, for the first time in 25 years, the original version of his work. But things were still not quite at home base. During the second reel, Lean and Coates suddenly realised that the camels in a scene were moving from right to left—backwards which was obviously wrong. Lean remembered having the camels going from left to right.

On checking other prints, it was revealed that a mistake had crept in when a 35 mm interpositive was made in 1966. Since that time, every copy of *Lawrence* in video, theatrical or TV form (excluding the 187 minute re-issue of 1971) had 10 minutes reversed.

Lean then became concerned that the new footage would retard the flow of the story and suggested that maybe a new edit should be made. After this fine cutting, the 70 mm work print with 6-track Dolby *SR* sound was presented for Dawn Steele and the Columbia staff at the Academy of Motion Picture Arts and Sciences.

Lawrence of Arabia opened in the UK earlier this year to unanimous rave reviews, praising the restoration work and re-appraising the film as even more of a classic than before. While working on the project, Harris and Painten were adamant that if a certain quality couldn't be reached, they would not complete the job.

Harris commented, in a part tribute to David Lean as a film-maker: "It's a David Lean film. At no time were we willing to drop below his standards. You give it your best, nothing less.□

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MOLES

Moles. The venue, the studio and the record label. Julian Mitchell reports on this unique UK west country arrangement

Ten years ago Phil Andrews used a lease-loan of £1,000 to open a live venue in the centre of Bath, the famous UK west country spa town. Andrews named his club Moles and its site was the basement of a four-storey Georgian building just around the corner from Bath's main shopping area.

The club experienced meteoric success, an indictment of the chronic shortage of decent venues in the Bath area at the time (which is still the case today). This also represents a testimony to the club's unique atmosphere, akin to the Marquee in its heyday, with its close audience contact, low ceilings and brash acoustics.

Word soon got round that Moles was an ideal place to see and promote new talent. The club's popularity grew even more with the appearance of some major names like The Cure, The Eurythmics and T'Pau. Soon Moles was offering a healthy variety of local bands and major acts, who saw the club as a vital warm up venue for tours.

With this success came inevitable requests from bands for recordings of their performances, something Andrews had already been thinking about. He had approached Mike Long, already vastly experienced in live sound reinforcement, with the idea of setting up a small 8-track control room on the first floor of the building. Long was very keen and a 'well-priced' 8-track package was quickly found. Just as quickly, however, Andrews and Long realised that 8-track recording was becoming outdated and they would have to think bigger, 16-track seemed like a compromise and so budgets and details were drawn up for a 24-track studio.

Moles' 24-track studio was completed just over a year ago ostensibly to record from the club, so no other live area was set aside although there were two available floors above. The idea was to record either full performances or use the club as a drum room, for which it was well suited with its low ceiling, tiled floor and stone walls. Overdubs would be done upstairs, and vocals in a small booth just to the side of the control room.

Long, now Moles' chief engineer had used the DDA Live Sound series console extensively and was impressed finding it 'superbly clean'. On the strength of that and in the search for possible equipment for the studio, Long visited the DDA factory to take a closer look at the *AMR24* console.

He was impressed with what he saw at DDA's factory and continued his research by talking to many existing *AMR24* users. Also on the shortlist for Moles was the Amek *Angela* desk but Long found although the EQ on the desk was good it didn't fulfil all their requirements. Another point in the DDA's favour was that it marketed the studio in the right price bracket and still made it possible to hook up to digital multitracks, something they are looking at for the future.

The DDA *AMR24* 60-channel desk was chosen, with good reason. Long: "I basically like it because it's got such a pure signal path, you can bypass circuit stages and get a straight through signal. Sometimes I even bypass the desk, for instance when I'm recording vocals I go from the valve Neumann 67 microphone to the Teletronics valve limiter into the Pultec equaliser and straight into the multitrack."

The DDA also seemed perfect for live recording where the bulk of the future recording would be. Long again: "You can have a totally independent monitor mix run-off for cassettes with independent EQ and at the same time run a proper

▷

◁ balance onto the 24-track machine."

For multitracking Long chose the Otari *MTR 90/II*, mainly for its record of reliability and partly for the good deal he got. He also found out, from Tim Thompson of Studio TimeLine, about *OptiFile*, a desk automation system that could be retrofitted into the DDA.

The *OptiFile II* is a hard disk automation system which operates on 64 channels of the DDA *AMR* desk, 1-36 input, 1-24 monitor and masters. The system has proved very reliable and easy to use, the automation controls faders and mutes and also stores snapshots of the console, again helpful for live sessions as Long explains, "If we were doing a live session where there were two bands on, we could take snapshot settings of the faders and mutes and automatically recall them the next time the band came on."

Another piece of equipment apparently chosen to deal more efficiently with live recording was the Akai *DP-3200* digital patchbay. The reason it was chosen, however, was much simpler: with all the outboard equipment Moles had, they had run out of inputs on the standard DDA patch. But the patchbay did have more to offer. Long: "Using the Akai is a very elegant way of patching equipment through, what I've done is to wire it into 24-track B monitor returns so that when you're in mix mode and you select Tape B all the effects from the digital patchbay come up on the right hand section of the desk and we can then label the different client setups, so if somebody comes back and wants to do a remix we can go through their files and it'll be labelled with their name and date of original mix. Repatching only takes a few seconds, before the arrival of the Akai it would've taken up to two hours just patching things in."

When the studio was designed, 32 links were provided between the DDA and the club below. In operation microphones are plugged into the club's stage box and then split to the Soundcraft house console and up to the the DDA desk. The feed is totally independent and the signal remains very clean. The result of this clean signal and the lack of any grounding problems means a very swift setting up time for live recording, a band can start sound checking at six o'clock in the evening and be ready for a 9pm start.

As mentioned, Moles has a large amount of outboard equipment.

"Basically we have a great variety of toys for whoever is working here. There are 24 gates to silence the tracks—BSS, *Kepex II* and Drawmer—but more often than not they're used to trigger off sounds, especially the BSS *502*s, which are MIDI gates—very useful as an audio to MIDI converter. We also have a lot of compressors (Teletronics *LA-2A*, UREI *1176LN*, UREI *LA4*, dbx *165/160/160X*, Drawmer *1960*, BSS *DPR 402*, Valley People *440*). With live recording we find as you're miking everything up and everything has to go down at the same time then you might need 19 compressors on various instruments."

Other 'toys' comprise Pultec *EPQ-1A3* and *MEQ-5*, EAR *822Q*, Orban *642B*, Klark-Teknik *DN 27A/60* and TC *1220* equalisation; reverb and effects outboard includes Lexicon *480L*, Quantec *QRS* room simulator, Yamaha *SPX-90*s, AMS *RMX* 16, Klark-Teknik *DN 780*, EMT *140* stereo plate, EMT *Gold Foil* plate reverb, Yamaha *REV1/REV5/REV7*, Roland *SRV 2000* and *DEP 5*; delays and pitch shifters comprise Eventide *H3000/H949/910 Harmonizers*, AMS *DMX 15-80 S*, TC *2290*, Bel *BDE 2400*, Roland *SDD-320/SDE3000/SDE1000* and SRE *555*; microphones come from Neumann, AKG, E-V, Shure, Sennheiser, Beyer, Amcron and Tandy.

When the Moles studio was first set up it was thought that because of the lack of a separate live room, MIDI equipment would play a large part in the recording process. In fact the level of equipment hasn't changed. The present list includes the Akai *S1000* sampler, Roland *D550*, Alesis *HR16* and Steinberg *Pro 24* with Atari *1040* computer sequencing system.

With the club now firmly placed as an important venue throughout the country, the time has come for expansion. The main plan is to build another live area on the floor above the present studio. The area will include a live room and a small pre-production studio possibly with a second 24-track desk. The present control room is also undergoing expansion, which includes a raised stage area complete with lighting grid. Long feels this pseudo-stage will add some important continuity, "We've found that once drums are finished down in the live environment most of the work carries on in the control room, often we've had a complete band in here playing, hopefully the raised platform and the lights will give the musicians an impression of a live feel."

Long also wants to incorporate a more comfortable area for listening to mixes, "Behind the raised platform there'll be a large sofa and a couple of fill speakers by the sofa to complete the sound stage. I've often found that after 11 or 12 hours straining over the desk, with this huge reflective surface, you're not in the ideal state to hear the right mix."

Long's slightly unorthodox style of recording and live-sound past helped him to ignore traditional Tannoy, UREI and JBL monitoring and pick something more akin to his replay system at home, the choice was the ATC *SCM100*, now upgraded to the *SCM200*, 3-way actives with in-built power amplifiers and electronic crossover with Yamaha *NS10*s for nearfield monitoring, "The ATC's aren't fatiguing whatsoever, in fact, the only slight problem is because they're so clean you can have it up loud but you don't realise it until you try to talk to someone!"

The Moles empire was further enhanced this year by the forming of Moles, the record label. Gill Sargent, studio manager explains the reasons behind the decision, "There are two branches to the record company, Moles Records and Moles Records International. Moles is distributed through RCA Distributors but Moles International goes through the cartel. There were bands coming though the club who were unsigned and who we thought we could do something for, so it seemed a natural progression for the company to start its own label. The international side will be just that, a lot of African bands as well as jazz, the UK Moles label will be more commercially orientated."

Masters are sent to Tape One in London for cutting. They are usually DAT from the studio's own Sony *DTC1000* machine, although *F1* from Sony *PCM 701ES* and two Sony *C9* Betamax machines, and ¼ inch from the Otari *MTR 12/II*, are available. Long sees Tape One's AMS *AudioFile* editing system as being very useful in its ability to master straight from DAT.

Mastering also demonstrates another facet of the *OptiFile* automation system, "With the *OptiFile* you can top and tail your mixes," says Long. "By calling up a window in between two timecode points we can edit to $^1/_{25}$ second, about 1 inch of tape. We're frame accurate, it's a rough way of editing but it works fine for singles and B sides when you don't have a critical timing between tracks to worry about."

Moles' expansion plans have taken up all floors of the building, with a suite of admin offices planned for the top floor. There was talk of making the studios residential but Gill Sargent has sealed an agreement with some local holiday home agencies for visiting musicians.

The future looks good with the label already breaking new bands, the club still ruling the roost as far as local venues go and the studio undergoing major expansion after just over a year of being a going concern.□

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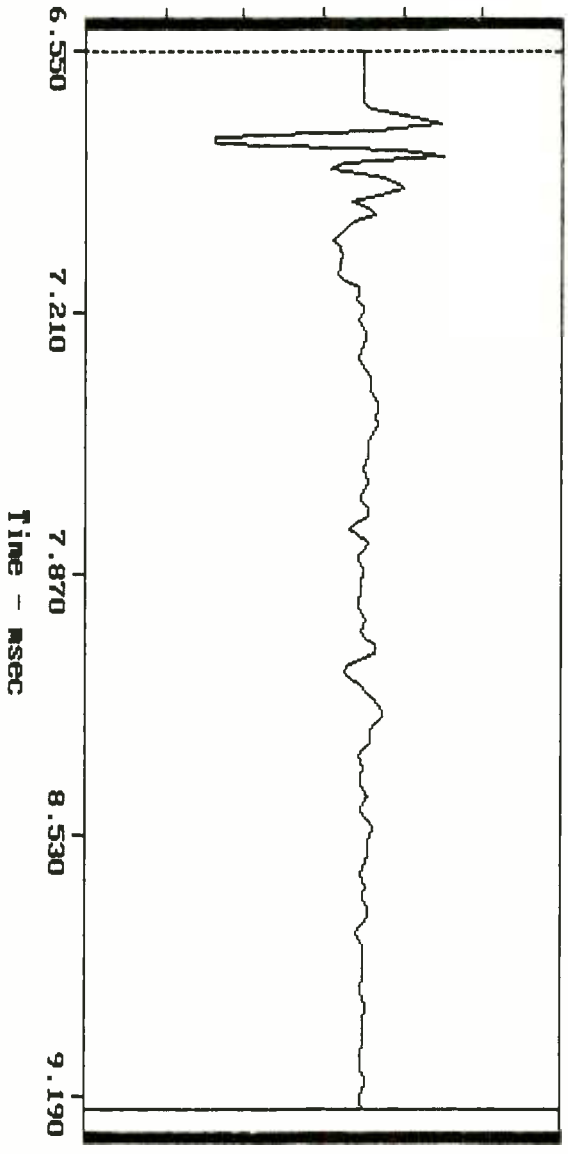

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THE SOUND OF READING

This year's Reading music festival celebrated a few interesting changes. Mike Lethby was on hand to speak to the new reinforcement company

The Reading Festival has been a regular fixture on the UK summer music calendar since the '60s. Traditionally held over the last weekend in August it has been organised for many years under the auspices of the Marquee Club and Entec Sound & Light. In 1989, however, the task was taken over jointly by Myra Hickey and Powerhaus Promotions (the promotions arm of the Mean Fiddler Organisation, a London-based music venue chain owned by Vince Power).

The new organisers awarded this year's sound production contract to Birmingham-based PA company SSE Hire. For SSE, the 3-day event provided a tough showcase for their recently acquired Electro-Voice *MT-4* system, spiced with the challenge of servicing a venue whose environmental difficulties have historically imposed huge compromises on sound production.

The 1989 event was the most commercially successful ever, according to the promoters who ran full page 'thank-you' ads to participants in the music press, to prove the point.

The Reading environment

The phrase 'environmental requirements' crops up in conversation with SSE's engineers more often than seems reasonable. It's this single factor, above everything, that has called the PA tune at Reading year in, year out.

The 30,000-capacity site is a flat, roughly rectangular field located between the town's western suburbs and a sprawling industrial park. Access is dreadful with lengthy jams since traffic is obliged to find its own, unguided way through the busy town centre, and natural attributes are limited to bumpy grass and a few cow-pats. The main London-Bristol railway runs close by.

Bob Doyle SSE's sales manager: "Although Reading Council are happy to accommodate the festival—as long as it's properly managed—the inherent problem is that there's a hospital on one side and residences virtually all the way round. Those residents are pretty vocal in their complaints; understandably, because a lot of people are invading the area where they live 365 days a year and the ambient level of the festival is well over their TV sound—which isn't so funny when it goes on for three days! So we can't allow the sound to spread.

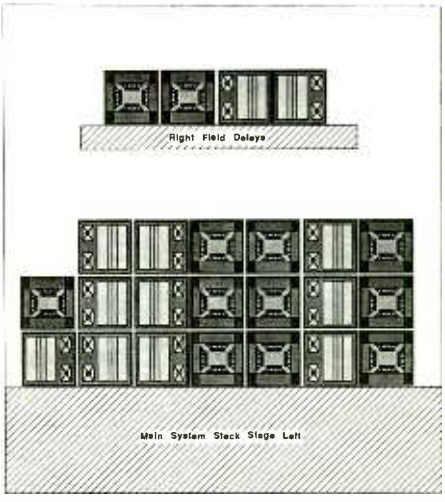
"We're allowed SPLs of 100 dB average with 105 dB peak. On the soundcheck day we have very specific tests: each delay tower's SPL level is tested individually, and then all together. Officials are posted around the perimeter while other people take measurements a mile or so away, so the whole dispersion pattern is graphically documented. After each festival they sit down and work out the differences achieved from the year before."

The FOH system was laid out with two main PA stacks and two 'outrigger' stacks either side of the stage, and three stereo pairs of time-aligned delay towers downfield. This is a well-proven format for Reading, born out of years of barter between Reading Council and past PA suppliers. Understandably, SSE saw little reason to re-invent a particularly contentious wheel.

Doyle: "We've roughly followed the configuration of the last festival. The main system, which starts 8 ft up either side of the stage, is angled 10° down, which means it's firing into the grass at 62 ft from the front of the system. If you're closer than 14 ft from the stage you won't hear the high ends, so we have nearfield infills either side of the stage.

"We have a special control area—a little Wendy House!—a further stage of control, which is there specifically to maintain Reading's environmental controls. There's a TAC *1042* master desk, which is continually manned, and all three FOH boards are returned into that—along with the disco, CD and a cassette machine. And there's a chart recorder, a sound level meter and a readout of SPLs at 5 minute intervals.

"A Reading environmental officer will be here and so will I! So if an engineer goes a bit over the top we can adjust it here—we have an overall compressor to set a threshold level so that it's not discernible for the engineer. We don't want to upset anybody, but everything has to be within environmental guidelines and sometimes the difference between disaster and OK is just 2 dB. We're not going to slam a limiter across it—it's not what people who've paid to come here want to listen to, and nor do I!"



Mirror cabinet configurations for stage right/left field

Delay arrangements

Doyle: "It's a question of path length to the mix position. The two outriggers in line with the stage have the longest path lengths, so those are on zero delay and they effectively extend the main system stereo mix sideways.

"The main PA stacks are delayed by 11 ms; the 'B' delay towers at 35 metres downfield are on 73 ms; and the 'C' delays, which are virtually level with the mix position another 35 metres downfield, are on 102 ms. They're routed through two Klark-Teknik *716*s, which are stereo, 1-in/3-out units, which gives us 2-in/6-out.

"To set it up we used a computer program which gets us almost there, then we fine-tuned it by sampling a click into an *SPX90*, which clicked away until we were satisfied."

The house system

SSE's FOH line-up featured the 'parallel system' approach that's fast becoming the norm at events of this size, with duplicated consoles and effects racks to allow a swift changeover between bands.

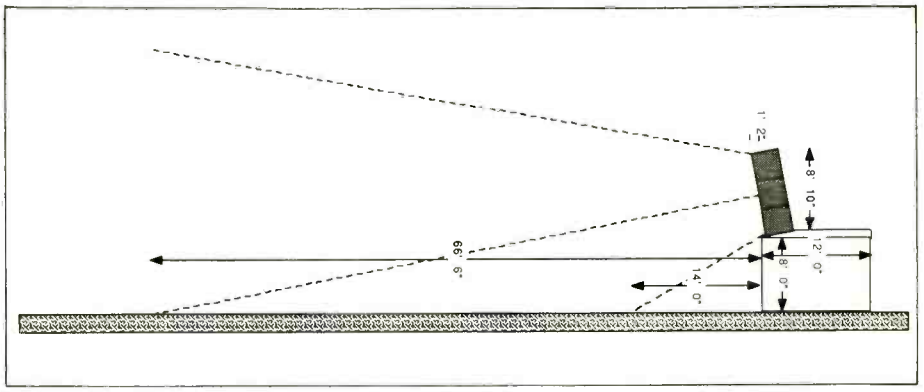
Doyle: "We have 10-15-minute changeovers so we're using two 40-input TAC *Scorpions*, which flip-flop between bands every day, and an *SR9000* just for the top of the bill, which is used twice every day: first thing in the morning when the engineer does his line-up and EQ check, and then for the band's set. Each desk also has its own gates and effects, so they're three autonomous setups.

"The system is analysed and every graphic is set to reflect that before each engineer goes on. But he's not stuck with it; he can adjust the graphics as he goes through the set. When he goes off, the graphic is re-adjusted back to the analysed setting and all the line levels are checked while the next band's engineer is using the other desk.

"There's two completely separate line systems with 40 lines each from stage and two monitor desks on stage, which also flip-flop. So on changeovers, it's just a question of taking a multi out of one of the flip-flop desks and plugging it into the other.

"For line drivers, we're using an SSE active system here—line drivers with transformer splits—although BSS are very attractive and we'll probably move to BSS active splitters. Ours are dedicated to a job, they're installed in-house and we don't have to mess around with them, whereas BSS are great if you've got to change between different split situations, they're very versatile."

Foldback and line checking at the mix tower involved five SSE bi-amped floor monitors, driven by a dedicated control rack. The arrangement, says Bob Doyle, "saves us from having to resort to cans all the time—it's much easier to communicate with the engineers".



MT-4 Array distribution characteristic

Doyle: "Crossovers on the house system are BSS *FDS360*s, which we had BSS align with the *MT-4* system. They duplicated the time alignment and EQ pre-emphasis from published information, within the crossover on the plug-in card."

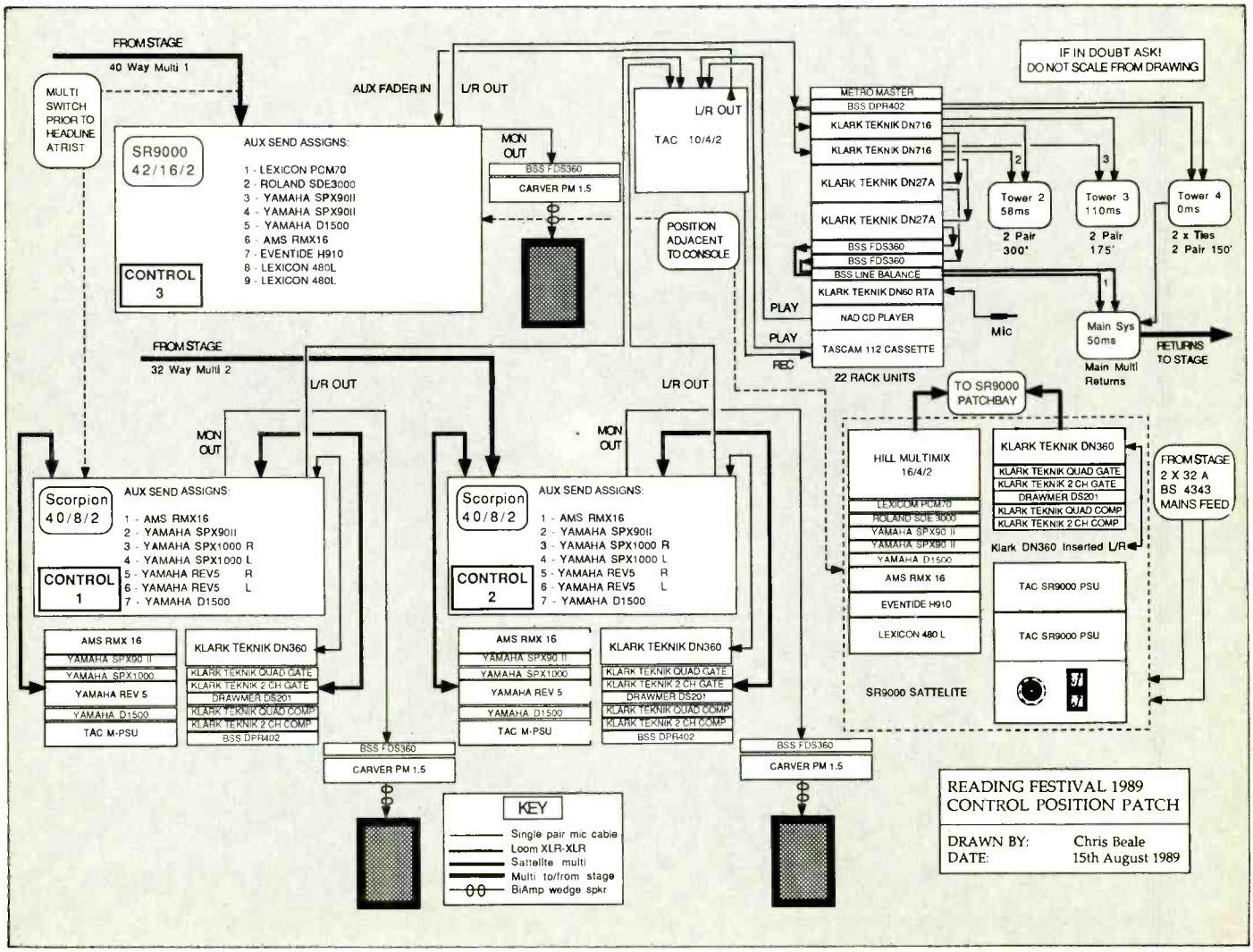
SSE's director John Penn adds: "They were very helpful and attentive to make sure it worked correctly—which was great.

"For line checks we use AR *Power Partners*. It's a compact, high power speaker with a built-in amplifier. We can stick a feed in them, talkback system or anything; we can EQ the desk, run it on the solo on the *SR9000*, which has a solo bus like a studio desk. For an audio check we have a pair of those clipped in: we run up all the audio lines and we can hear them not on cans but right THERE."

Manifold technology: the MT-4 system

Doyle: "The FOH PA is the *MT-4* Manifold Technology system, which is a high power, high efficiency, 4-way active system—a two-stack system with a bass bin and a composite mid/high unit.

"The bass bins have 4×18 inchers. Each pair of 18s has an impedance of 4 Ω and runs from one side of a *MacroTech 2400* amp, so one *2400* runs a complete bass bin, around 1600 W RMS. The mid/high unit has four 10 inch low mids—each pair of 10s is 4 Ω and runs from one side of a Carver *PM1.5*, about 1000 W of low mid.



"We like the Carvers, they're light and they sound great but they're not ideal at the bottom end. We tried every amplifier and for LF the *MacroTech* was easily the best.

"The high mids and super highs are where the manifold technology comes in. Each section has four drivers, mounted on a common throat, which exhausts into its own constant directivity flare. The high mid has 2 inch drivers and the super highs have 1 inch drivers. Normally, with compression drivers on a multiple array you end up with phase problems and a lot of inherent distortion. This technology eliminates that, enabling you to get a lot of components into a small space. And the dispersion pattern is very predictable, which, environmentally, is very good for this application."

Is dispersion a major feature of the system arrangement here?

Penn: "Yes—the main feature of the *MT-4* is it's a high Q system with a narrow beam. That's why it works well for us in arenas; we get a lot of throw over a great distance and we can control where it goes, unlike a direct radiating system.

"We wanted a system which we could use in arenas and, ultimately, in stadiums. It was designed to be used in those places.

"We looked at the marketplace and looked at where the company was going. We were doing very nicely thank you in the concert market, but we realised that there's going to be more larger shows, more NEC-style performances, and those have the opportunity to be more lucrative because they make a profit in the way that small tours don't. So we were looking around at which way to go and most rental companies have gone the route of getting their own proprietary gear, which is what we'd always done. But obviously it costs a lot of money to develop a very specialised system.

"Nobody had bought the *MT-4* system over here, [the UK] and we saw that it offered all the things we were looking for, a package that would fly easily, fit in trucks easily, and work well in arenas and stadiums. It didn't affect the rest of our stock which would carry on working in concert halls; we added another phase and I think it was the right decision for us."

Doyle: "We also did a lot of groundwork on the system. It's very efficient, you can pack a lot of power into a very compact space and every cabinet is flyable. Plus it was a new system in town. So our strategy was to buy up the complete import allocation of the *MT-4* for 12 months, which gave us a year's start on our competitors.

"What we have at Reading fits into two 40-footers [trucks], with a bit of room to spare. The whole packaging is designed to make the space usable: standard boxes for everything, standard case sizes to make truck loading easier. Within the company we manufacture a lot of stuff ourselves, so we can package it the way we want it to be.

"There's a simple cost equation: with a lot of systems, it's 'this works great in a concert hall, we'll get a lot more of it and put it in a very big building', which is like saying 'I've got 50 hi-fi speakers, let's do a concert'; it doesn't work.

"But because of the way the system's packaged, we can put it up and take it down faster than anybody else with an equivalent wattage, because there's fewer units. We had 32 boxes to do the NEC—a couple of hours. We watched another big act loading in there with the same SPL as us and they had 96 cabinets. Not a 2-box system but loads of different boxes and they've all got to be flown and curved and the stage crew are getting exhausted—three times as long as for us.

"And consider the hidden costs. This other company quotes so much for a tour; fine, they've got the gig. But the gear takes a lot longer to put up and down than other people's because there's too many boxes, so what happens is the promoter pays the stage crew, 20 to 30 guys, a lot of money, and it's docked from the band's fee as part of the production cost. The band don't think of that when they're quoting the PA in the first place. Do that five nights a week and it starts to add up. We can charge you more in the first place but it'll still cost you less. Also the physical attrition on human beings, it all makes a difference. We can quite happily start at the NEC at 10.30 and be ready for lunchtime.

SSE: a potted history

John Penn formed SSE in 1976, initially as a PA hire company, and gradually developed a sales side embracing manufacturing, woodwork and other activities. Chris Beale joined in 1983 and a year later became a director and shareholder.

Penn: "When I was appointed Amek and TAC's sales director I took a back seat in the hire company because I didn't have the time, so Chris Beale took over the running and built it up. I came back into SSE full-time in November 1988 after leaving Amek and TAC."

Bob Doyle took over responsibility for procuring accounts from Beale on his arrival 18 months ago. Doyle had previously owned Texserv, a Birmingham-based PA company with whom SSE had worked closely for some years, and brought his crew and some of his hardware.

His move coincided with SSE's move to their new Coventry Road premises, owned by lighting company LSD—an arrangement which, says John Penn, has the benefits of "24-hour access, security and a sort of empathy; we do sound, they do lights and we both have a lot of experience and contacts". A further recruit to SSE was Johnny Merchant, owner of a local PA outfit, now the company's warehouse manager.

Today, Penn is in charge of financial control while his wife, Heather, is company secretary, managing the accounts and handling the company's PR and marketing activities.

SSE has also kept up its sales side, maintaining a close business relationship with TAC (as both a dealer and a major user because, Penn says, "we love the product") and recently announced the opening of a new hire operation in Ireland.

Besides TAC, sales lines largely consist of products used by the hire company day-to-day.

Penn: "We looked at the products we really rate and endorse, and we've become agents for them, such as KT, BSS, Carver, Crown, and TAC of course—and the peripherals that go with them such as cabling systems. We intend to develop our own little sales centre; how far we go depends on the management time available and the profitability. You have to be careful."

SSE see 1989 in general and Reading in particular as a watershed in their efforts to move into the first division of sound reinforcement. (On the same weekend they also staged another major show at the NEC). This step has brought into focus some of the residual attitude problems facing regional firms, and their potential to respond as de-regulation in 1992 and the Channel Tunnel approach. ▷

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Penn: "Quality and projection are very much a part of the *MT-4*. Bob's emphasised the compactness. Well, when you're doing these really big shows, the whole idea of a high Q system that can project the power in the long distances is so important—because you've got an obligation if you're doing Wembley Stadium that everyone at the back has paid the same money and should be able to hear it! All too often they either don't really hear it or if they do it's not very good, and that's not on.

"DB Sound used an *MT-4* system over here last year on the Prince tour. We work with them a lot, they pass on acts that use the *MT-4* in America and we throw acts like New Order to DB because they've got the *MT-4*. It's a gentlemen's agreement—it works well and they're good people.

"It takes time to establish the products, of course—to get people to take the chance and use it. The more we use it the more it's accepted: it's been a big learning curve in almost a year now. We've been very successful in the shows we've done with it and won some major accounts, never had any problems. When we did the UB40 stadium gig—our first really big show—it was remarkable; people commented on how good the sound was. We've 32 2-box stacks, about 4k a stack. If we need extra we can sub it in from Germany. We'll be buying some more shortly, I'm sure."

Three separate effects racks were used for FOH—one for the *SR9000*, serving top of the bill acts, the other two being duplicate racks for the alternating consoles. SSE examined each band's requirements—gleaned from a 'hardware questionnaire' included with their detailed technical manual, circulated in advance—and provided a common denominator which would hopefully satisfy everyone.

Streamlined stage

If anything exemplified the new regime at Reading, it was the stage itself; past festivals employed a cumbersome dual stage arrangement.

Doyle: "It was decreed early on that we'd have one stage, 90 ft deep. The idea was to create an equipment flow around the stage with ramps either side—everything comes on stage left and is placed on rolling risers and put into the 60×40 ft playing area. Behind the playing area is a black curtain, so while one band plays the next one's gear is set up, miked and line checked. As soon as the playing band have finished, their equipment is exited stage right where it's packed and loaded onto their truck."

Stage monitoring consisted of 22 SSE bi-amped floor monitors (each containing a 15 inch RCF driver and a JBL *2441* compression driver). Since New Order specified Meyer monitors there were three pairs of *UPMs* and three *MSL-3* sidefills flown each side, the latter used for the whole festival. Microphones followed the pattern of three complete setups—one for the day's headliners and two alternating systems for the rest, through 26 BSS active DIs.

Doyle: "We've got two 40/12 TAC *Scorpion* monitor boards, one EQ'ed control rack and an insert and effects rack with a *DN60* analyser, a Yamaha *D1500* DDL, two *SPX90*s, and six channels of gates and compression. Each wedge monitor rack has six Carver *PM1.5*s or *PM-2*s and three stereo 2-way *FDS-360*s. So each (very

compact) rack powers six bi-amped wedges. Here, we've got three racks so we can run up to 18 wedges. And there's two 3-way sidefill racks for sends to side and drum fills."

The future of rock'n'roll?

Penn: "The whole industry is getting more and more professional as it moves to bigger shows, because people can't afford to take chances. There's a degree of professionalism that wasn't there before and the equipment is there to do it.

"Unfortunately there are still people who haven't invested and are still trying to lash it together, which means the artist and the audience suffer. Realistic fees aren't being charged and too much is based on the goodwill of the crews, everybody's cutting margins. At the end of the day that's not healthy; you have to make money. So we'll charge a realistic rate for a good job to be able to re-invest.

"Our objective is to be able to service accounts worldwide. One reason we bought the *MT-4* was that we were sick of seeing Americans coming over and taking every major tour. If it carried on like that there wouldn't be a UK PA industry."

Gone are the days when you could run a rock festival with one portable toilet and a hamburger stall.

Penn is full of praise for this year's line-up at Reading, however.

"I think it's great to see this bill with all these up-and-coming acts, half of whom, unless you listen to John Peel's radio show you've never heard of. If you look at the Reading line-up 10 years ago, many of those bands are now mega-acts. So somewhere out there there's some guy with his arse hanging out of his trousers who'll end up with a platinum album on his wall and all the rest of it!

"But it's been a real problem—small bands haven't had the opportunity for proper exposure in the last few years with Reading becoming this ritualistic holocaust of heavy metal acts and I think it's really good that the whole thing has changed. European festivals have been like this for years: that's how these bands survive, they can go out to Europe and get enough of a name to do the indie album and all the rest of it.

"To talk about the music business for a minute, apart from John Peel, what do you get on wonderful Radio 1 in that sector? They won't play these so-called 'minority' bands until they're commercially successful—and by then they're out of date! It's an important issue.

"We feel very positive about the whole thing. We're looking forward to doing bigger shows and really setting standards. There's going to be more and more big gigs: the market is there. We know how to run large shows properly so let's just do it right.

"All we have to do is continue doing what we're doing, get the results, and everybody will notice. At the end of the day, that's all there is to it."□

MONITOR SYSTEMS - A BACKGROUND TO RESEARCH PART FOUR

Phil Newell continues the search for a new, high definition midrange loudspeaker horn. This article is based on research by Keith Holland, BSc, at the UK Institute of Sound and Vibration Research, University of Southampton

Last month's background article on horns was actually written some two and a half years ago. So following the stated principles, where has research led us? One of the biggest hurdles is still the problem of correlating what is measured with what is perceived. The individual shapes are somewhat akin to the individual species of animals. If an ape has a mutant offspring, the offspring will be a mutant ape. If a lion has a mutant offspring, that offspring will be a mutant lion. Never has the genetic mutation of the foetus of an ape, been such that it is born as a lion, or a giraffe. Likewise with horns: a horn with a particular characteristic sound, no matter how its physical shape may be deformed, always seems to sound like a modified version of the original horn. So far, just as the alchemists failed to turn base metals into gold, we have not been able to change any characteristic sound of one horn, into that of any other. We tried to measure the overall flare rates of individual horns, then mould into the walls of other horns, shapes which would modify the flare rate of one horn into the flare rate of another. Would *this* make one horn sound more like the other? After all, great importance has historically been placed on accurate and controlled rates of flare. To our surprise, we could engineer gross disturbances into the flare rates with pitifully small effect on the perceived sound. Things were disturbed, however, by the installation of pillars and dividers, especially when placed on the central axis of the horn. Don't laugh, it is not that obvious; there are manufacturers who do install pillars on the central axis, even very close to the throat where their disturbance is most severe (see **Fig 1**).

Initially, the listening to, and measurement of, the 'modified' horns took place on-axis. Nonetheless, it was soon noticed that if an asymmetrical disturbance was introduced into a horn, its presence was noticeable from a listening position at a normal to the disturbed wall (**Fig 2**). So, the overall flare rate was of little consequence but relatively minor sidewall disturbances were easily noticeable when listening from the opposing side of the horn. There were two immediate questions that sprang from the above observations. Firstly, that they fit in well with the original trigger for the research, the super smooth contouring of the Lockhead Blackbird (Part Three, *Studio Sound*, October 1989). Secondly, if the ASS horn (**Fig 3**) was sounding remarkably neutral, just what would happen if the 'smoothness' of contour were to be taken to its extreme; a perfectly axisymmetric horn, free of all dividers or other obstructions? From the observation that minor disturbances to the shape at any point at a normal to the listening position were readily noticeable, it was construed that *any* top/sidewall/bottom junction must form a disturbance in the response at any points at a normal to those boundaries.

There had been many other pointers to the desirability of axial symmetry, which had a habit of appearing at frequent intervals. While Keith Holland had been working with Tonni Johansen in Trondheim, people kept pressing the question "Why not axial symmetry?". It had also long been know that in partially reverberant conditions, any wide discrepancy in polar pattern with respect to frequency, would cause the reverberant field to have a differing 'frequency response' to the direct, on-axis response. Such a discrepancy, if severe, can cause undesirable characteristics to be attributed to that loudspeaker system. Obviously, the room acoustics will have a great bearing upon the perception of any such effects, and when the room and monitor system are part of one, integrated design, these things can be accounted for at the design stage, putting conventional horns at no disadvantage. However, proprietary systems for general use may well benefit from axial symmetry.

So why have we not seen more of axisymmetric design? I suppose that 99% of all large horns are used in public address applications where pattern control is of prime consideration, a 'mind-set' could well have dictated that horns are rectangular. Furthermore, conventional horn

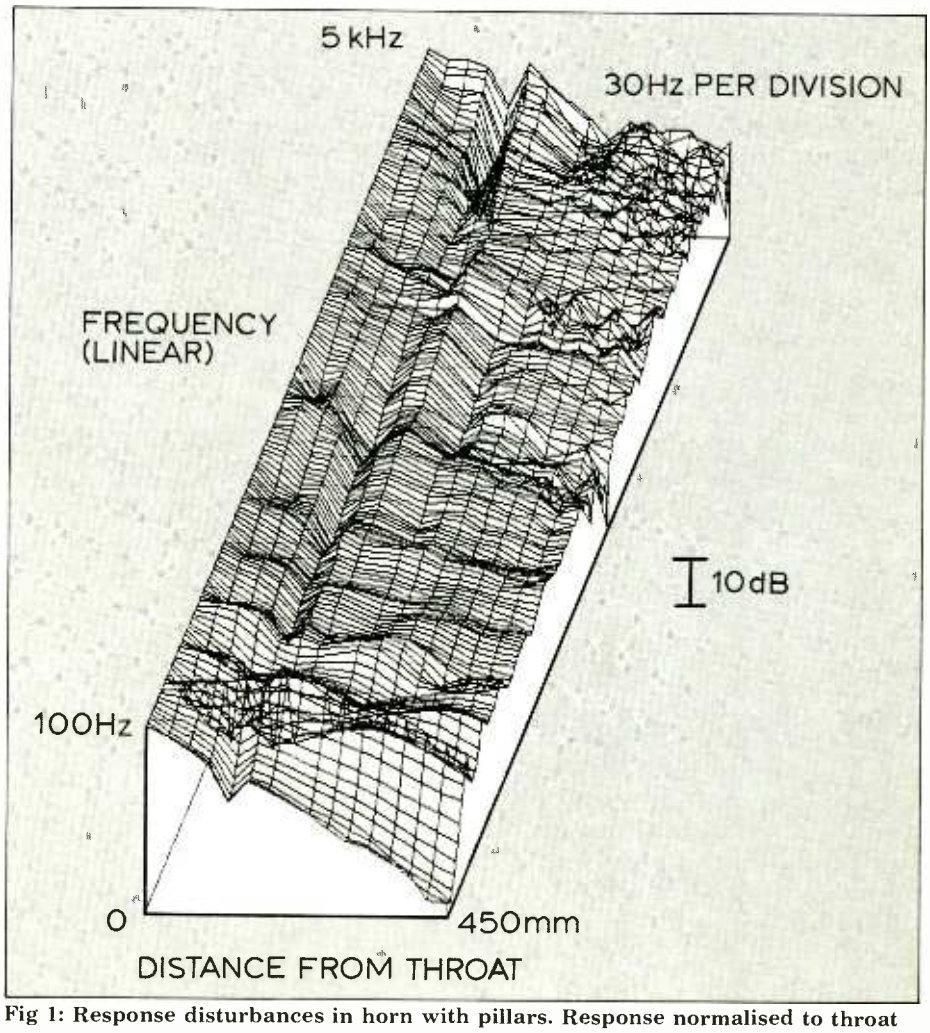
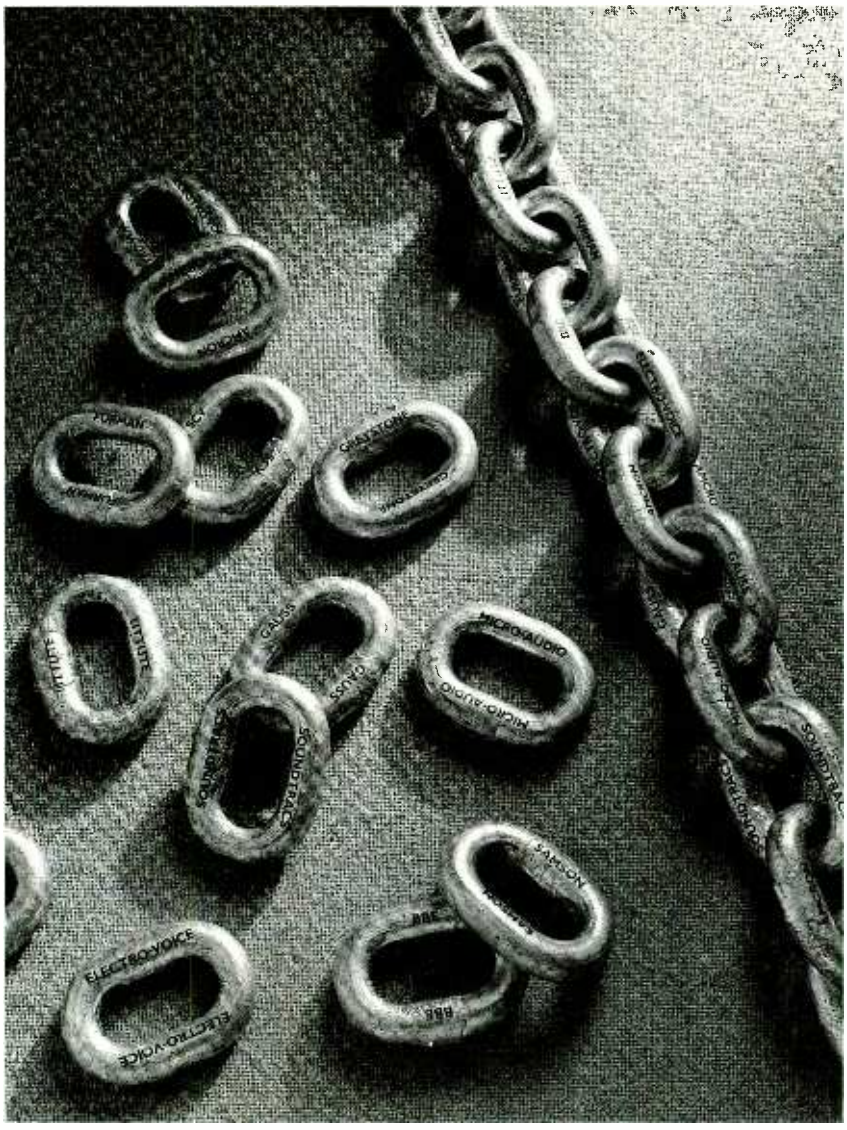


Fig 1: Response disturbances in horn with pillars. Response normalised to throat



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◁ practice could well have dictated an inordinately large diameter of mouth. Our research has shown, however, that this need not be the case.

Following the leads that were pulling us towards axial symmetry, Holland had axisymmetric horns made with opposing extremes of flare rate. The throat cut-off frequency is solely a function of the rate of flare, while the effectiveness of the mouth to terminate smoothly to the outside air becomes untenable once the width, height or diameter of the mouth approximates to one wavelength. Harking back to the intuitive feeling that short horns were desirable, we construed that a short horn with a relatively wide mouth would probably be desirable but this would require a rapid rate of flare. The rapid rate of flare would push up the throat cut-off frequency and we had already elected to avoid the cut-off frequency by at least an octave in order to avoid the phase and amplitude irregularities associated with the cut-off. By these criteria, many of our 'desirable' properties were beginning to appear as though they could not be 'welded' together in one horn.

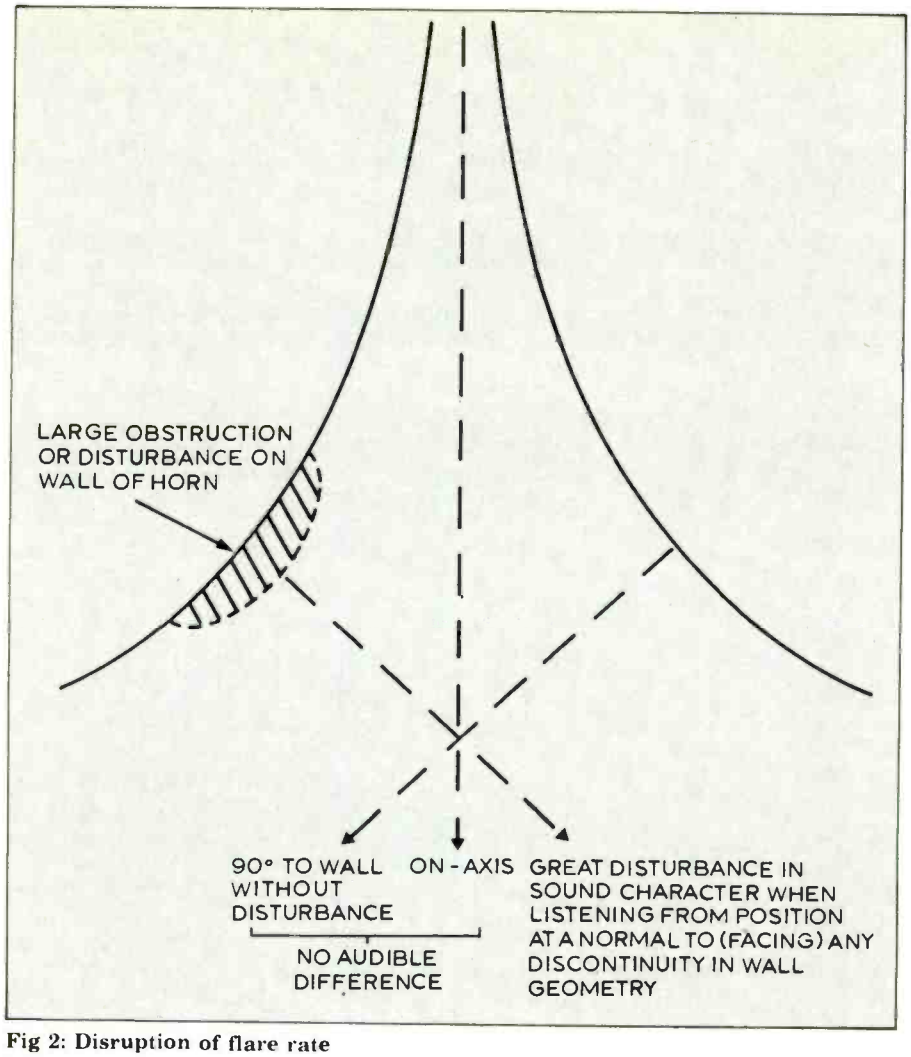

Fig 2: Disruption of flare rate

Undaunted, Keith Holland drew up the axisymmetric designs and ordered them from the model makers. The first two were chosen with differing compromise points. The first was a short horn with a flare rate giving a cut-off in the region of 400 Hz. In order to remain short, the low rate of flare dictated a small diameter mouth, which would probably only be rendered usable by the addition of accoutrements such as slant plates or other such termination aids. A low rate of flare in conjunction with an adequately sized mouth would inevitably dictate a long horn with greater possibility of phase dispersion and other unwanted properties. The second model had a cut-off frequency far too high for our original design criteria, in fact the cut-off was only slightly below the lower limit of our desired operating range.

Mathematical modelling had suggested, however, that the latter horn may well be a viable proposition as the mouth termination seemed to be very close to what was considered to be theoretically desirable. The correlation of the mathematical prediction with the actual, measured device was remarkably accurate. The mathematical modelling had been devised by Holland after an in-depth investigation into the phase plots of waves travelling down a horn. Conventional horn theory dictates that the flare must expand in cross-section at a precise mathematical rate as the sound wave travels down the horn. What has been unclear, however, is just how the wave propagates. A horn propagates sound, not with the piston action of a direct radiator, but with the breathing action of an expanding and contracting chest or balloon. The shape develops gradually from the virtual plane wave at the throat, to a spherical wave at the mouth. The overall expansion of the horn must take into account the changing shape of the propagating wave, for in reality it is the *wave* that must expand at the appropriate rate, rather than any particular cross-section of the horn. Holland's phase contours within the horn gave him the necessary mathematical weaponry to attack the horn shape problem.

The measurements and aural appraisal of the short, fast flaring horn were very revealing. Measurement of throat impedance showed the horn to be almost devoid of mouth reflexion problems. The throat impedance approximates to the 'frequency response' of the horn, as it is a function of the loading the horn presents to the driver diaphragm. The unusual smoothness of response was attributed to the flare rate being high enough to allow the horn to blend with a baffle without any abrupt change of angle at the boundary. This, together with the newly calculated rate of flare, minimised the phase distortions inside the horn, and allowed phase to remain largely coherent as the waves left the horn to enter the listening room.

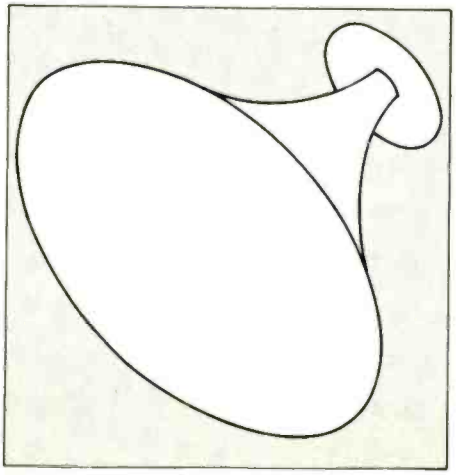

Fig 3: Axisymmetric horn geometry

I was beginning to think of the sound waves leaving the horn in a way not dissimilar to that of a bubble leaving a child's bubble blowing kit. To test my 'bubble theory' further, I twisted pieces of wire into shapes approximating the mouth geometry of various horns. Dipping these wires in bubble blowing fluid, I was not too surprised to see that the circular shape produced the largest and most reliable bubbles. Many of the other shapes saw the bubbles-to-be tearing themselves apart as they attempted to leave the wires. It was rapidly becoming apparent that any boundaries formed by different faces of a conventional horn would make it very difficult for a clean, spherical expanding wave to transfer itself from the horn to the room. The surprise bonus from the short, high flare axisymmetric horn was that it was usable from a sonic standpoint, almost all the way down to its cut-off frequency. The conventional necessity to remain an octave or so above the cut-off was no longer a prerequisite as the new axisymmetric device was almost free of vices in the cut-off region. Indeed, it had an almost perfect 12 dB/octave roll-off that begged the question as to whether or not in future designs, the horn could be made such that the crossover frequency coincided with the cut-off, and that the acoustical roll-off could be incorporated in the overall roll-off when connected to the electrical crossover system?

Listening tests showed the horn to be very smooth and neutral, corresponding very closely to the measured characteristics. It was interesting to note that the new horn sounded like a smoother version of the original ASS horn, which had inspired the early work and the thoughts about acoustical/aerodynamic similarities. Holland had taken many of the basic parameters of our original horn, pushed them towards our most desirable parameters, and the result actually sounded like a smoothed out version of our starting point. Once again, the 'mutant' horn sounded like a close relative of the horn from which its concept had been derived. Despite looking totally different from its predecessor, sonically, it remained of the same species.

While the flare rate, irrespective of shape, will dictate the diaphragm loading and the horn's general electro-mechanical properties, the widely held belief that a horn of any given flare rate can be any desired shape, does not seem to hold true ▷

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from a sonic point of view. Shape now seems to play a very great role in the perceived sonic performance of a horn. Two horns of similar shape but both having flare rates deviating in different directions from a theoretically desired norm, are much more likely to sound similar than two horns, which may adhere precisely to the desired overall flare rate but which possess significantly different shapes. To investigate this theory further, we are making rubber horns that may be either predistorted for measuring and listening tests, or may even be distorted in shape while those tests are actually being carried out.

The rubber horns of identical shapes to other test horns, will also form part of the investigation into materials. Although extremely difficult to measure by conventional techniques, it has long been suspected at the business end of the industry that the material from which a horn may be constructed, can have a significant bearing upon the perceived sound character. A combination of high density and low Young's modulus would appear to be the most desirable combination. Metal horns have frequently been considered 'bright' or 'brittle', though I doubt that could be said of a lead horn. Once again, public address applications have probably precluded lead from the points of view of weight, cost and rigidity in transport.

Wooden horns came into vogue in recording studios in the early 1970s. The hardwoods now seem to have given way to plywoods, and even the plywoods now seem to be gravitating towards their heavier density varieties. Ken Kinoshita's penchant for Japanese apitong ply, as opposed to other apitong plies, almost certainly is a choice based upon density. In the difficult acoustics of a concert hall, delicate subtleties of sound are far less important than lightness and ruggedness. Studios have yet again been the poor relation in the previous history of horn designs. The cost-effectiveness of the research into certain subtle areas of horns have been non-viable to the horn producers. Heavy dense horns have not been required for PA.

Granted, wooden horns look pretty, and this has no doubt had a part to play in their widespread use in studios. Wood also has less of a tendency to ring than many of the metals used in most horns. High density woods therefore conform with basic tenets of high density and dead acoustic properties. When the high density materials are used in quite thick sections, there is a lot of mass in the horn itself; it will take a lot of moving. I have known many people involved in the theory of horn design to laugh at such insistence upon the use of particular esoteric materials but I do feel that there is something in it. Sound travelling through the structure of a horn and recombining, even at much lower levels, with the airborne signal at the throat, can produce response irregularities and time smearing. The multiple, layer-boundaries in plywoods make it much more difficult for a sound wave to propagate, than through a solid piece of homogenous wood. Given modern computer numerically controlled (CNC) woodworking machines, axisymmetric designs should be at no disadvantage when made from wood except in terms of cost, when compared to other materials, such as glass fibre resins. Such resins, however, especially when heavily mineral loaded, still hold the prospect of offering great possibilities as horn materials.

Another of our basic tenets which still seems to hold good, is the short horn philosophy. The shorter the horn, the smaller the amount of time that the sound wave will spend in the horn. In turn, this will reduce the length of time for which the sound will be subjected to any unwanted characteristics that may be imparted by the horn. I do not mean here that all short horns will sound better than all long horns but rather that it is probable that 'shortness' will be one property of our 'ultimate' horn. By short, I am considering a 12 inch maximum distance between diaphragm and mouth. Obviously, with these overall restrictions upon horn length, mouth size will limit the flare rate. With the larger mouth size, the coupling to the room will improve at lower frequencies but the higher flare rate will raise the throat cut-off frequency. With a 12 inch diameter mouth giving reasonable coupling down to around 1 kHz, the flare rate will produce a throat cut-off only just below 1 kHz. Given the workability of the new designs down to frequencies very close to cut-off, the parameters are beginning to close in from either side. Anyhow, anything above 12 inch diameter would probably begin to become somewhat unwieldy, as it would then become difficult to optimally mount the other drivers in the system. Close coupling of the mid and high frequency components of the system would be particularly difficult unless the midrange horn were to be modified into an enormous 'bullet' with an HF driver in the tip.

In order to extend the directivity control of the upper octave of the audible regions, devices seem to be required such as guides or compound flare rates, which would appear to be contrary to the cleaning up of the geometry. If it is this cleaning up process that is so important to sonic purity, then as per our original design criteria, three octaves would still appear to be the limit of range for any optimally derived horn system. I do not forsee the physics of horn design allowing 5-octave horns of the highest sonic purity. Having said that however, there are few direct radiators that could be claimed to be performing optimally at the extremes of a 5-octave range, so I do not see this restriction as being a limitation that could in any way be construed to leave midrange horns at a disadvantage. Indeed, the requirement of the physics of any electromagnetic transducer are so opposingly polarised toward the extreme ends of the audible range, that extension of response would seem to be one of the last design priorities in the search for sonic accuracy. By virtue of this fact, I believe the multidriver option is still the way to go, though this transfers a much greater burden onto the development of phase accurate crossover systems.□

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Barry Fox

Problems with the launch of UK Nicam stereo TV transmissions

The official start of Nicam broadcasting in Britain should have been a landmark in broadcasting history and something for Britain to shout about. Instead Nicam fumbled onto the scene, a lost opportunity and a symptom of the IBA's demob happy attitudes. It is as though the IBA, knowing it is due to be disbanded next year, can no longer be bothered to do its job properly. The Cable Authority, which is due for the chop at the same time, behaves equally remotely.

Picking up on the BBC's accountants' decision to freeze plans for a Nicam service until late 1991, the IBA said earlier this year that it would push ahead with its own Nicam service to start in September in the London area, from the Crystal Palace transmitter and in Yorkshire, from Emley Moor.

Tests began in the spring, and in the early summer the IBA published a full roll-out schedule leading up to 75% coverage of the population by the end of 1990. Although engineers for the ITV companies and Channel 4 soon knew that September 11th had been chosen as the official start date for London and Yorkshire, it took the IBA until August 11th to make a formal announcement.

By then Yorkshire TV, LWT, Thames and Channel 4 had run on-air tests that had thoroughly confused viewers. And with less than a month to go, the TV stations still had not made any effort to inform the public. Worse still they seemed to see no reason to do so, and be quite shockingly ignorant over what Nicam is, what it has to offer and how lack of publicity and information has been causing widespread confusion that risks turning the public sour on Nicam.

Through the summer months callers to radio phone-in advice programmes in London had no idea a Nicam service was due to start. Those who did know, feared that their existing television sets might suddenly become obsolete. People who had already bought Nicam sets found they were mysteriously receiving the wrong soundtrack, as engineers conducted unannounced tests with music or tone on the Nicam track instead of the intended programme sound.

I went round high street electronics shops and found that although Nicam TV sets and video recorders were on sale, no effort was being made to explain the significance of the word. They just sat alongside sets marked 'stereo', 'stereo sound', 'stereo sound quality from stereo source' and 'stereo TV'—which can't receive Nicam.

Clive Leach is not just managing director of Yorkshire TV, he is also the current president of the Television and Radio Industries Club, an organisation pledged to 'promote mutual understanding and goodwill among those engaged in the audio, visual and allied industries'. I asked Clive Leach if he realised the extent to which the lack of publicity from the commercial television companies and IBA on the official start of Nicam broadcasting was letting the trade capitalise on the public's ignorance, to get rid of non-Nicam sets. I suggested there were going to be a lot of very unhappy people as soon as the official Nicam service began and people realised that they had just spent £500 or more on a stereo set that won't receive off-air stereo and can't be retrofitted with a Nicam decoder.

"I am prepared to discuss your comments regarding the lack of publicity on the start of Nicam broadcasting when we next meet," replied Clive Leach, without any indication of when he in Yorkshire and me in London might happen to chance upon each other.

"I would be interested to learn what publicity is being undertaken by Nicam as the main beneficiary of the system," Leach continued. "The initial news release was received by me this morning."

In a subsequent conversation, Leach referred to "Nicam themselves".

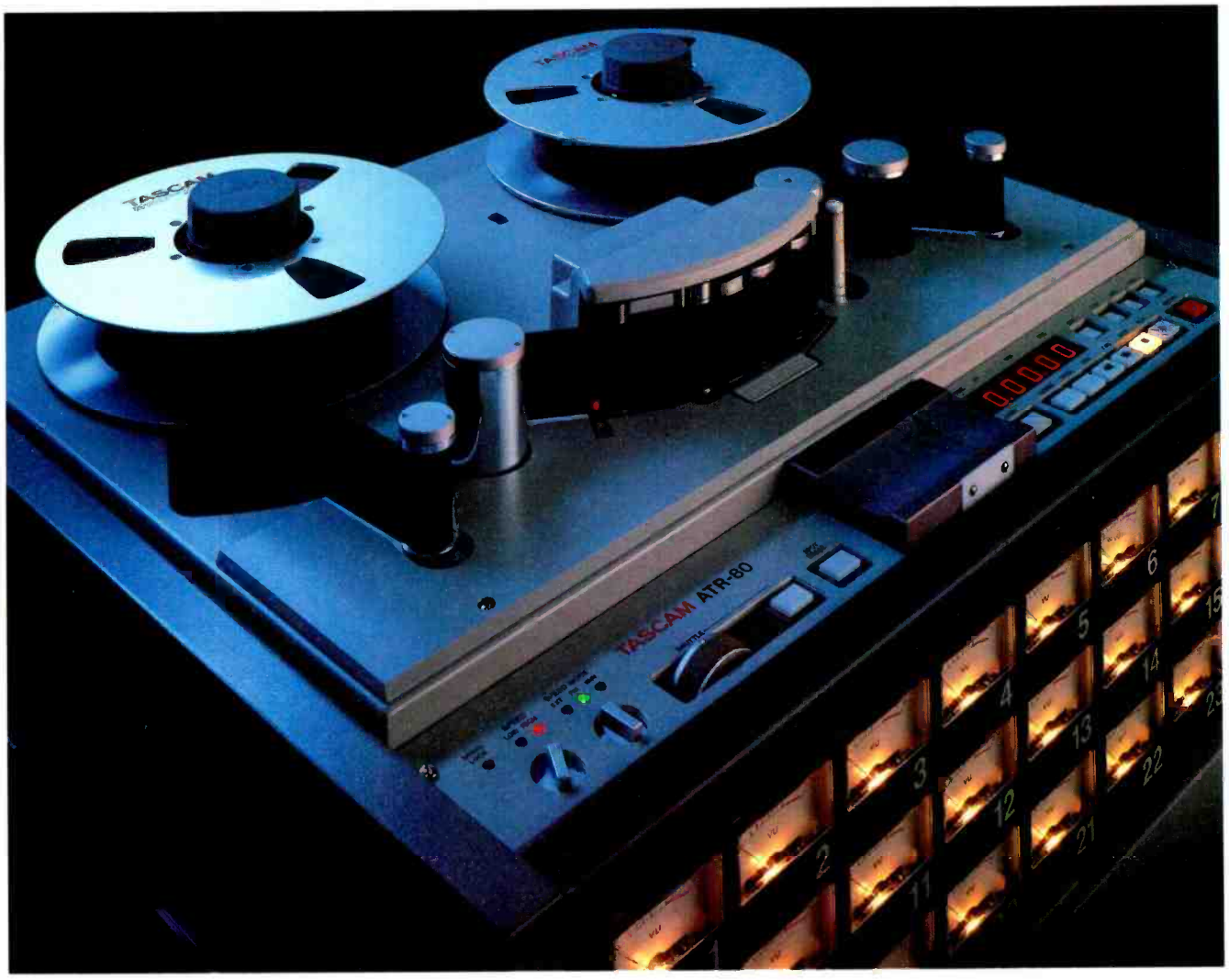
Is it really possible that the president of TRIC and MD of Yorkshire TV thinks Nicam is a company?

The IBA's control over the on-air tests has been so slack as to be non-existent. On July 10th/11th Thames TV celebrated 21 years of broadcasting with *The Marriage of Figaro* in Nicam stereo, unannounced to the public. The sound was fine but the Thames engineers left their system set to transmit mute sound on the Nicam carrier after the programme ended. So anyone with a Nicam TV in the normal automatic reception mode got no soundtrack for the following programme (a re-run of *I Spy*). They then got test tones for the beginning of *Sportsworld Extra* and finally, as the engineers threw the right switches, correct sound halfway through the programme.

I spoke informally with the IBA the next day and checked what was happening. Although billed as 'live', the *Figaro* transmission was in fact recorded and cut into two halves for transmission on consecutive nights. The IBA at Winchester talked with Thames about the technical faults, and put them down to "finger trouble".

Fair enough, mistakes happen. But then Thames made exactly the same mistake on the second night, July 11th. The feature film *Behind the Mask*, which followed *Figaro*, went out with mute sound on the Nicam track. So again anyone with a Nicam receiver set to the normal automatic position would have heard nothing. The Nicam line was in fact connected to the Thames VTR suite, because Nicam listeners several times heard the sound of tape rewinding at high speed and then being cued to a start point.

I rang Thames immediately the problems began and asked to speak to a duty officer. The duty officer had gone home leaving only a security guard who would not put me through to the VTR suite. So the problem persisted.



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The next day I lodged a formal complaint with the IBA and got back a patronising letter telling me how Nicam TV sets and VCRs work.

In the meantime, on July 30th, London Weekend transmitted its *Gala Night* of entertainment, unannounced, in Nicam stereo. And sure enough, during commercial breaks the Nicam track muted.

And while all this was going on, the stations were still running broadcast tests during the day, putting music or tones or silence over routine programmes.

The official IBA line is that there have been no complaints and anyway all will be resolved when regular transmissions begin because the FM mono and Nicam soundtracks will always be the same, even if the Nicam track is simply a digital mono version of the FM mono track.

But this begs the question of how the IBA will cope with bilingual broadcasts, with different language soundtracks, eg for a dubbed film.

I now get regular calls from the trade wondering what on earth is going on. Even the firms making reception equipment don't know. Most of the information I get on IBA activities and problems, come from people inside the ITV companies and Channel 4 who worry about the IBA's failure to communicate.

It is surely this lack of communication that has led the BBC and IBA to order incompatible Nicam encoders for stereo sound-in-sync links.

The BBC and Channel 4 already distribute the mono sound for their TV programmes round the country, between transmitters as sound-in-syncs, digital code slotted into the gaps created in the video waveform by picture synchronisation pulses.

To squeeze stereo into the syncs, the gaps are slightly widened and 4-level, instead of 2-level, digital coding used. ITV has been using BT analogue landlines with a bandwidth of only 8 to 10 kHz.

Both the BBC and IBA, are now busily converting their whole networks to stereo operation. The IBA plans a 'big bang' switch over on April 1st, 1990, with all ITV and Channel 4 transmitter links switched to stereo SIS overnight. ITV listeners, regardless of whether they are receiving Nicam stereo, should hear a big difference as they are cut free from the noisy lowpass landlines.

The IBA is buying its stereo SIS encoders from a Danish company, RE Electronics. the BBC is buying its encoders from Pye Varian. Believe it or not, although both cram 728 kbits/s into the sync pulse gaps, the BBC and IBA systems are incompatible; they use different types of 4-level coding. This means that any news service, or independent production studio that supplies the BBC and ITV companies with programme material will need to install two quite different sets of Nicam stereo encoder to patch into the incompatible systems. When I asked the IBA and BBC about the wisdom of this, it turned out that only a few people knew of the incompatibility.

As DAT dies on its feet as a domestic format, with machines just gathering dust in Japanese shops, Dolby Laboratories have made the inevitable move. Dolby have developed a domestic version of *SR* called *S-type* and is offering it to consumer electronics companies as 'the next generation consumer tape system'.

The main difference between *SR* and *S-type*, is the latter's partial compatibility with the Dolby *B* noise reduction system, which has become the standard for domestic cassette recorders and pre-recorded musicassettes. In the spring, Dolby planned to announce *S-type* in July and expect to have the first samples of integrated circuits available by September. Cassette recorders with the new system, and pre-recorded cassettes, will be made available first in the United States, probably in 1990, and later in Japan and Europe. Although the final technical specifications of the system will not be announced until autumn 1989, most of the development work has already been done.

Whereas Dolby *B* reduces the level of unwanted HF noise by around 10 dB (a subjective halving of level) *S-type* reduces noise by up to 24 dB. But unlike Dolby's previous domestic systems, and like *SR*, *S-type* uses a bank of variable filters. These continually monitor the sound and adjust the signal processing circuits so that only those parts of the music frequency spectrum needing protection against noise are processed. Stronger signals in other parts of the frequency spectrum are left untouched.

I'll end with two predictions. First that the domestic launch of DAT will be both later and slower than many people expect. Every day it becomes clearer that the record industry does not like the deal struck by their trade bodies, the IFPI and RIAA, one little bit. The record companies are just not interested in backing the hardware industry in a Big Bang launch of DAT decks that digitally dub from CDs at 44.1 kHz.

The IFPI has called on all countries in the EEC to pass laws putting a royalty, ie tax, on blank tapes. The British Government has already written this out of the new copyright law, which came into force on August 1st, and the DTI legislators have said clearly and unambiguously that the chance of a change of heart is "very remote".

There is also going to be a lot of fun ahead with battles between the film and home video industry. Panasonic has just launched a VHS recorder that plays back NTSC tapes through most PAL TV sets. When you bear in mind that many feature films are released on VHS tape in the US before the film is even released to the cinemas in Europe, you can understand why the film industry is so upset.

Now Pioneer is ready to start selling a PAL video disc player that plays back NTSC discs through PAL TV sets. The political pressure on Pioneer is so heavy that the company has now forbidden its staff in Europe to mention NTSC playback in publicity material, or even tell it to the press.

Of course it didn't take long for the press to find out.□

Martin Polon

Not with a bang but a whimper. Comment from our US columnist on the DAT 'one-copy only' agreement

The night was pitch black. There was no sign of Athens' famous moon over the Acropolis. The only movement was the flurry of automotive activity as posh limousines delivered their obviously important passengers to a discreet location. Security men moved warily through the surrounding undergrowth, whispering into their two-way radios. Negotiations were intense and laboured within the meeting. Curiously, further in the distance, other men worked, equally discreetly with the added cloak of anonymity. They were among those who try to keep the peace in our troubled world. These men were puzzled by the obviously conspiratorial goings-on of the main group. Long range surveillance microphones, infra-red night scopes and other tools of reconnaissance were at the ready. Who were these plotters who so concerned their careful watchers? PLO, Libyans or the Hezbollah? Japanese Red Army, IRA or Welsh nationalists? Bader-Meinhoff splinter groups, Moluccan freedom fighters or radical Greens? No, none of these.

No terrorists were present in Athens on June 9th and 10th, 1989. Worse, much, much worse according to some audiophiles and stereophiles. It was 12 Japanese and three European consumer electronics equipment makers and representatives from the International Federation of the Phonographic Industry (IFPI) and the Recording Industry Association of America, Inc (RIAA), settling DAT's hash. Well, lads and lassies, there you have it. The great DAT war is almost over. Not with a bang but with a proverbial whimper. The gatherers had slipped into Athens to draft an agreement to end the vexing stalemate over DAT and that is just what they accomplished, although at what price remains to be seen!

The actual agreement or 'DAT II/The Second DAT Concordat' as some wags refer to it, functions as follows. First, a Serial Copy Management System (SCMS), based on a Philips NV innovation known as *SOLO II* will be installed in any and all consumer DAT recorders to be manufactured and sold without sanction in the future. This system, contained in a custom chip to be placed into consumer DAT recorders, will prevent the recorder from making more than one copy of an 'identified' digital source. The system operates via DAT control tracks and embedded information on the CD. There is no interference with or infringement of the recorded signal. Legislation will be solicited to give the use of the SCMS the force of the law. In addition, the parties in Athens acknowledged the possibility of royalties on DAT recording hardware and blank software; although with a clear sense that acknowledgement by the consumer electronics hardware makers was absolutely not agreement with the concept. Lastly, the record companies won a concession from the CE hardware makers that any future innovations will be subject to a significant dialogue on 'a technical mechanism for alternative systems for private copying remuneration in future digital recording devices'.

SOLO II operates by identifying the first recording made in the digital domain and allowing one copy of it. When copying a compact disc, the system detects the original use of digital signals via the control information on the disc. An SCMS-equipped DAT machine will make only the one copy from such an identified signal. The machine will not make any subsequent copies from that first tape, so marked electronically. If the source to be recorded is analogue or an unidentified digital, then the machine will make the first recording and code that tape as the identified first digital recording. A second tape can be made from the first but no more than that. The second tape will contain control track information identifying it as the first copy from an identified digital tape source—in this case, the original digital tape. In effect, the consumer is left with his or her original tape or CD and then a digital copy thereof. Of course, an unlimited number of copies can be made by copying the original tape or CD directly, over and over again. SCMS will not allow copying in the digital domain tape to tape. The record companies feel that most people will not bother copying in such a restrictive environment. The record people fear multiple copying of digital tapes much more than disc to tape and that is what *SOLO II* prevents.

The legislative component is designed to do two things. First, it is to prevent any conflict with prevailing anti-trust or monopoly law. Second, and much more important, it is to provide the teeth to force all DAT makers-importers to 'toe the line'. Without the force of law, there would be nothing to stop a 'rogue' manufacturer from dispensing with the *SOLO* chip to cash in on the market for unlimited copying of DATs. Some observers also feel that the record companies would like a definite copyright infringement payback via specific DAT royalties in the legislative package. Until the enabling legislation is passed, the mass market importation of DAT recorders will remain on hold. Also implicit in the new DAT agreement is a discontinuance of the old anti-copying dictates from the original DAT concordat that denied the DAT recorder access to digital audio from a CD by the artifice of a lack of 44.1 kHz compatibility.

Of course, the DAT format itself is not exactly out of deep water either. Mechanical issues are raised most often but there is a growing sense of discontent with the consumer and professional formats. A recent report from the laboratories of the German broadcast industry has not helped to cool the controversy. The Germans announced after 'exhaustive' research that the professional DAT units being used could not exchange recorded tapes reliably machine-to-machine 100% of the time. One component of the problem identified is that the so-called 'professional' machines use the consumer mechanisms in most cases. There are also some questions raised about the quality of some blank tapes on the market, at least initially. From the technical side, numerous questions have been raised about the extraordinarily small tracks laid down and the fragile nature of the revolving head mechanism. Critics of the report cite the 6,000 machines in professional use in the UK and the US with positive feedback from users.

Neither can digital audio be taken for granted as acceptable to the consumer. The compact disc, despite its presence among us for nearly six years, has not been setting the saturation statistics afire. Sales are expected to reflect by the end of the 1989 only a 17 to 18% impact on the industrialised countries. DAT has shown sales of only about 60,000 units to date, even where it has not been subject to embargo as in Japan and the EEC. It is likely that the professional use of DAT will remain strong. In fact, it is this two-tier system of consumer DAT units that are copy restricted and professional units that are not copy restricted that has appeared to be part and parcel of the record companies' plans to control the DAT medium to date. New units made under the concordat and priced above the $1,500 (£1,000) price point would probably continue to be exempted from the SCMS feature, although that is not at all clear. Since the initial price tag for consumer DAT units is expected to be in the same $1,500 price range, one can only wonder what criteria for so-called professional status will be applied. Perhaps the presence of Cannon connectors?

DAT costs will be reduced very slowly in the initial term. There are elaborate mechanical components necessary for a helical scan recorder, at least one microprocessor and sometimes more to control the transport and the electronics (and to comprehend the signals that makes the copy protection system work), input and output stereo digital to analogue (D/A) converters, and other associated circuitry. None of this comes cheaply. Stereo pairs of input and output D/A and A/D converters sell at OEM manufacturers cost of $200 plus. The better the converter, the higher the price. Needed microprocessors and memory chips are not inexpensive either. It is not hard to visualise a set of chips costing several hundred dollars. That kind of OEM pricing just for chips easily presages a $1,000 plus price tag on consumer units. A recent DAT recorder released by Nakamichi carries a $10,000 price tag to 'do it right'. Even at the hoped for median price of £1,500 in the UK the product is so expensive as to eliminate all but a few potential buyers. American newspapers were heralding the agreement as 'no big thing' since the $1,500 price point (about half the equivalent price in the UK), was beyond the reach of most Americans so DAT would clearly be only a 'toy for the wealthy'.

The presumption that a legislative 'lock' will be forthcoming to cement the agreement, could be a significant stumbling block. The feeling in the US Congress, according to an interested 'staffer', is that "there is no strong incentive to pass such legislation right now. First and foremost, there is a reluctance to 'legislate' technology. That is not

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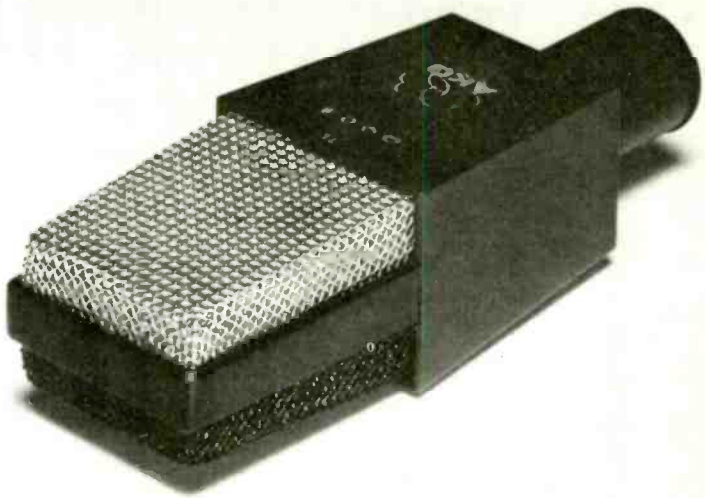

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the way it has been done in the past and it is not a precedent that many members of Congress look to establishing. Technology has always been treated as a child of market forces—not legislative ones.

"Second, Congress is like an elephant that does not forget. Few have failed to note the way that the RIAA and IFPI coerced and pushed for legislation mandating that inimitable 'Copycode Scanner' 18 months ago. Congress was told, without reservation, by a gaggle of trained record company experts testifying on command, that the *Copycode* system did not interfere with musical quality. The National Bureau of Standards blew those arguments out of the window with its report condemning *Copycode* as audible and unreliable.

"Third, that whole push was pointed at 'Saving the American Record Companies'. Even Congress can see today that Bertlesman, NV Philips, Sony, and Thorn-EMI are not exactly 'mom and apple pie' and that RCA, Polygram, Columbia and Capitol are not exactly home town boys anymore.

"Fourth, the credibility that the record companies had with Congress is probably gone. Such 'credit' came from a lengthy and handsome record of contributions by the record industry to the campaign funds of key members of Congress. Since 1989's flurry of 'legislator cannibalism' in Congress (to quote the lately retired, formerly great, House Speaker Jim Wright) there has been a stark reappraisal of power brokering. It seems very unlikely that any Representative or Senator would be willing to risk an appearance before the Ethics Committee (now known to many as 'You Bet Your Career') to help a contributor. The pressure and the security is just too intense.

"Fifth, the record companies had a pro-entertainment champion in the White House for the last go around. This time there is only cool neutrality.

"Sixth, the Congress is looking for issues that save American manufacturing like HDTV. The fact that the DAT player is virtually an off-shore product will reduce the importance to Congress of taking any immediate legislative action. In fact, success for the DAT could mean further fiscal distress for America. Substantial sales of a consumer format in which no American company is really involved would mean a worsening of America's already staggering balance-of-payments problem.

"Lastly, Congress has a very full agenda when it meets again in the fall of 1989 to tackle the issues of fiscal year 1990. Many groups intend to lobby against record company royalty solutions, supposedly including the EIA. There are even those who would suggest that the new DAT agreement is an effort at engaging in monopolistic practices. So it is a real crap shot as to if and when DAT legislation would surface and pass muster."

Curiously, Euro legislation is not a sure bet either. To some extent, the US experience with the original (and inimitable) 'Copy Code Scanner' was played out for both the European Parliament and for the British Parliament. So some of the residual sense of being used is still prevalent among the memberships of these august bodies. Also, since the combination of Europe into a single business state is rushing forward almost at an unstoppable pace, the question of any 'special deals' with the record industry will be heard by the entire European Parliament. It is not clear that all countries, especially those on or in the Mediterranean, will share the industrialised Northern view about the protection of intellectual property as opposed to lowered per unit costs for the consumers.

Further, the European Community (EC) may also be reluctant to carry current tensions with Asia forwards through restrictive legislation. Critics within the system are already saying that problems with the perception of present EC 'Asia Bashing' could slow passage of any enabling DAT legislation in the future. It seems that the EC has already slapped stiff anti-dumping tariffs on Japanese and Korean CD players. The Commission of the EC has hit 15 CD makers from Japan and South Korea with levies ranging from 6.4% to 33.9% of the import prices. Since this action was prompted by complaints from the three major European consumer electronic equipment makers—Philips of Holland, Bang and Olufsen of Denmark and Grundig of West Germany—some critics see it as difficult to frame further legislation over DAT without being crudely discriminatory. These three Euro makers, along with Thomson of France and 'naturalised' Japanese makers like Sony are expected to dominate the production of DAT machines within Europe 'if and when'. Even Japanese approval of the agreed to controls seems in doubt, since the Japan Phonograph Record Association, the Japanese Society for Rights of Authors, Composers and Publishers and the Japanese Council of Performers' Organisations did not like the limited protection the *SOLO II* system affords. In fact, these organisations feel that the whole SCMS system was not an effective safeguard for Japanese copyright holders. Only a royalty system would assuage their concerns, according to published reports of reactions to the Concordat.

In the future, new technologies that will threaten the record companies' control over the digital audio marketplace might not come from the established and somewhat complacent consumer electronics industry in Japan. It is true, one could argue, that the Japanese Government via MITI (Ministry of International Trade and Industry) felt that this was just one battle not worth fighting to the death. Nevertheless, the recording optical disc or the audio ROM chip could just as well come from the US computer industry as from anywhere else. The computer boys will not roll over and play dead for the RIAA and IFPI. Fibre optic audio delivery will probably come from either Snow White (ATT) or one of the seven dwarfs (RBOC—Regional Bell Operating Companies) in the US and Euro giants like British Telecom or the Mercury group. None of these major league players are going to wet their proverbial shorts when the IFPI squeals into the room. So the record industry's plans to keep a hammer lock on the digital audio future seems less than clear, despite the code written into the fabric of 'DAT II'.

In total, it seems that in some ways we may have simply just extended the stalemate over DAT. We apparently must await the passage of legislation that may not be at all forthcoming for the DAT agreement to coalesce. But other factors are at work that could drive DAT into the marketplace fast and furious.

1. Computer storage formats are taking shape using the DAT system. Sony and Hewlett-Packard have reached near release stage on a back-up memory system for computers that is superior to some of the streaming tape back-ups in use today.

2. Still and TV video formats are developing around the DAT. The DAT standards committee has acknowledged two still video formats and several others are in the process of refinement by various manufacturers. The two 'standard' still formats allow either a 6 bit video-10 bit audio split or an even 8 bit-8 bit split. the 6 bit video system allows 350 lines of horizontal video resolution per frame recorded every 4 secs, leaving 62 dB of audio dynamic range. The 8 bit video system provides better than 450 lines of resolution per still frame recorded every 5 secs. This yields 1,440 images on a standard 2 hr DAT tape. Audio would have only 50 dB of dynamic range but would retain the digital immunity to certain kinds of noise. The audio from both of the 'accepted' still standards remains compatible with standard DAT playback. A third format is being developed to use the 8 bit audio-video scheme with non-linear audio. That would yield 90 dB of non-compatible (with standard DAT) audio. With all these formats, the promise is of still photography plus audio, with the DAT mechanism taking the place of the floppy disk system currently envisioned. In addition, research labs in Japan are trying to substitute the DAT mechanism and tape for current VCR systems. The resulting unit would make feasible the 'Video Walkman' and open the consumer floodgates to a new category of portable lifestyle electronics.

3. Professional audio usage of DAT is expected to continue with audio editing becoming more feasible and with possible linkage of several DATs from multitracking.

4. Play-only DATs for audio and/or video. This is the 'big one' with a potential financial impact in the billions. If recorded musical DAT software and play-only DATs are placed on the market, the 'Digital Walkman' will be born. The drawbacks of portable cassette and CD units will be forgotten, as DAT dominates the portable music scene. And if the same unit could be used to watch Bon Jovi on a pop up screen; so much the better.

The future of the DAT could prove to be an interesting analogy for the future of the electronic entertainment industry. DAT now with direct evolution to still video, VCR and play-only usage could become the 'one box to do it all'. The record companies like to point out that they are making a lot of money right now without DAT. That is all well and good but a stroll through the wonderful world of consumer and professional audio reveals a different picture. DAT, if cleared for take-off right away, could put the world audio industry back on the road to excitement and profitability. If DAT remains grounded, then we must all await the next innovation and hope that it, too, isn't sidetracked in legal and legislative battles. Let's see if someone besides the lawyers can prosper from the future of the audio business.□

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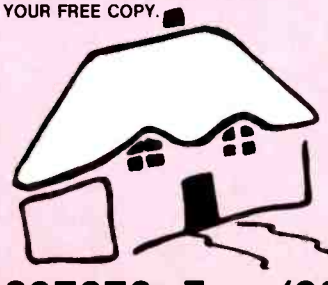

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Sony DAE-3000

Patrick Stapley looks at Sony's digital audio editor with recent software

The *DAE-3000* editor is certainly no newcomer to the digital marketplace as it has been available since March '88. In Europe alone Sony have sold over 90 units and with the help of keen user feedback the system has already seen a number of software improvements. The editor has been well received, especially by users who have upgraded from its predecessor the *DAE-1100A*, and enthusiastic comments such as 'It's the difference between driving a Rolls after owning a Mini' abound among the engineers I talked to. This article investigates the unit's potential while making some comparisons with the *DAE-1100A* for those who may still be considering an upgrade.

The *DAE-3000* looks radically different: the lightweight keyboard is nearly half the size of the *DAE-1100A* and it has a hinged EL (Electro-Luminescent) display. The old 'McDonald's cash till' surface has been replaced with standard computer keys, making its appearance more compatible with the *DAQ-1000* cue editor.

Like the *DAE-1100A*, the keyboard has been laid out in eight distinct sections: Player, Recorder, Editor, Search Dial, Fader/Balance Controls, Numeric Keypad, Cursor Keys and Function Keys. Apart from the obvious addition of the latter three sections, noticeable changes have been made to the editor controls and a click stop balance pot has been incorporated above the fader that allows stereo imbalances to be corrected without having to revert to analogue.

The secret behind the keyboard's compact yet extremely versatile design lies in the interaction between keys and the various display screens. There are, broadly speaking, three types of screen: Main, Sub Menu and Menus. The main display provides overall information on the current set up, showing timecode values, edit details, locate positions, crossfade times, stereo bargraph meters, etc. The sub menu is used to access one of the five menus: Machine Assign, Edit Set Up, Time Code Generator Set, Dither and Tests. With the use of the seven function keys, the cursor keys and the numeric keypad, these menus allow the user to configure the system quickly to suit his own requirements. In the case of machine assignment a maximum of five machines (dependent on the number of machine interfaces supplied) can be electronically patched between four playback positions and one record position without any replugging. This results in a single Player section on the keyboard, with four Player Select buttons for accessing the patched machines, and compares favourably with the Player A and Player B arrangement on the *DAE-1100A*.

Another way in which the control surface has shrunk is by the reduction of transport buttons in the player and recorder sections: the pause button has disappeared as have the x1.5 and x2 backwards and forwards controls. The stop button will now pause the machine with a single press, stop it with a double press and put it into low speed fast forward/rewind mode when pressed in conjunction with FF or REW. The stop button for the record machine will stop all machines with a prolonged press.

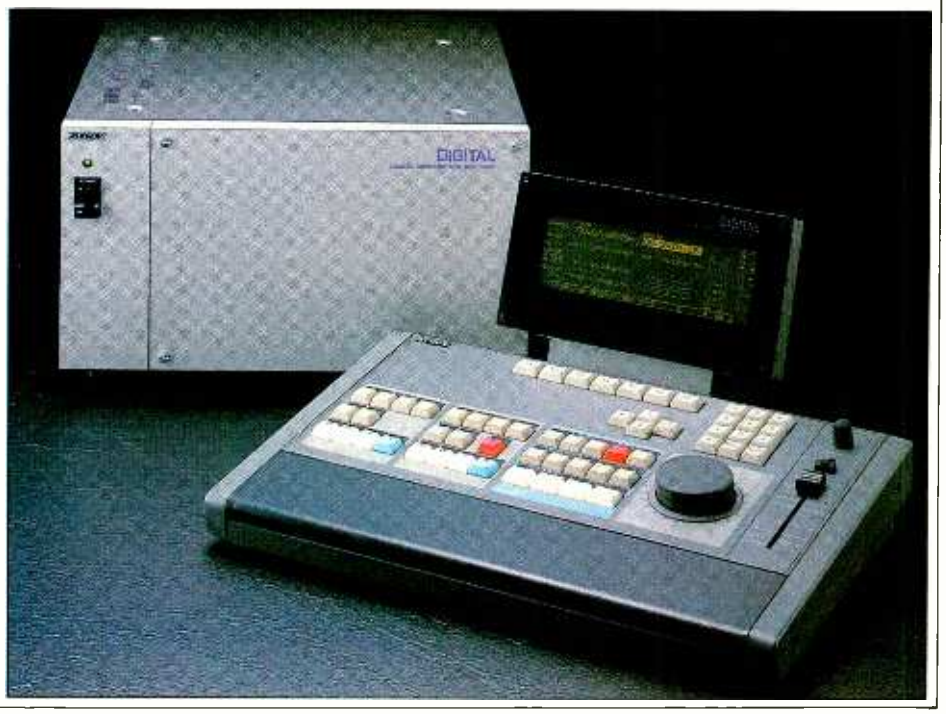
One of the most significant changes is the improvement in memory operation. It is now possible to have segments from record and play machines in memory at the same time; allied with the fact that the memory playback has been upgraded to give the same 16 bit quality as the source and in stereo rather than mono, the edit can be rehearsed accurately without having to run both machines in preview mode. Not only does this greatly speed up operation but it has the added advantage of saving on machine use and thus head drum wear.

The playback control over the memory contents has also been improved with the Search dial offering a choice of Jog or Shuttle operation; jog provides the normal 'rock and roll' editing associated with the *DAE-1100A* and has a choice of three sensitivities; shuttle plays back the segment, which can then be continuously varispeeded down using the search dial. There are three additional buttons that aid memory playback; the first will play the segment on the selected machine up to the edit point, the second plays the segment on the selected machine after the edit and the third plays the resultant edit between the two machines. All three can also be varispeeded and there is a Memory Rehearsal Repeat mode whereby the selected playback will cycle. This proves especially useful when playing across the edit, as it is possible to experiment with different offsets and crossfade times during continuous playback. To further enhance and speed up this mode of operation, the amount of playback time pre and post the edit is settable.

The edit points can be moved by entering new positions while in shuttle or jog modes, alternatively a timecode value may be entered directly from the keypad in Edit Point Shift mode or, as mentioned, offsets can be entered during memory rehearsal repeat mode. With this last method the position of the edits on player and recorder can be adjusted separately or in parallel using the search dial as controller.

Editing modes

The *DAE-3000* has two modes of editing: Assemble, which is a continuous process of joining one section after another; and Insert, which drops a section in between two points. Insert edits are performed in three different ways: Manual, Auto and Spot. Manual is used for more basic functions like dropping in silence and, because it has to be stopped manually, the out point should be non-critical; auto will automatically drop in and drop out a section; spot is used when the section to be inserted is short enough to fit entirely into the memory and consequently allow the complete edit to be memory rehearsed; with auto inserts the insert in and insert out points are treated separately.



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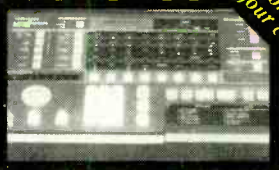

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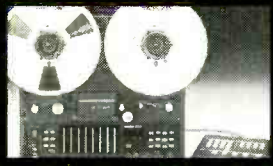



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The main screen displays horizontal bargraphs which relate to the playback of Recorder and Player segments held in the 12 sec memory. In the case of assemble edits, manual inserts and spot inserts, the two segments are 6 secs each, but with auto inserts where there are separate recorder and player segments for the insert in and insert out points, each of the four segments is 3 secs long. Auto insert points are dealt with one at a time and the display will show insert in or insert out points using arrows to indicate the position of the edits. Spot insertion, on the other hand, because the segment to be inserted is short enough to fit into the memory, has just one pair of bargraphs with four arrows showing the in/out points on both machines. Spot inserts are useful in erasing noise and can clean up gaps between tracks very successfully, rather like adding imaginary digital leader. To edit in a section of digital silence, an edit is performed in the normal way but with the fader pulled down.

The crossfade time or both edit in and edit out points is independently adjustable in 1 ms steps from 0 to 999 ms—the *DAE-1100A* provided just 10 fixed settings. Another improvement has been made to the precision of the edit, which is now 16 times more accurate, with a resolution of one sample (23 μs) when using *1630*, and this is reflected in the edit point timecode readouts, which have extended to display words. It is possible then, using a 0 ms crossfade, to insert a section of just one sample long!

Fader and balance movement made during preview mode can be stored in memory, thus offering a degree of dynamic automation. Only one set of moves may be stored and there is no provision for updating, other than inserting a new edit into a previously recorded section. The memory is ample for most requirements and there is a display to indicate the remaining space, also displayed are the fader and balance moves. The fader can be set to a maximum value of 6 dB or 12 dB and the balance control has a range of 0 dB to −3 dB or 0 dB to −6 dB per side, these adjustments are made from the Edit Set Up menu. With both fader and balance set to 0 dB, an LED will light to show that the stereo signal from the player is unaffected by these controls; it extinguishes if either control moves from 0 dB. As with the *DAE-1100A*, the fader incorporates a mechanical safety stop locking at 0 dB.

The problem of quantisation noise heard at low fader settings has been addressed by the introduction of a dither function, which adds white noise before requantisation to average the quantisation noise. Comparing the quality of fades with that of the *DAE-1100A*, it is noticeable that even without dither, a considerable improvement has been made and this is due to the fader resolution being doubled. With one of the three dither modes active, the white noise acts as a mask and helps to produce smoother more natural sounding fades. There are two dither noise levels and a mode where dither is disconnected at 0 dB.

Once an edit has been rehearsed/previewed to the user's satisfaction, it is executed by pressing the preview and edit keys together, putting the system into auto edit mode. On the original *DAE-3000* software this was the point of no return as, unlike the *DAE-1100A*, the edit data was not retained in memory after the edit had been performed. The latest software, however, now allows this data to be retrieved.

There are two ways to enter locate points: either a timecode value can be entered from the keypad, or the current time can be entered by pressing the Mark button found on both player and recorder sections. Whichever method is used, the point is autolocated minus the preroll time by pressing the Preroll key. The keypad is also instrumental in setting values for the timecode generator, which can be set internally to generate SMPTE DF or NDF. User bits, which are used to enter an eight-digit number on the tape for archiving or dating purposes, now have access to the first six letters of the alphabet.

Other features

The system incorporates a number of self diagnostic tests and the results are shown on the screen or via LEDs on the various internal boards in the processor unit. There are also error messages that appear on the main screen alerting the user to operational mistakes and other problems.

The processor unit is slightly smaller than the *DAE-1100A*, and power consumption has been reduced from 160 W to a remarkable 60 W. The system will interface to most of Sony's digital machines and the standard package of two *DMR-4000/2000* interfaces is expandable to cater for *PCM-3402* twin-channel DASH machines, *PCM 3324/48* DASH multitracks and the *DAQ-1000* cue editor. It is also possible to add external digital equipment such as a mixer, limiter or EQ unit, by way of the SDIF 2 connectors. AES/EBU, RS 232C and GPI 15p (general purpose interface) have been provided for future use.

New software is supplied free of charge to existing users and some recent updates include memory lock mode, which protects data from erasure keeping it current even if the record machine has been put into play. There is a definable playback range for memory rehearsal giving the same kind of pre/post trim found in memory rehearsal repeat mode. Edit points can be entered directly from the keypad and entry of a new edit point during auto edit is now possible. A display showing the relative time before and after the edit points has been incorporated and a facility to enable/disable the auxiliary digital input has been added so that an external device such as EQ can be switched in and out directly from the keyboard. Also, if the editor is hooked up to a *DMR-4000* with the extra decoder card, the keyboard will switch read after read/read after write.

Conclusion

Those familiar with the *DAE-1100A*, I think will appreciate the large step forward that has been made by the *DAE-3000*. Not only does it offer greatly enhanced facilities but it is also more ergonomic, quicker to use and, all important, better sounding.□

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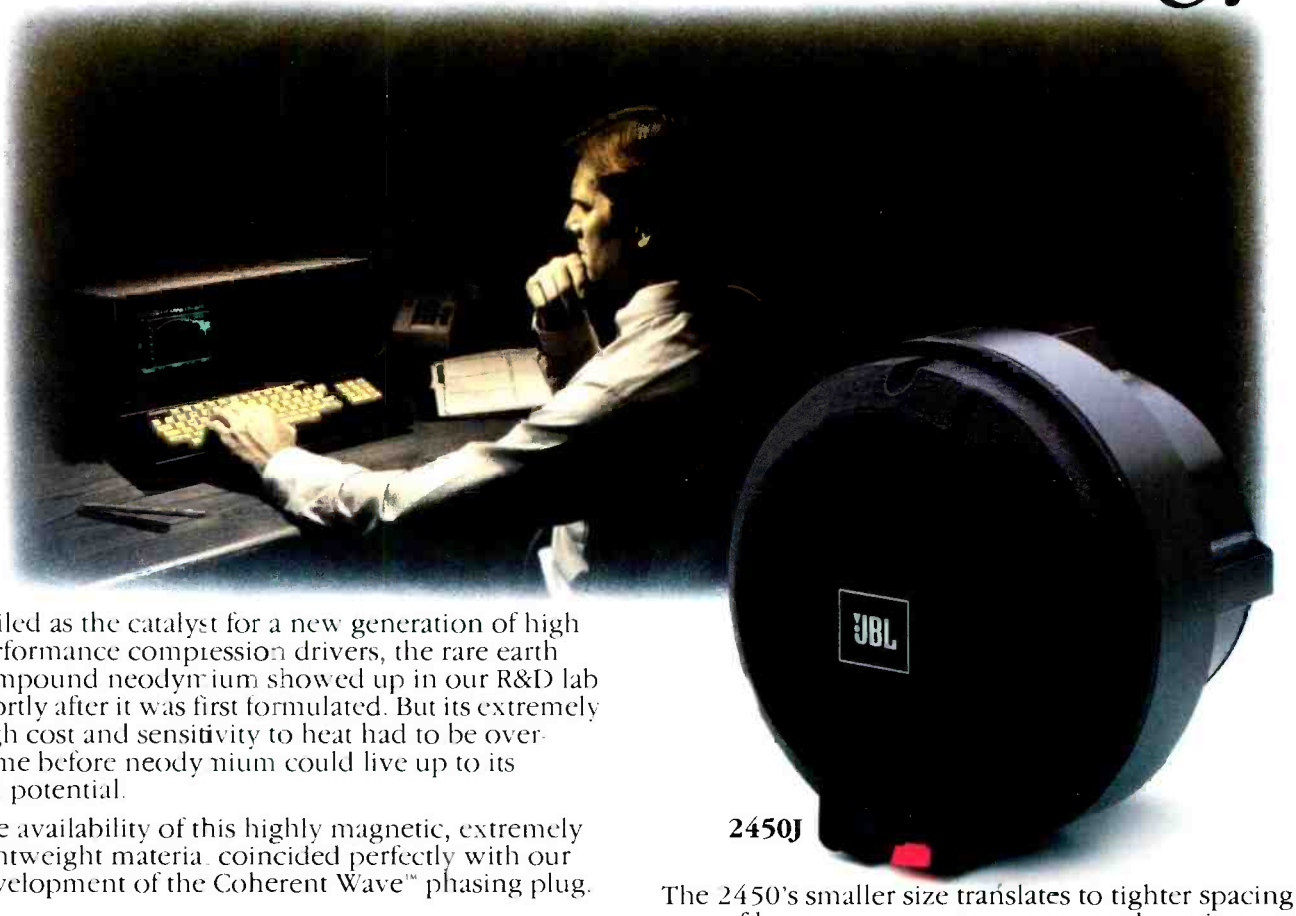
It Takes More Than A Little Neodymium To Change The Face Of Driver Technology.



2450J

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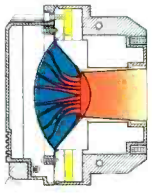

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This new design, a phasing plug with annular apertures of constant path length, uniformly directs sound through to the throat providing in-phase combining of sound waves for extended high frequency performance. This new technology is combined with our patented diamond surround titanium diaphragm, incorporating a new embossed dome, to reduce the possibility of distortion or damage at high SPL.

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