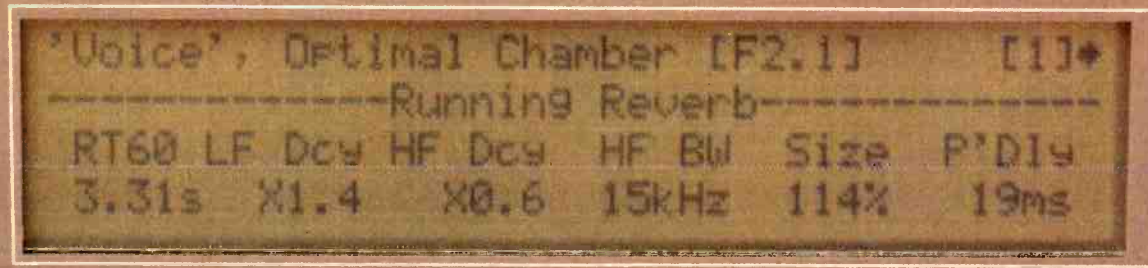
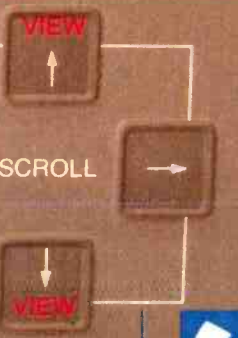
A LINK HOUSE PUBLICATION

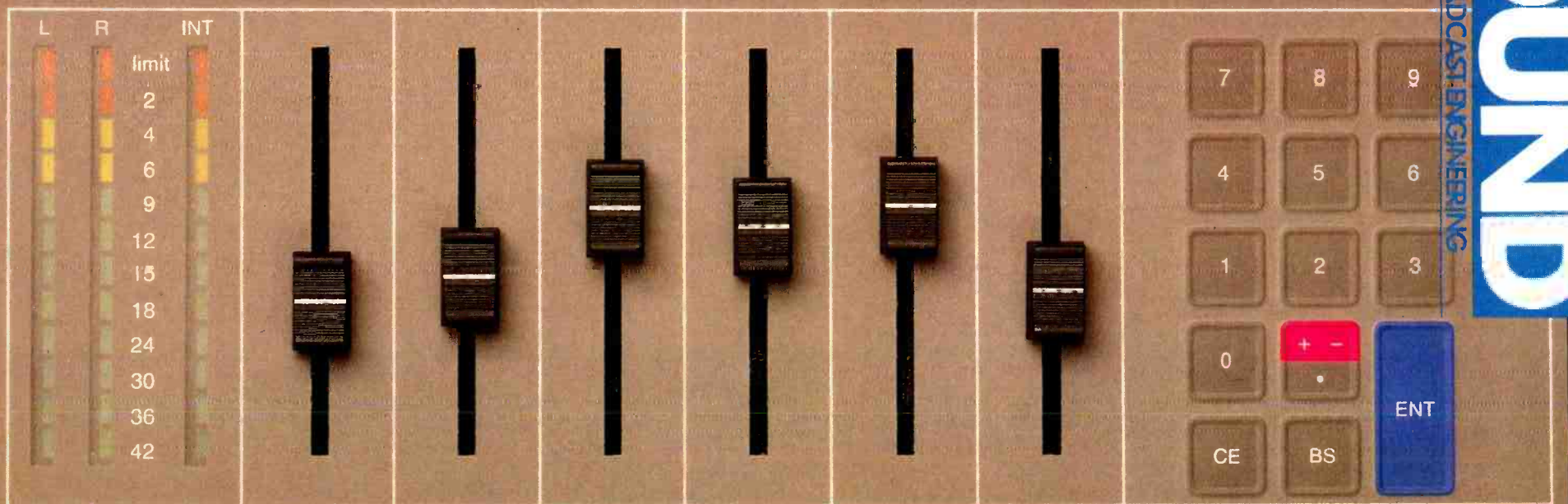
AKG acoustics

ADR 68K

EFFECTS & REVERBERATION



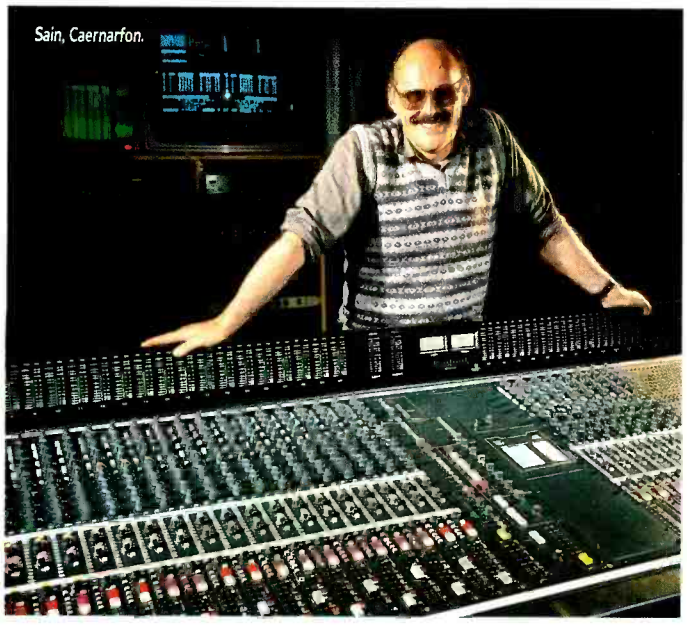




STUDIO SOUND

AND BROADCAST ENGINEERING

February 1989 $5.00 £2.00



Listen to the business end of a TS24.

Four successful studios.

And one choice of console.

As you can see, they speak for themselves.

Robin Black, Black Barn: 'Since we opened we've handled everything from instrumental work to Motorhead and they've all loved the desk. I wanted a console that was extremely versatile and easy to use without complications; and the TS24 with a Saturn made a great package. The EQ is first class, and the reputation combined with Mastermix means it sells itself.'

Brian Masterson, Windmill Lane: 'We've had our TS24 three years now. I really do like the sound – it's so neutral. But it's the operational design that's best; it never gets in the way, the EQ's very comprehensive, it's easy to get your sounds, and it's the simplest board to bounce tracks down on. The signal flow concept and global switching is the way I like to work. We've had the Waterboys and U2 in recently and the TS24's a great asset when you're handling a wide variety of music.'

Bryn Jones, Sain (Recordiau) CYF: 'We needed a desk to keep up with the needs of independent TV post production and the TS24 is excellent for this. The main feature for us is its flexibility; essential for our work which includes rock, male voice choirs, folk and TV. We've only had two free days since we opened in March 1987 and with Mastermix, it's a very well thought-out combination.'

Tony Millier, TVi: 'We had to go to 24-track to keep up, and everything's there on the TS24 for very fast work. You can re-configure very quickly indeed because there's virtually no need for re-patching. I'd say it was an informed choice – but after a couple of months with it I realised there was even more to it than I first expected. A great package.' For more details and a brochure on the TS24 In Line console, call Steve Gunn at Soundcraft.

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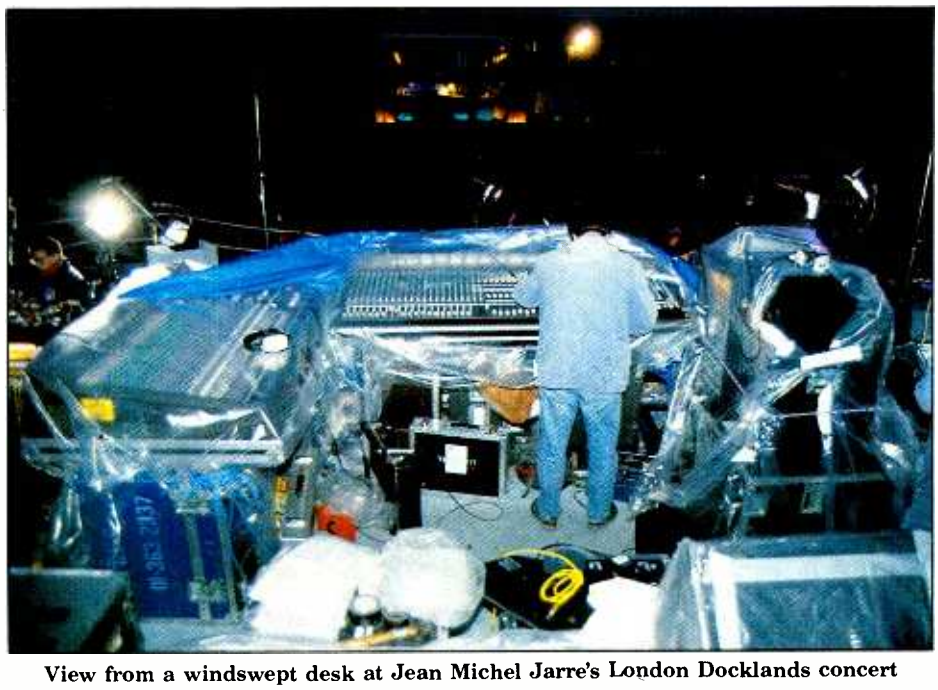
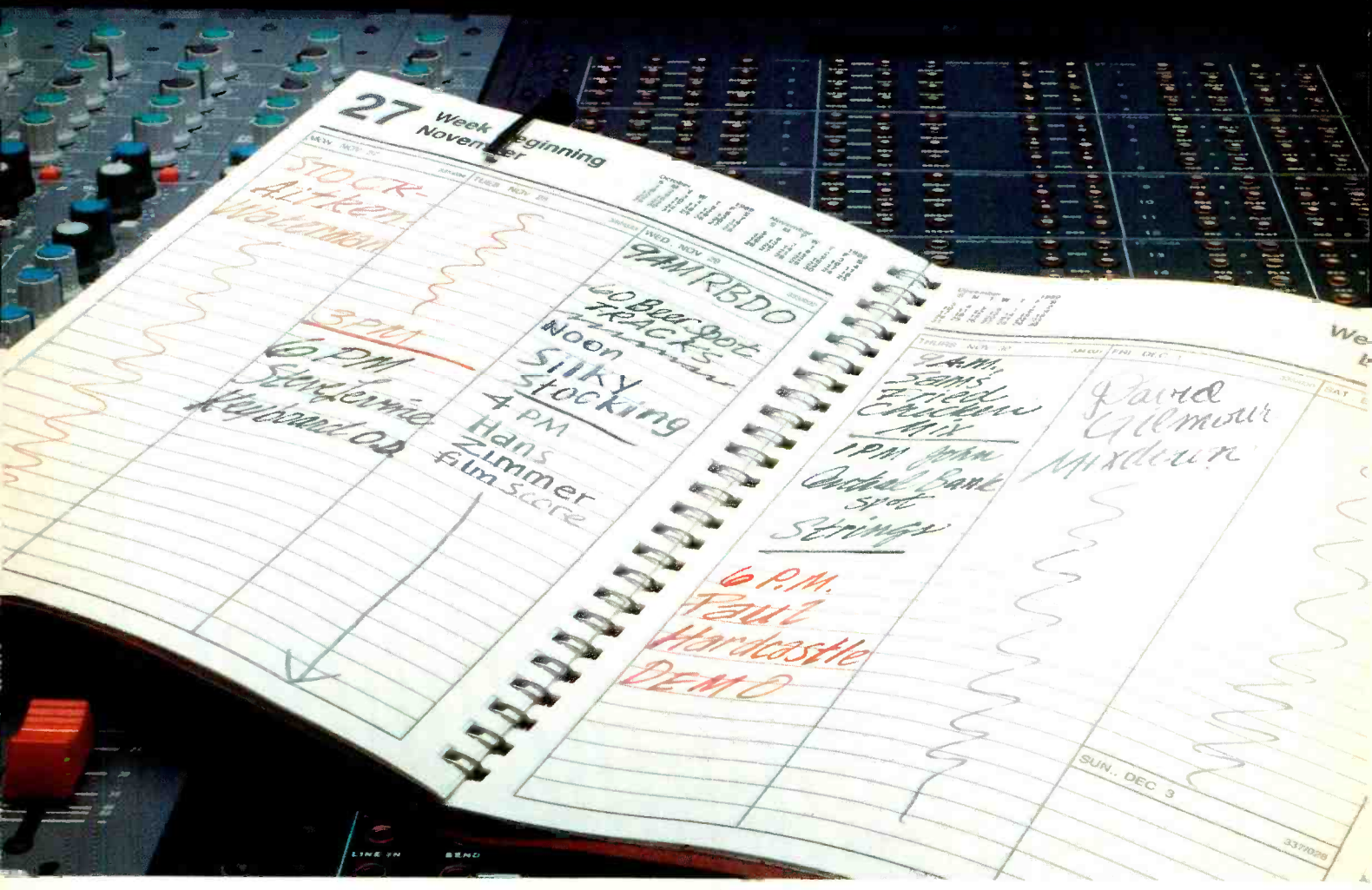


View from a windswept desk at Jean Michel Jarre's London Docklands concert

AMR24



THE AMR24 TRACK RECORD.

Why is it that more than 100 of the World's most successful owners, producers and engineers have chosen to base their studios around our AMR24 console?

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Could it be that, to the producers, the AMR24 represents both a sweeter sound and the chance to achieve greater productivity. After all, it means being able to work as fast as their brains dictate and not as fast as the time it takes to reconfigure a conventional board.

More time is devoted to recording so the artist needs less studio time for the same output or has more time to explore alternatives for the same cost.

Perhaps it's also because, when armed with an AMR24, recording engineers can take full advantage of the new opportunities for creative expression offered by digital audio.

So the studio owners make money, the producers and engineeers achieve more for less, the artist spends less time in the studio and the record company ends up with a higher quality product at a lower production cost.

It's not really surprising, therefore, that in EQ Magazine's regular Shopping List feature, three times as many studio owners, engineers and producers said they would specify the AMR24 than those who went for any other console.

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(ABC audited)

Cover: AKG *ADR 68K* digital audio processor. Photography by Roger Phillips

Here we go round the Mulberry bush

The end of 1988 gave some clues to the most likely sources of preoccupation for this year and at the moment it all looks very familiar—copyright infringement, compatibility and software—just the products are different.

Very few of us had any real notion about the true possibilities of the optical disc when the compact disc was announced in the late '70s. There had been the video disc in the form of *Laservision* but the preoccupation with recording from the TV inhibited its development as a popular medium. The audio compact disc came along in '82 and it has become a major consumer format despite a slightly shaky beginning. Gradually we have seen optical disc developments appearing in the form of CD-I, CD-ROM, CDV, CD-3, CD-Graphics and CD-MIDI. Most of these developments have been widely welcomed as commercially viable and worthwhile or at least look like they are uniform standards or are likely to be accepted as such—CDV excepted for the obvious TV standard reasons.

The problems are loaded on the CD-R, or recordable optical disc. The latter half of 1988 saw some advance announcements of the development of a recordable CD or rather an optical disc that would be purchased as a blank with predefined 'grooves' and could be recorded on once, using a machine with recording capability. Write Once Read Many (WORM) optical discs have been available for some while now but the current interest is over a type that is fully compatible with the standard compact disc and will replay in a standard machine, the CD-R. At the end of last year we saw Korean company Tayio Yuden (known for *That's* tape in Europe) demonstrating the CD-R in the form of an example recorded in their laboratories on an adapted optical recorder. They are apparently close to being able to manufacture the discs but have no interest in hardware manufacture. It is likely that prototype machines will appear towards the end of this year although these will probably be expensive and aimed at the professional market where the ability to make small runs of pre-recorded CD-Rs would be very useful. I understand that there are other systems currently under development also to appear at some point this year.

While the product has not yet appeared the scare stories have. The IFPI (International Federation of Phonogram and Videogram Producers) has announced that it expects to see a twin deck CD-R copier player at a price 'slightly higher than normal CD players whose only function would be to make copies of pre-recorded CDs'. They also have estimated a CD-R blank price of a third pre-recorded CDs. Having had an insight into some of the technology involved in CD-R I very much doubt that we will see such equipment at a price anything like the IFPI claim. Also the public in those territorries where R-DAT has been available, have shown a marked lack of interest in the medium for consumer applications and there is no reason to assume that the situation with CD-R would be very different. With regard to the price differential between blank CD-R and pre-recorded CDs (no figures have been supplied to us by the manufacturers), then there would appear to be an excellent reason for a drop in the cost of pre-recorded CDs to reduce the price differential and so the urge to replicate. Such an action would undoubtedly increase demand and this in turn may help to prevent the closure of any more CD manufacturing plants following in the wake of Shape and Egva (Norway).

Unlike DAT, the record industry is going to have to come to terms with CD-R as it has applications far outside audio particularly in the computer industry which as we have said before sees the record industry purely in petty cash terms and as such is a far more gargantuan adversary.

Space has expired before I have touched upon my other opening concerns but I think we can all be assured that there will be something reassuringly familiar about living in 1989.

Keith Spencer-Allen

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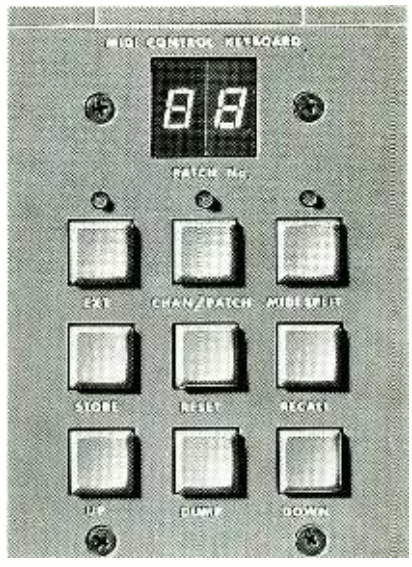

MIDI MUTES CAN BE WRITTEN IN REAL OR STEP TIME, AND RECALLED EITHER INDIVIDUALLY OR AS PATCHES THROUGH THE KEYPAD OR USING A MIDI SEQUENCER

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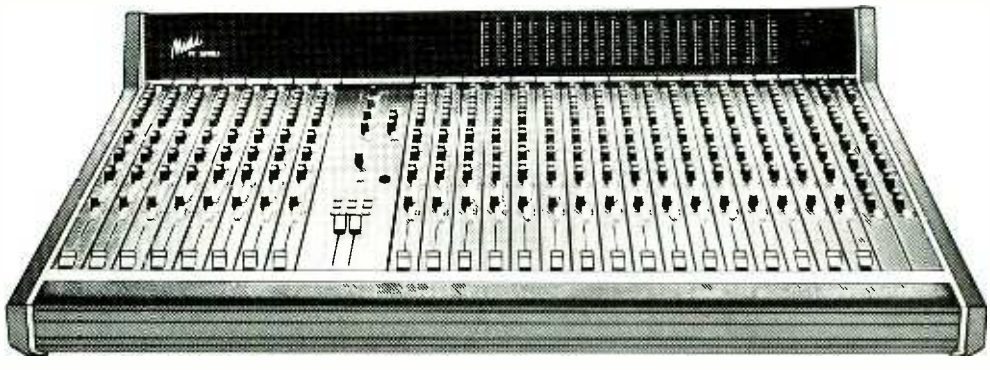

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The S-950 is Akai's successor to the remarkable S-900. Incredibly, it offers a whole range of extra features — at a lower price! An expandable memory. Superb 48kHz sampling frequency. The ability to load information whilst playing. Full compatibility with the massive S-900 and S-1000 sound libraries. Time stretch, cross-fade looping and pre-trigger recording facilities, a filter envelope and much more. All for the astonishing price of £1,399. Optional boards for hard disk and digital input make the S-950 a uniquely versatile machine.

The S-1000 is the new 16-bit sampling standard. It produces the cleanest, clearest stereo samples you've ever heard, with the ease and immediacy which have made Akai famous. 2Mb of memory, expandable to a staggering 8Mb. A maximum sampling rate of 48kHz. 16 voices, with easy layer, multiple looping and cross-fade capabilities. A large 40x8 LCD display makes editing incredibly simple and the use of a separate monitor unnecessary. For its sheer power, intelligence and accessibility — at a cost of only £2,899 — the S-1000 is unequalled.

And to complete the picture, Akai have developed the S-1000PB 16 bit sample playback machine, priced at £2,199, and the S-1000HD with built-in hard disk, providing a generous 40Mb of storage: at £3,999 nothing else even comes close.

If it's quality drum sounds you want, check out the XE-8. Coming complete with two memory cards, the XE-8 provides a wide variety of excellent 16 bit drum samples in a compact 1U rack unit. Choose from individual or mix outputs. Used with MIDI drum machine or sequencer — such as our ASQ-10 — you can edit and store your own sounds to give the crisp, clear dynamic attacks of real or electronic percussion, for an unbelievable £499.

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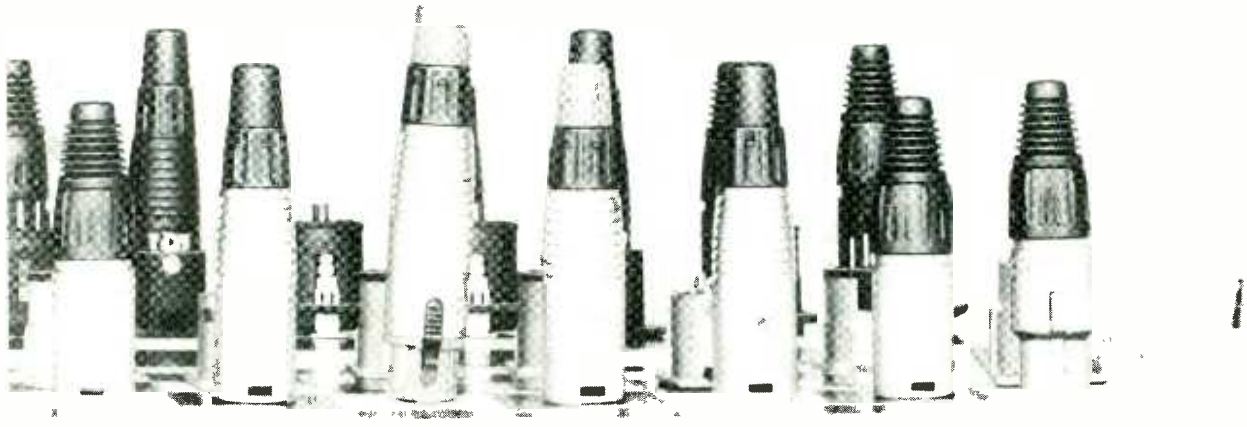

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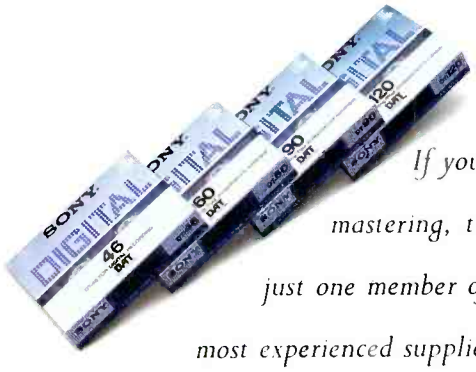
Take a fresh look at the industry standard for DAT mastering.

Amongst audio professionals, the Sony DTC-1000ES is now widely recognised as the DAT standard. It's officially supplied by HHB – Sony's leading independent distributor. That means genuine service and spares support, as well as expert advice.

Second generation DAT hardware incorporates rationalised integrated circuitry and single A to D conversion. This may make DAT more accessible to consumers, but it's bad news for the audio professional. That's why we've talked to Sony and secured an extended production run for the DTC 1000ES.

Along with twin A-D conversion, all DTC 1000ES recorders from HHB are now specially adapted to record at 44.1kHz as well as 48 kHz. A modification that's impossible to implement in most second generation devices. For additional professional convenience, we've even designed an optional 19" rack tray.



If you're thinking about a secure future with highly-affordable DAT mastering, take a fresh look at the new DTC-1000ES package from HHB. It's just one member of a powerful family of DAT equipment available from the industry's most experienced supplier of digital recording hardware.

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Shape Optimedia ceases production

Shape Inc, based in Maine, USA, recently announced that Shape Optimedia Inc, their CD subsidiary, have ceased production. The company has made arrangements to sell their assets as a turnkey manufacturing facility as quickly as possible, or to proceed with plans for an auction if a buyer is not found.

In response to reduced sales volume, Optimedia reduced their workforce by two thirds in November 1988 and some full and part time employees were laid off. Others were transferred to other Shape facilities.

Shape also announced the sale of their subsidiary Wasbach Datatech, IL, to The Media Group of Tulsa, OK, USA and Wasbach Datatech International in Essex, UK, to Euro-magnetic Products, Redhill, Surrey, UK.

Klark-Teknik sound design handbook

Klark-Teknik have recently published a technical reference handbook entitled *The Audio System Designer*. This is a 100-page book in an updatable A5 binder format containing sound system engineering formulae and data.

Specifically written for consultants and professional sound system designers, the book covers general acoustics, sound insulation and absorption, room acoustics, psychoacoustics and speech intelligibility, sound system engineering and physical data.

Priced at £35.00 including postage and packing, it may be ordered from International Media Sales, Cherry Trees, High Street, Deddington, Oxford OX5 4SJ, UK. Tel: 0869 38794; or the Sound & Communications Industries Federation, 4B High Street, Burnham, Slough SL1 7JH, UK. Tel: 06286 67633.

Exhibitions and conventions

January 21st to 25th MIDEM, Palais des Festivals, Cannes, France. Contact: Peter Rhodes, International Exhibition Organisation Ltd, 4th Floor, 9 Stafford Street, London W1X 3PE, UK. Tel: 01-499 2317.
February 21st and 22nd Sound '89, Heathrow Penta Hotel, London, UK. Contact: Sound and Communications Industries Federation, Slough, Berks. Tel: 06286 67633. Fax: 06286 65882.
March 7th to 10th 86th AES Convention, Congress Centre, Hamburg (CCH), AM Dammtor, D-2000 Hamburg, West Germany.
April 28th to May 2nd NAB, Las Vegas, USA.
June 7th to 9th APRS 89, Olympia 2, London, UK. Contact: APRS Secretariat. Tel: 0923 772907.
June 17th to 22nd 16th International Television Symposium and Technical Exhibition, Montreux, Switzerland.
September 18th to 21st Media Visie 89, RAI International Exhibition Centre, Amsterdam, The Netherlands. Contact: RAI, Europaplein, 1078 GZ Amsterdam. Tel: (0) 20-549 12 12. Fax: (0) 20-461006.
October 3rd to 9th World Broadcasting Symposium Geneva, Switzerland.
October 25th to 28th Broadcast 89, Frankfurt, West Germany.
October 19th to 22nd AES 87th Convention, New York, USA. Contact: AES, USA. Tel: (212) 661-8528.
November 28th to December 3rd Sound Expo/China '89, Shanghai Exhibition Centre, Shanghai, China.

1990

March 30th to April 3rd NAB, Atlanta, GA, USA.

Applied Microsystems re-formed

Applied Microsystems is to be re-formed by Steve Brown who sold the company to Audio Systems Components 18 months ago, but retained the rights to the name. Brown joined ASC and during his time there designed, among other things, the new *CM200* chase synchroniser.

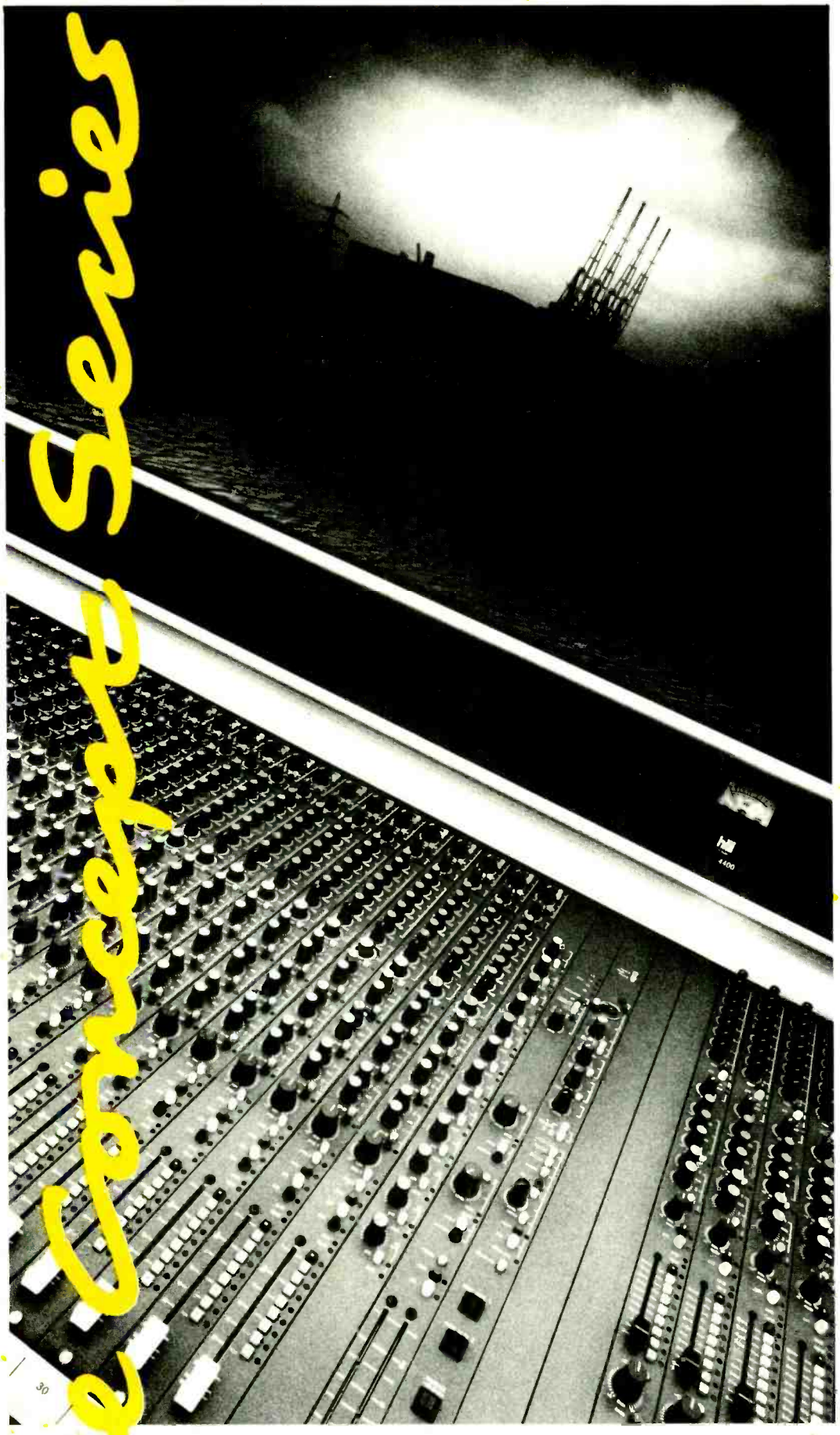
The new Applied Microsystems will operate from 111 School Lane, Addlestone, Surrey KT15 1TF, UK.

Address changes

• **Connectronics** have recently moved to new premises at Unit B9, Haslemere Industrial Estate, Pig Lane, Bishops Stortford, Herts CM23 3HQ, UK. Tel: 0279 506684. Fax: 0279 505614.
• **Court Acoustic Systems** at PO Box 831, Windsor, Berks SL4 4EZ, have new telephone and fax numbers. Tel: 0628 38555. Fax: 0628 784706.
• **Decibel Audio's** new address is: Unit 44, New Lyndenburg Industrial Estate, New Lyndenburg Street, London SE7 8NE, UK. Tel: 01-853 2121.
• **Sony Broadcast** UK have moved to Jays Close, Viables, Basingstoke, Hants, RG22 4SB UK. Tel: 0256 55011. Fax: 0256 474585.
• **Studio Magnetics** have opened a new manufacturing plant at Unit 4, Radfords Field Industrial Estate, Maesbury Road, Oswestry, Shropshire SY10 8HA, UK. Tel: 0691 670193. Fax: 0691 670194.

Contracts

• **Cinac** of Switzerland will supply and install the audio systems for modernisation at Mosfilm Film Studios, Moscow, USSR. Equipment from SSL, Studer, Sondor and UREI will be installed. There will also be a comprehensive MIDI room for the music studio. The sound system will be JBL. Effects equipment will include Lexicon *480Ls*, Quantec *QRS/XL* with *CARL* computer and Eventide *H-3000B* broadcast versions of the *Ultra-Harmonizer*. Klark-Teknik equipment will be used for equalisation and spectrum analysis.
• **Sondor** have supplied a *V2P* highspeed *Xenon* projector, two *OMA S* master recorders and an *EPS 8000* complete synchroniser/ADR/ master control system to Munhwa Broadcasting Corp in Seoul, South Korea. Two identical 16 mm studios have been installed at RTVE Madrid in Spain. Grampian TV has ordered an *OMA S Dual Dubber* and Tyne Tees TV has taken delivery of an M03 *Libra* recorder/reproducer. *OMA Ss* also go to GLPP, Paris, France; Universal Films, London; and Sincronia, Madrid, Spain.
• **K-Tek** of Surrey, UK, have supplied and installed a complete 16-track control room for Triple A Studios in London. The studio features an M&A *Series 4* mixer with 24 inputs and eight group modules, with provision for eight more. Full patchbay and harnesses were also supplied.
• The Royal National Institute for the Blind have purchased four 'special' **Studer** *900 Series* mixing consoles. The 'special' nature of these consoles is their design. One operator at one desk can control two recording rooms, ie, two desks in one unit with identical controls and communications for two separate studios and tape machines.
• Harman UK have sold **Focusrite** EQ and dynamics modules to four UK hire companies: Audio Rents, Dreamhire, Hilton Sound and London Sound Hire. Focusrite modules have also been purchased by Select Sounds, Random Access studios, North London, and Cold Storage studios, Brixton, London.
• Wendell Recording Studio, Wendell, MA, USA, has recently upgraded with the addition of a 24-track **Otari** *MTR-90* series recorder, **Trident** *24* console, 32-track **Megamix** automation, a ¾ inch video editing suite and **Adams-Smith** synchronisation.
• ORF Austrian Radio have bought several consoles built by **DDA** in Middx, UK, including a specially modified *D* series with gold connectors throughout. A *D* series 44/16 monitor console was recently used for the summer tour by Eros Ramazotti. Vince Clark of Erasure has purchased a DDA *DCM 232* for use in his home studio in London.



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Fax: 011-44-536-69029

PEAVEY DIGITAL ENERGY CONVERSION AMPLIFIERS

Digital Under Milk Wood

EMI's new release of Dylan Thomas' *Under Milk Wood* is believed to be the first fully digital spoken word recording. Producer George Martin and AIR Studios engineer John Jacobs believed that only digital recording and production techniques could improve upon the BBC's 1954 production, especially when many subtle sound effects were to play a central role in the piece.

The sound effects were recorded on portable R-DAT in Wales and after initial selection transferred to a Digital Audio Research *SoundStation II*, which was employed as a library from which up to four effects at a time could be recalled, edited, cross-faded into the mix of voice, music and song.

The *SoundStation II* provides four hours and four channels of 18-bit audio from four 360 MByte hard disks.

Shep acquires Sound & Vision Workshops

The company that supplied UK spares and services for 3M multitrack machines, Sound & Vision Workshops and Studio World, has gone into liquidation and been purchased by Shep Associates of Herts, UK.

Shep has acquired all 3M spares and owners and users of 3M machines can obtain spares from Shep at Long Barn, North End, Meldreth, Royston, Herts SG8 6NT, UK. Tel: 0763 61686. Fax: 0763 62154.

In brief

• UK agents for **Sennheiser**, Hayden Laboratories Ltd, have announced that there is now DTI approval for the complete range of Sennheiser radio microphone equipment including UHF and VHF systems to DTI specification number MPT 1350.

• **Videosonics** have available for hire Le Mobile, a 24-/46-track mobile/OB sound recording unit built in Switzerland. Equipped with a Harrison *MR4* 36-channel console, two Studer *A80 Mk4* 24-tracks, Dolby *A*, 1 inch video recorder, BTX synchronisers, low band *U-matics* and centre-timecoded ¼ in machines, the mobile is available for hire and has recently been used by Carlton TV to record a Channel 4 arts programme. Details are available from Videosonics, 13 Hawley Crescent, London NW1 8NP. Tel: 01-482 2855.

• Michael Talbot-Smith, who has recently retired from the BBC, has set up his own consultancy business under the name of **TS Acoustics**. He hopes to offer, among other things, training in audio matters. Contact: Michael Talbot-Smith, Fairlawns, Wick, Pershore. Worcs WR10 3PD, UK. Tel: 0386 553416.

• **Ampex** digital mastering audio tape has been chosen by the International Electrotechnical Commission as the worldwide primary reference tape for digital open-reel audio recorders. Ampex tape was chosen after tests that involved independent evaluations and concurrences by major equipment manufacturers including Sony, Studer, Mitsubishi and Otari.

• The British Standards Institution has issued BS 6840: Part 2. It refers to sound system equipment and contains definitions of general terms for sound system components. In some cases calculation methods are included. It supersedes BS 5428: Part 1: 1977 and is identical with IEC 268-2-1987. Copies of BS 6840: Part 2 may be obtained from BSI Sales, Linford Wood, Milton Keynes MK14 6LE. Price £28.50 (£14.25) to BSI members.

Falconer buys Firehouse

Falconer Music Mastering, London, have bought Firehouse Studios in Highgate Road, London, after lengthy negotiations and have renamed it Falconer One. The studio is now fully operational after the sale and taking on mastering and track-laying work. Falconer One has a large live area, a stone drum room and three separate rooms. A DDA console has been installed.

Falconer's original studio will re-open as Studio Two and will also be 24-track. Falconer One will be the main studio taking on mastering, digital and 48-track work. Two will be used mainly for budget work, while Falconer's third studio will remain as a 16-track facility.

Sandwell College/manufacturer partnership

The Audio Studies facilities at Sandwell College in the West Midlands, UK, have been enhanced through a £200,000 partnership with Klark-Teknik, AMS, DDA, Wharfedale and the Department of Trade and Industry.

The partnership will extend Sandwell's existing 16-track digital mastering/recording studio, programming suite, radio production studio and editing suite.

The new development will include a 24-track digital mastering studio, a further programming suite and an AMS *AudioFile* studio. The new facilities should be on-line in February 1989.

Agencies

• **Vastunique**, Cornwall, UK, have appointed Expotus Ltd as overseas agents for their range of analogue effects systems.

• **Allen & Heath** of Brighton, UK, have named Stage Electrics of Exeter (Tel: 0392 55868), UK and Stage Electronics of Newcastle (Tel: 091-281 4248), as live sound distributors for their range of mixing consoles in the UK. They have also announced two new dealers based in Scotland: Northern Light Ltd, Edinburgh (tel 031-553 2383) and Northern Light Ltd, Glasgow (tel 041-440 1771).

• **Quested Monitoring Systems'** new dealer in the USA is Audio Rentals Inc, New York, NY. QMSs' new dealer in Singapore is Studer Revox, Audio Private Ltd (PTE Ltd), Singapore 1130. Contact: Chan Kheng Wah. Tel: 250 7222. Fax: 256 2218.

• **DDA** crossovers are now being distributed in the USA by Klark-Teknik Electronics Inc, Farmingdale, NY 11735, USA. Tel: (516) 249-3660. Fax: (516) 420-1863.

• **Audio Kinetics**, Herts, UK, have announced that their service spares dealer for West Germany is Studio System Technik based at Adelbert-Stifter Str 1, 8269 Burgkirchen, West Germany. Tel: (8679) 6257. Fax: (8679) 6391. Audio Kinetics have also appointed HHB Hire & Sales, London, as UK distributor for the new *ESBus* A/V synchroniser.

• **Soundcraft Electronics** have announced the appointment of the following distributors: R & S Electronics, Bombay 400 058, India, tel: 22 577 579; Al-Nazaer Artistic Production & Distribution, 32038 Hawalli, Kuwait, tel: 265 8500; Hi-Fi Centre Ltd, Columbia 3, Sri Lanka, tel: 941 580442, Audiophile Components, Metro Manilla, Philippines, tel: 2 818 7577; Mahajak Development, Bangkok, Thailand, tel: 2 223 2865.

• NSR have been appointed dealers for the **Anchor** range of products, imported by Paul Farrah Sound. Paul Farrah Sound have also appointed Raper & Wayman, London Microphone Centre and Midland Theatre Services as dealers for the **Metro Comms** range, manufactured by Farrahs. The companies will carry the full range and supply sales literature and technical support.

Report from Tonmeistertagung

The Tonmeistertagung show in Germany is growing in European importance with every meeting. Held every two years, the 15th show moved from its usual haunt in Munich to the Congress Centre in Mainz, which became the audio capital of Germany between November 16th to 19th.

The Tonmeister meeting is organised on the same lines as AES Conventions with technical papers, workshops and technical tours and, of course, an exhibition. The latter has grown considerably in size over the last few shows and the new venue appeared to find favour with many of the exhibitors.

European shows are becoming an important part of the world audio calendar and while some shows have international aspirations others aspire on a national level.

The Tonmeistertagung (Tonmeister Days) fall into the latter category even though there is an important contingent of visitors from both eastern and western Europe. Recording studios, sound reinforcement, etc, are fairly well represented, although there is no doubt that for the major manufacturers/distributors the principal target for marketing is broadcast.

The national nature of the show is emphasised by the number of exhibitors not often seen at exhibitions outside Germany and it is noticeable that the majority consider broadcasters their principal–if not only–customer.

This said, the 15th Tonmeister did reveal some new companies that are setting their sights further than the border and who are looking for openings into the wider international market.

It is significant that even ANT might be thinking of broadening their field of operations by the fact that they were showing conceptual designs of their digital console–officially launched at the show although it has been around for some time now. While it has all the operational features, the console has a very traditional look to it at present and though ANT are not saying any more than "if a customer would like one, we will be pleased to suppy it", the fact that they are looking at designs more at home in recording and A/V production studios would indicate an awareness of some wider application than broadcast.

A walk around the exhibition floor indicated that the pro-audio business in Germany is in quite a healthy state and a finger on the pulse of the recording industry was provided by Peter Wolff of Peter Wolff Enterprises who has seen his equipment rental business virtually double over the past year.

The Tonmeistertagung is now an established event in the round of European professional audio meetings. The questions are now whether it will become an annual event or at least alternate with Photokina, where the integral Professional Media Show also continues to grow in importance.

• **Steinberg Digital Audio** were showing the *Topaz* digital recording system for CD mastering, film and video post-production, broadcast applications and multitrack recording. Features include sampling rates of 32/44.1/48 kHz, 65 minutes recording time (one disk system at 48 kHz), non-destructive editing with sophisticated EDL capabilities.

The graphics represent a typical mixing console surface and software controls the following parameters: start and end points (of the programme material), volume, pan, 3-band parametric EQ, high and lowpass filters, speed, pitch and time correction (ie: time compression or expansion). An optional remote controller with two motorised faders, alpha dial and assignable function keys is also available.

• **EMT** have released the *401* model *Audio Stopwatch*. As well as offering conventional stopwatch operation, the *401* can also be started automatically with programme and stops at the end. For signals using fades the trigger threshold can be adjusted as required and the watch continues counting during pauses in programme. The *401* features stereo balanced inputs, 6-digit display with a 0.01 second and resolution and capacity of 59 minutes.

EMT have also released the *448E* Spot Reproducer using an EPROM storage unit. This enables recordings made on the *448 Unimatic* and to be transferred via a programming kit into an EPROM. Typical applications include jingles, station identification, etc.

• **D&B Audiotechnik** have introduced the *1220* system for sound reinforcement. This consists of the *F1220-LS* loudspeaker enclosure housing a 12 inch bass speaker and 2 inch compression driver/CD horn with 60°×40° dispersion characteristics. The cabinet is trapezoid and designed for flying. The second component is the *1220-CO* controller/amplifier, which provides the necessary crossover, phase correction and protection functions, etc, as well as the power to the system, which is 650 W (bass) and 125 W (high).

• **Lake People** manufacture a range of modular dynamics processors that fit into either the *SR9* rack (containing nine modules plus power supply) or the *SR3* rack (three modules horizontally). The range consists of the *V2* limiter, *V3 Unigate* and *V4 De-esser* and all models provide complete control over all operating parameters. New to the range is the *Mon-Ster V8* autopanner. This is a microprocessor-controlled unit offering many effects associated with panning and can be controlled by MIDI. The *V8* provides factory programs as well as RAM locations for user programs.

Lake People, Konstanz, West Germany. Tel: 07531-24428.

• **Audio Innovations** produce the 3M *DAG-100* modular gate, of which eight can be fitted into a powered rack. The *DAG-100* offers extremely high audio performance and great flexibility over the control parameters, including a 'Hysteresis' function of 1 to 10 dB.

For further information contact **3M Deutschland GmbH, Neuss, West Germany. Tel: 02101-140**

• **ARSonic** have introduced the *Sigma* range of signal processing equipment and a power amplifier.

The *Sigma 3.1* and *3.2* are mono/stereo parametric equalisers respectively and offer three overlapping parametric bands with individual bypass switches, sweepable high and lowpass filters, input and output level controls and LED level meter. Input(s) are electronically balanced with transformer balanced output(s) and unbalanced phone jack inputs/outputs are also provided. The equaliser is also available in the *4.1/4.2* versions with *Dynafex* single-ended noise reduction.

The *Sigma 5.2* dynamic noise controller is a single-ended noise reduction system using a dynamic filter with a compander in the control path. The unit also incorporates a soft gate to attenuate broadband noise during pauses in programme.

The *Sigma 8.2* power amplifier has been specially developed for nearfield monitoring. A special feature of the design is the use of a low negative feedback circuit and current limitation of the power supply. This is to achieve a high degree of dynamic performance and the amplifier has been designed to handle complex loads presented by crossovers. The *8.2* is rated at 2×110 W/4 Ω.

The *Sigma 1.2* level control unit is a stereo microprocessor-controlled 'master fader' that is inserted between the console and master recorder. Employing a refined version of *Dynafex*, the *Sigma 1.2* automatically sends programme at the studio standard level (+6/+8/+9 dBm) while maintaining the correct dynamic range. Psychoacoustic 'brilliance' can also be added to dull-sounding material. Other features include programmable fade-outs and fade-ins, 100 user-programmable memories, alphanumerical peak levels to IRT standard and single-channel or stereo operation.

ARSonic, Bayreuth, West Germany. Tel: 0921-57711. Fax: 0921-56700.

Terry Nelson

Contracts

• A *SoundStation II* digital audio recorder from **Digital Audio Research**, Surrey, UK, has been sold to TVi for use in their programme post-production facility. The system will include *SoundStation II* editing and signal processing functions, four channels of digital and analogue I/O, four 380 Mbyte disk drives capable of storing four hours of audio, chase synchronisation and resolving, and stereo *Timewarp*. Four *SoundStation* systems have also been sold to European clients following IBC in September.

• BASF, Ludwigshafen, West Germany, have purchased an **Otari** *T-700 Mk II* laser-based high speed video duplicator to be used for production of BASF chrome tapes for the Thermal Magnetic Duplication process. Otari have also recently purchased the rights to this video duplication process, dubbed *TMD*, from E I Dupont de Nemours and Company. TMD, claim Otari, does away with the realtime duplicating process which requires thousands of video recorders and constant loading/unloading.

DIGITAL AUDIO FOR POST PRODUCTION

SOUNDSTATION II

Digital Audio Disk Recorder and Production Centre

From simple spotting of sound effects to timecode, to complicated dialogue and soundtrack editing, **SoundStation II** from Digital Audio Research offers unparalleled power, speed, ease of use and flexibility for Video Post Production applications.

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Stirling Audio,
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The AC600 is an electronic crossover with added capability. But the term "Crossover" describes only a part of this units standard features. These include: Separate Frequency Band Limiters, Two Independent Channels, Polarity Switching, LED Signal Level Monitoring, Band-edge Phase Correlation Adjustment, Filter Programming by Plug-in Frequency Cards and Inclusive Transparent Security Cover.

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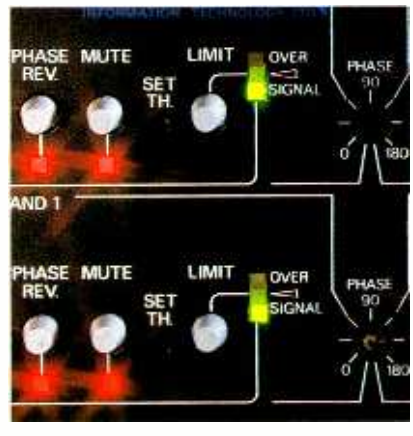

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Report from AudioVideo Pro '88

The second show organised by the APA (Association des Professionels de l'Audio) of France took place at the Parc des Expositions, Paris, October 18th to 21st. Following Audio Pro '87 last year, the APA wished to emphasise the growing integration between the audio and video industries and so renamed the 1988 exhibition. However, video representation was fairly low though companies such as Sony (which cover both audio and video) and Ampex (mainly concentrating on tape) did make a respectable presentation.

The change of venue from the Palais de Congrès to the Parc des Expositions met with mixed reactions: while most agreed that the exhibition area was good it missed the more upmarket atmosphere of the Palais de Congrès and its more central position. It was also unfortunate that the show coincided with a number of other important exhibitions which made access to the venue difficult. This was not helped by industrial action on public transport services.

Views on the timing of the show also varied and it was surprising to hear that many exhibitors and visitors found that the previous December dates were, in fact, not such a bad idea after all as they came at the end of the main round of shows.

AudioVideo Pro '88 also featured a series of lectures chaired by Denis Fortier every afternoon. The first day covered the French professional associations; the second microphone techniques and sound reinforcement; the third digital editing and *D2* MAC; and the fourth the role of the producer.

APA president Patrick Aufour summed up his impressions just after the close of the show.

"First of all, we have had 4,779 visitors over four days compared to roughly the same number last year over three, which would indicate that the professional audio community in France can be numbered in the region of just over 5,000. While it is clear that the problems with transport have not helped, a lot of people have managed to get here and the majority of the industry in France is still grouped in and around Paris.

"As far as France is concerned, we suffer from having too many exhibitions (not only in France) and the APA will be actively lobbying for one large event to combine everything into one show.

"The other point that I think is very important is that the Europe of 1992 is now only just around the corner and it is important that France has an audio/video show of international stature—not just a local event—and this is another reason for the wider scope of the show.

●**Ateis** have released the *BAC8* audio interface for the *BVE-900* video editor. The unit features eight VCA inputs and two outputs, together with 2-track return and 2-track monitor inputs. The *BAC* can be used as a standalone unit or used with a console by connecting the VCA inputs to the channel inserts.

The *SPM8* console has been designed for video suites and contains four/six/eight input channels and two master faders which can be routed to four output buses. Each input channel features input gain, 3-band EQ with highpass filter, PFL function, peak LED, routing switches and long throw plastic conductive faders. The input to the channel can be fitted with either switchable A & B line inputs or mic/line inputs with −20 dB pad, phase reverse and 12 V phantom. The output modules include 1 kHz oscillator, cal/uncal (with pot) output levels and full monitoring/intercom facilities.

Ateis, St Martin D'Heres, France. Tel: 76 42 29 19.

●**Montarbo** have introduced the *R16* digital effects processor/analyser. The *R16* is 16-bit with 32-bit internal processing and contains 31 factory programs ranging from reverb, delay, modulation-based effects, sampling and pitch changing. All parameters can be user-accessed and there are 60 RAM locations.

When used in conjunction with a PC, Atari or *Macintosh* computer, the *R16* becomes a realtime analyser over the 20 Hz to 15 kHz bandwidth with three modes of operation: ⅓-octave; continuous (1024 FFT); FFT 3-dimensional. User presets can also be transferred to disk.

Other features include MIDI control, LCD screen with two lines and 40 characters, HELP page and stereo outputs.

Montarbo, Italy.

France: Exagone, Montreuil, France. Tel: (16.1) 48 58 07 01.

●**Swann Audio** have introduced the stage monitor version of their *Walkyrie* speaker system. The wedge is 3-way passive with the Swann Audio crossover plus 'Swann Process' protection circuitry and can be mono or bi-amplified. Quoted frequency response is 60 Hz to 20 kHz (±2 dB). The mid range is covered by a single driver from 250 Hz to 5.6 kHz. Suggested powering is 900 W. Maximum dimensions are 554×480×450 mm (22×19×18 in) for a weight of 33 kg (70.75 lb) and peak SPL output of 132.5 dB.

Swann Audio, Vierzon, France. Tel: (16.1) 48 71 73 80).

●**Tenor** manufacture a range of high quality loudspeaker systems for sound reinforcement and monitoring applications, based around the *D-220C* and *350C* 3-way enclosures, and a range of three subwoofer assemblies. A peculiarity of the system is that the full-range cabinets incorporate a rear module containing a proprietary crossover network and power amplifiers, together with phase and amplitude response networks to ensure phase coherency and clarity of sound. Tenor loudspeaker systems have been designed with a view to the requirements of modern cinema sound.

Tenor, Lisieux, France. Tel: 31 31 26 22.

●**Ibis** have added a modular routing matrix to their *Euribis* range of broadcast modules using the *Eurocard* standard. The *GR 2102* has a maximum capacity of 32×32 and can accept audio and video signals plus auxiliary functions such as remote commands to ATRs and VTRs. System control is via *RS-422/232*. The matrix itself comprises a 6U *Eurocard* mainframe with internal or external power supply and video, audio and auxiliary (2-contact relay) 10:1 modules. The matrix is then built up by configuring the mainframe circuitry.

Ibis, Massy, France. Tel: 64 47 13 10.

●**33 Audio** have introduced two new speaker systems, the *Convention* and the *Neutron*.

The *Convention* is a 3-way full range enclosure that can be built up into a flown array, stacked or placed on a stand. The system features a compression driver loaded by a 90°×40° horn, a 10 inch (25 cm) speaker with its own chamber and a 15 inch (38 cm) bass driver in a symmetrically loaded, double tuned cavity. Overall dimensions are 440×590×490 mm (17×23×19 in), weight 47 kg (104 lb) and peak SPL output is 133 dB for a maximum power of 400 W.

The *Neutron* is a 2-way nearfield monitor and is fully shielded, thus making it suitable for use in close proximity to video monitors. The low frequency section (50 Hz to 2.2 kHz) uses a Kevlar sandwich cone and the high frequency section (2.2 to 40 kHz) a glass fibre cone driver. Dimensions are 230×355×340 mm (9×14×13 in) and maximum power admissible is 50 W. An active version of the *Neutron* is also available with a Class A MOSFET amplifier.

33 Audio, Bagnolet, France. Tel: (16.1) 43 63 34 47.

●**Process Control** have introduced two sound reinforcement systems, the *LP 1000* and *MP 1600*. Both systems are controlled by a dedicated processor that functions as a 2-way electronic crossover and provides frequency shaping, speaker protection, dynamic control and phase compensation.

The *LP 1000* is a long throw system (40°×20°) consisting of a bass horn loading a 15 inch (38 cm) driver and a bi-radial constant directivity horn loading a 2 inch (5 cm) compression driver (carbon fibre membrane). Both cabinets are of identical size and trapezoid for the easy assembly of arrays. Frequency response of a single system is 80 Hz to 16 kHz with the bass response descending progressively as more cabinets are added.

The *MP 1600* is a medium throw system (60°×40°) with a single enclosure containing two 15 inch (38 cm) individually horn-loaded drivers and a 2 inch compression driver with a bi-radial constant directivity horn. The cabinet is also trapezoid.

Distribution is by Analogique **Numerique Diffusion, Chatenoy-le-Royal, France. Tel: 85 41 10 11. Fax: 85 41 28 55.**

Terry Nelson

MUSIC LAB RECORDING NEWS

Telephone 01-388 5392 for latest information and prices

Cost-effective 24-TRACK starts here!

Setting up your first 24-track studio used to be a risky business. Budgets were invariably stretched, and much equipment often needed to be bought second-hand - with all the potential for unreliability which that brings with it.

But that's all in the past thanks to the Studio Magnetics AR2400 recorder. It has all the features you would expect from a professional tape machine: it uses standard 2" tape in reels of up to 10 1/2" diameter, it runs at 30 ips (switchable to 15), and it comes with a full-function remote unit and a nine-point cue and one cycle autolocator.

The only "standard" feature it lacks is a top-heavy price tag - which means that, in conjunction with a quality console like TAC's Scorpion, you can be ready to record for well under £20,000. Especially since if you buy both of them - Music Lab will supply a FREE wiring loom and an R-DAT recorder to produce your masters on.

Studio Magnetics AR2400

The Music Lab philosophy is to provide its customers with the right equipment at the right price. That's why we are now offering Studio Magnetic's new 24-track recorder at the kind of price normally reserved for second-hand equipment. And before you start thinking that this is a "budget" recorder - take a look at the specifications.

The chassis is milled from 1/2" alloy plate for robustness and rigidity. Papst AC spool motors are employed, as is a tacho-controlled DC servo capstan motor. The transport system has a roller tape lifter and a centre-pivoted constant pressure pinch roller, and the autolocator is microprocessor controlled.

It's a machine that should make an upgrade to 24-track recording a realistic proposition for many 16 and even 8-track studio owners. So how can it be so cost-effective? Simply because Studio Magnetics manufacture the entire machine in-house, and are not dependent on subcontractors. What's more, they support it with a full two-year warranty.

Music Lab are sole UK distributors for the AR2400 and can provide you with a machine from stock.

TAC's Scorpion

This extremely flexible range of mixing consoles can be configured to suit nearly all audio applications, in multitrack recording, live sound reinforcement and broadcast and video production. To date there are several thousand TAC Scorpion consoles working all around the world - a testimony to the correctness of the design.

Music Lab is the main London distributor for all TAC mixing equipment, and has supplied Scorpions to a variety of well-known users, including Elton John, Chris Rea, Dave Hewson, Smiley Culture and the Town & Country Club.

For studios moving up to 24-track, we recommend the Scorpion 28:12:2 console with 24-track monitoring. This provides flexible four-band equalization and 27 meters, and is available with or without an on-board patchbay and with either four or eight auxiliary sends. Stereo line input modules are another popular option, particularly with studios using stereo effects units.

The Scorpion has a reputation for a high level of build quality and superb equalization - adding up to a level of sonic excellence unique in a console of this class. It interfaces perfectly with the Studio Magnetics AR2400.

Contact Gary Dent or Tony Musgrove at Music Lab for full details and prices on all TAC consoles.

72 - 76 Eversholt Street London NW1 1BY

MUSIC LAB

Sales 01-388 5392 Hire 01-387 9356

Tascam DA-50 DAT machine

Tascam have introduced a new DAT recorder/player, the *DA-50*, with several new features. It incorporates four Tascam Zero Distortion (ZD) circuits which, claim Tascam, "add and subtract digital dither in the conversion processes to reduce granulation noise to virtually zero". The five main internal sections are shielded in individual boxes, and seven power supplies are fitted, with separate transformers for digital and analogue circuits; all critical wiring is mono-crystal silver-coated cable and glass epoxy PCBs are used for audio, control and servo sections. Additional features include 38-key full function wired remote, 25-segment/3-colour level meter with variable peak hold, blank search and remote-controlled motor driven front shielding panel.

Tascam have also introduced a new ½ inch 16-track recorder, the *MSR-16*, featuring built-in dbx type-1, auto punch-in/out, and both serial and parallel external control ports.

Teac Corp, 4-15-30 Shimorenjaku, 4-Chome, Mitaka-Shi, Tokyo 181 Japan. Tel: 0422 45-7741.

UK: Teac UK, 5 Marlin House, The Croxley Centre, Watford, Herts WD1 8YA. Tel: 0923 225235. Fax: 0923 36290.

USA: Teac Corp of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303.

Boss mixers and speakers

The latest products from Roland's Boss division include a range of three compact mixers, the *BX-80*, *BX-60* and *BX-40*, aimed at musicians' multiple instrument setups or multiple-output devices such as samplers and drum machines. The largest and most sophisticated is the *BX-80*, featuring eight inputs with gain adjustment, simple EQ, effect send, panning and a fader on each, while the *BX-60* has six channels without the EQ and with rotary volume controls. Simplest is the *BX-40*, with four channels whose only controls are volume and a mic/instrument/line level input attenuator switch.

Also new is the Boss *MS-30* speaker system, a compact speaker with a 5 inch full range driver handling 30 W RMS and some unusual features. The cabinet is magnetically shielded, allowing placement next to, for instance, a CRT display, and the front panel incorporates a sliding bass reflex window, which Boss say allows the user to adjust the low frequency response of the unit to better fit the acoustical requirements of the room. Optional mounting brackets are available.

UK: Roland UK Ltd, Amalgamated Drive, West Cross Centre, Brentford, Middx TW8 9EZ. Tel: 01-568 1247.

USA: Roland Corp US, 7200 Dominion Circle, Los Angeles, CA 90040. Tel: (213) 685-5141.

ATC crossover and monitors

New products from ATC include the *EC23* crossover. Features include pluggable headers for altering crossover points, phase adjustment at the crossover points, FET-based momentary gain reduction circuitry to avoid driving following amplifiers into clipping, and a smoked perspex tamper panel.

The *SCM200* monitors are available only with the *EC23* crossover, and are designed to sustain very high SPLs for control room use; recommended amplifier ratings are 3×350 W/channel for the two bass units and mid drivers, and 250 W/channel for the tweeters.

ATC Acoustic Engineers, Loudspeaker Technology Ltd, Gypsy Lane, Aston Down, Stroud, Glos GL6 8HR, UK. Tel: 028 576 561. Fax: 028 568 859.

Mitsubishi X-880

Mitsubishi Pro-Audio have introduced the *X-880* 32-track digital recorder. Designed as a successor to the *X-850*, with which it maintains full tape compatibility, it is claimed to offer more convenient operation, increased reliability and improved sound quality, as well as reduced size and weight thanks to extensive use of LSI technology. Options include a 32-channel AES/EBU interface unit and a track remote giving complete machine status control from the mixing console, and the *CS-1* plug-in chase synchroniser, claiming a lock resolution between two *X-880*s of within ±20 μs (less than one sample) for phase-coherent 64-channel recording and sample-accurate electronic editing. The *CS-1* can also be rackmounted for use with *X-850* and *X-400* machines.

Mitsubishi Electric Corp, Mitsubishi Denki Building, Marunouchi, Tokyo 100, Japan.

UK: Mitsubishi Pro-Audio, Unit 13, Alban Park, Hatfield Road, St Albans, Herts AL4 0JJ. Tel: 0727 40584.

USA: Mitsubishi Pro-Audio Group, 225 Parkside Drive, San Fernando, CA 91340. Tel: (818) 898-2341.

Syrinx USM 09 mixing system

The *USM 09* from Syrinx is in basic terms a digitally-controlled analogue mixing console notable for its unconventional approach and layout. The system is a rackmount card-module type configuration, and the available modules comprise an input module handling attenuation, fading and routing of eight sources into four stereo channels (up to four of these can be used giving a 32-channel capability); a matrix module defining signal paths through the system—one module handles 16 inputs and eight outputs; and an output module. The system is controlled from a removable 'handler' featuring a large dedicated keypad and a 4-line 80-character LCD display. Mass storage capability is handled by memory cards, and more detailed system status information is available on a graphic display on a host computer—software is available for the Atari *1040* and should shortly be released for PCs and *Macs*.

Syrinx, Wiener Strasse 291, 8051 Graz, Austria. Tel: 0 316 6 22 10.

Permali and Alpha dBk

Two separate manufacturers have introduced panelling materials with properties of interest to those involved in studio construction. Permali's *Permawood Hi-Damp* consists of various wood veneers coated with a rubber solution and laminated under heat and pressure to form a resilient shock absorbent laminate. Alongside such attributes as impact resistance and safety factors it is intended for use as a sound absorbing material due to its visco-elastic rubber content. No figures are provided concerning its acoustic performance but suggested applications include music rooms, lecture halls, loudspeaker cabinets and musical instrument manufacture.

Perhaps more directly applicable is the *Soundfloor* system from Alpha dBk Ltd. This is specifically an acoustic flooring board and comes in two versions, *Soundfloor Plus* for optimum airborne and impact sound reduction, and *Soundfloor ST1* for use where optimum impact sound insulation is of prime importance, particularly on concrete floors. Quoted insulation specifications for both types easily meet building regs requirements.

Permali Ltd, Bristol Road, Gloucester GL1 5TT, UK: Tel: 0452 28282.

Alpha dBk Ltd, Gomm Road, High Wycombe, Bucks HP13 7DJ, UK. Tel: 0494 436345.

Otari tape machines

The *DTR-900B* series digital multitrack, features entirely redesigned autolocator/remote software and hardware, new proprietary VLSI technology, in-house manufactured heads and upgraded power supplies to accommodate the use of optional Apogee filters. Most of the new *B* series features can be retrofitted to earlier models. New accessories for *DTR-900*s in general are the *EC-104* plug-in chase synchronisers and the *CP-503* PD to DASH bi-directional format converter.

The *MX-50* is a 2-track analogue machine aimed at the lower budget professional market, featuring search-to-cue, search-to-zero, built-in varispeed, electronic lifter control and a dump edit function. A novel option is a Voice Editing Module, which provides 2x playback without pitch shift for fast editing and review of news or dialogue material, aimed at radio news applications.

Otari Electric Co, Otari Building, 4-29-18 Minami, Ogikubo, Suginamiku, Tokyo 167, Japan. Tel: 03 333-9631.

UK: Otari Electric (UK) Ltd, 22 Church Street, Slough SL1 1PT. Tel: 0753 822381.

USA: Otari Corporation, 278 Vintage Park Drive, Foster City, CA 94404. Tel: (415) 341-5900. Fax: (415) 341-7200.

Acoustical Physics Laboratories

The Acoustical Physics Laboratories control room monitor incorporates cone and dome driver technologies in a time corrected three-way design, aimed at providing high levels of spectral, transient and spatial imaging accuracy. The monitors are available in component form or as complete systems and include a choice of active or passive crossover networks. Custom control room monitor designs with on-site TEF performance certification are available for special requirements.

Acoustical Physics Laboratories, 3877 Foxford Drive, Doraville, GA 30340, USA. Tel: (9404) 934-9217.

Industrial Research System 41

System 41 offers an unusual approach to the installation of signal processing equipment in a variey of applications. Structured round a rackmount 6U mainframe, a large selection of modules is available to allow system customisation within a single unified package. Module options (there are about 28 at present) include all the obvious ones of EQ, Mic amps, D/As, crossovers and so on, plus some less familiar ideas such as a lectern diversity microphone mixer, which automatically switches between two mics to avoid phase cancellation effects, programmable matrix mixers up to 8×8, an automatic microphone mixer using dynamic threshold sensing, and prototyping PC boards for customising units to integrate with the rest of the system. The lockable rack front panel has an inside mounting surface for 'write-on' panels for recording control settings of each module. *System 41* is apparently aimed at the market for permanent installations such as courtrooms and churches.

Industrial Research Products Inc, 321 Bond Street, Elk Grove Village, IL 60007, USA. Tel: (312) 439-3600.

UK: The Sound Department Ltd, Askew Crescent Workshops, Askew Crescent, London W12 9DP. Tel: 01-749 2124. Fax: 01-749 8789.

Fostex stereo ribbon microphone

The *M22RP* stereo microphone, now available in the UK, borrows from proprietary technologies used in headphone manufacture to solve some of the problems encountered in the design of conventional ribbon mics. By using high impedance printed ribbon elements, the need for an output transformer and the mechanical fragililty of conventional ribbons are avoided. The unit uses MS techniques, with a bi-directional capsule mounted at 90° to a central cardioid capsule, and is recommended for location use since it requires no power supply.

Fostex Corp, 560-3 Miyazawacho, Akishima, Tokyo, Japan. Tel: 0425-45-6111.

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

USA: Fostex Corp of America, 15431 Blackburn Avenue, Norwalk, CA 90650. Tel: (213) 921-1112.

telcom C4 AC 27 compander card for Sony BVH 2000

The *telcom c4 AC-27* audio compander card is designed to improve audio channels 1 and 2 of the Sony *BVH-2000/2500* series type *C* 1 inch VTRs. It is a replacement card for the Sony *AU-27* board providing new record/playback electronics and incorporates the *telcom c4* compander system into both audio channels. The card plugs directly into the slot of the VTR, which requires no modification. The *AC-27* is designed to offer substantial audio improvements in terms of dynamic range and crosstalk performance, which the manufacturers claim result in a recording quality comparable to 16-bit digital. The card also corrects frequency response errors with head bump effects.

ANT Nachrichtentechnik GmbH, Lindener Strasse 15, D-3340 Wolfenbüttel, West Germany. Tel: (05331) 83-364.

UK: ANT Telecommunications UK, 17 Liverpool Road, Slough, Berks SL1 4QZ.

USA: ANT Telecommunications Inc, Avenel Business Park, 211 Perry Parkway, Suite 4, Gaitherburg, MD 20877. Tel: (301) 670-9778.

"Neve Je t'aime!"

Polygone Studios has received a design award for their new purpose built studio complex. The studio was "Number One" in France for the number of hits recorded in 1987. "The biggest hit of the studio has been the Neve V series."

Jacques Bally Studio Owner.

"Neve V series Je t'aime!"

Jacques Hermer Chief Engineer.

POLYGONE STUDIOS – TOULOUSE – FRANCE

Blackwood Studios uses the Neve V series for music recording and for live broadcasts from the nearby music club.

"It is in our opinion the most musical console available today, it is very very quiet."

Helmut Edinger
Studio Manager

BLACKWOOD STUDIOS – BASEL – SWITZERLAND

Neve
A Siemens Company

NEVE ELECTRONICS INTERNATIONAL LIMITED, MELBOURN, ROYSTON, HERTS SG8 6AU, ENGLAND
TELEPHONE: ROYSTON (0763) 60776. TELEX: 81381. CABLES: NEVE CAMBRIDGE. FACSIMILE: (0763) 61886

For £95, Mickey Mouse will never trouble you again.

Otari's MX-55 is quite some machine. A new compact ¼" tape recorder, crammed with all the features the true professional could demand.

4-memory "mini locator"? Built-in test tone oscillator? +-20% vari-speed? Noise-free punch in and punch out? User-friendly control design?

All standard. This is an Otari, after all.

But if you do a lot of voice editing, there's an optional feature that could interest you even more.

It's called VEM. And it lets you edit at twice speed without the squeaky "Mickey Mouse" effect. By holding the pitch constant while you double the tape speed.

It's a simple feature that could save you hours of working time each week.

And at only £95 extra on the MX-55's asking price of £2414, you'd be goofy not to check it out.

MX-55. The two track mind.

OTARI®

MX-55N. Part of a new range of Otari Compact Tape Recorders. For details of models and optional extras, including Centre Track Time code, write or telephone:

Otari Electric (UK) Limited, 22 Church Street, Slough, SL1 1PT, Berkshire. Telephone: (0753) 822381. Telefax: (0753) 823707
Otari Corporation of America, 378 Vintage Park Drive, Foster City, CA 94404. Telephone: (415) 341 5900. Telefax: (415) 341 7200
Otari Electric Co Ltd, 4-29-18 Minami-Ogikubo, Suginami-ku, Tokyo 167. Telephone: (03) 333-9631. Telefax: (03) 331-5802
Otari Singapore Pte Ltd, 625 Aljunied Road, 07-05 Aljunied Ind. Complex, Singapore 1438. Telephone: 743-7711. Telefax: (743) 6430
Otari Electric Deutschland GmbH. Rudolf Diesel Strasse 12, D-4005 Meerbusch 2, West Germany. Telephone: 010 49/2159/50-861-862 or -863. Telefax: 010 49 2159 1778

Sennheiser products

Sennheiser have added several new products to their various ranges. Four new headphones include successors to the *HD414* and *HD420*, the *HD450* and *480*, new mini-style headphones (*HD30*) and the *HD250* linear closed back headphones. The new *MKE 48* drummer's headset microphone is available for use in wireless applications with the *SK 2012* body-pac transmitter or conventionally wired, and features a special condenser microphone designed to minimise pop while offering high sensitivity, and the facility to add a single headphone driver for monitoring. The *MD 431* handheld dynamic microphone is joined by the *MKE 4032* handheld condenser, offering greater sensitivity and enhanced HF capability, and finally Sennheiser have launched the *VHF2G* wireless guitar system, using the miniature *SK 2012* body-pack guitar transmitter and the *EM 2003* single-channel diversity receiver and featuring a high dynamic range and constant power output.

Sennheiser Electronic, D-3002 Wademark 2, West Germany. Tel: 01 130 583-0.

UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks. Tel: 0753 888447.

USA: Sennheiser Electronic Corporation, 6 Vista Drive, PO Box 987, Old Lyme, CT 06371. Tel: (203) 434-9190. Fax: (203) 434-1759.

TDK cassettes

TDK's range of cassettes has been revamped in several ways. All types have been repackaged, both in terms of the outer wrap and the shells themselves, and familiar formulations have been upgraded in various respects. The MOL of the basic *D* cassette has been increased, as has the sensitivity of the *SA* version. In addition, newer formulations have been added, such as *AR*, a ferric-type tape using the newly developed NP ferric particles to produce a claimed MOL equal to that of metal tape.

UK: TDK UK Ltd, Pembroke House, Wellesley Road, Croydon CRO 9XW, UK. Tel: 01-680 0023.

USA: TDK Electronics, 755 Eastgate Boulevard, Garden City, NY 11576. Tel: (516) 627-0238.

Numark DM-1975 preamp/mixer

Although not really a *Studio Sound* type of product, Numark Electronics have responded to the growing demand for 'creative control' from DJs by introducing the *DM-1975* preamp/mixer with built-in 4 second digital sampler. The sampler uses 16 bits clocked at 48 kHz and the unit has 3.1 mbits of RAM divided into four memory banks of one second each, which can be ganged together or staggered for up to 4 secs of sampling time. The digital capability can also be used as a DDL with up to four seconds of delay. The facilities are intended to provide a wide range of familiar special effects such as scratching, stuttering and doubling live in real time without the use of a second turntable or over dubbing.

Numark Electronics Corp, 503 Newfield Avenue, Raritan Centre, PO Box 493, Edison, NJ 08818, USA. Tel: (201) 225-3222.

White Box Audio CD to R-DAT transfer modification

White Box Audio announce the availability of a low-cost modification to Philips technology-based CD players, which allows digital transfer to the Sony *PCM2500* and *DTC1000-ES* DAT machines, which would normally require external converters. They see the advantages of such transfer as being the R-DAT track identification facilities and the high quality of the DAT machines' D/A converters. White Box argue their way round the copyright problems by pointing out that the improvements over analogue transfer are not significant in domestic terms and unlikely to be of interest to those not involved in the production of source material, and that the vast majority of DAT players are in professional hands.

White Box Audio, Unit Two, 38 Osborne Road, London N4 3SD, UK. Tel: 01-272 0020.

Asaca tape evaluator/cleaner

The Asaca/Shibasoku Corporation of America have introduced the *ADC840* series tape evaluator/cleaners. The 5-machine line is designed to evaluate and clean virtually every format of video tape and speed up the evaluation stage of the manufacturing process. In the evaluation mode the machines will handle 10 metres of tape a second, while in cleaning mode the speed rises to 12 m/s. The machines are fully automated and can be controlled by the IBM AT, and the manufacturers claim that the cleaning system can remove 70% of temporary dropouts.

Asaca/Shibasoku Corp of America, 12509 Beatrice Street, Los Angeles, CA 90066, USA. Tel: (213) 827-7144.

Celestion SR series loudspeaker and controller

The latest additions to Celestion's *SR* series are the *SR3* loudspeaker and the *SRC3* system controller. The *SR3* incorporates a specially-developed 8 inch driver employing Celestion's 'Hard Dome' technology, mounted in a rugged injection moulded polymer cabinet with threaded inserts to accept a wide variety of mountings.

The *SRC3* controller provides the necessary equalisation to give smooth response over a 60 Hz to 20 kHz range with a power handling of 150 W per unit; the *SCR1* controller increases this capability to 250 W.

Celestion International Ltd, Foxhall Road, Ipswich IP3 8JP, UK. Tel: 0473 723131. Fax: 0473 729662.

USA: Celestion US, Kuniholm Dr., Box 251, Holiston, MA 01746. Tel: (617) 429-6706.

Dolby 363 switchable SR/A NR

The Dolby Model *363* is the first studio unit to offer Dolby *SR* with *A*-type noise reduction as a switchable option. The 2-channel unit occupies a 1U frame and both channels are equipped for record/play changeover either manually or from a recorder. The *363* uses a new family of processor modules, the *cat.300* containing both *SR* and *A*-type, the *SR*-only *cat.350* and the *A*-type *cat.450*, none of which are pin-compatible with either the *cat.22* or the *280*. A new alignment mode is incorporated, with 4-element LED calibration displays as well as Dolby tone or Dolby noise facilities.

Dolby Laboratories, 346 Clapham Road, London SW9 9AP, UK. Tel: 01-720 1111. Fax: 01-720 4118. Dolby Laboratories, 100 Potrero Avenue, San Francisco, CA 94103-4813, USA: Tel: (415) 558-0200. Fax: (415) 863-1371.

Neve 66 series

The latest step in Neve's association with Siemens is the *66* series console, Neve's first digitally-controlled analogue console and the first Neve console designed in collaboration with Siemens to address the European broadcast market.

Designed to meet the stringent German IRT specifications in all respects the console features include dual input mono and stereo mic/line channels, CMOS matrix switching, a software fader logic system, microprocessor-controlled reset system, multiple clean feed (mix-minus) system, up to 12 mono and two stereo auxes and up to four independent monitoring outputs.

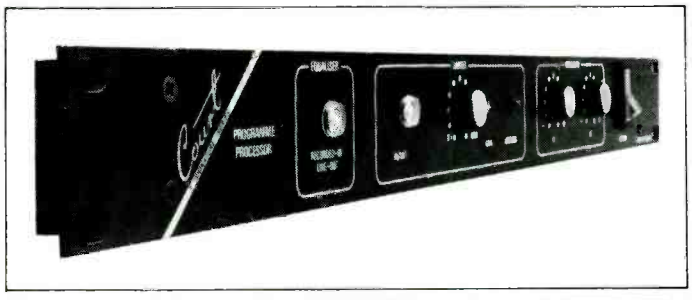
Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU, UK. Tel: 0763 60776. Fax: 0763 61886.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel CT 06801. Tel: (203) 744-6230.

The familiar Revox PR99 ¼ inch tape machine is now in its Mk 3 version. Most of the workhorse-oriented features remain the same, but microphone options are no longer available; however, a free standing version is added to the existing rack-mounting model.

Court loudspeaker processor

Court's loudspeaker processor is a multi-function signal processor, apparently intended for insertion on the power amp input(s) of a monitoring system, which possesses some unusual facilities. Familiar enough is a 2-way electronic crossover, crossing over at a fixed 250 Hz with variable output levels on each band. Also included is a limiter, designed to prevent power amp clipping; this has a threshold control and a screwdriver gain adjustment. The most unexpected feature is a fixed-curve equaliser, which when switched to 'live' has no effect but in 'recorded' mode boosts high and low frequencies. Additions to the spec on the new Mk II version include a 90 Hz mono sub bass output coupled with a bass cut switch on the full range output. Court say the processor "is being used by studios to convert compact monitors such as the Rogers and Yamaha *NS10*s. . .to 300+300 W full range systems."

SJ Court & Associates Ltd, PO Box 831, Oakley Green Road, Windsor, Berks SL4 4EZ, UK. Tel: 0628 38555.



Lexicon MRC

The *MRC* is a joint project from Lexicon and Clarity, born out of Clarity's *XLV* signal processor automation interface. Manufactured and sold by Lexicon, its initial role is as a definable MIDI remote for the *LXP* and *PCM70* employing system exclusive control, but it also functions as a general MIDI remote, in which mode each *MRC* fader and switch may be defined as any MIDI source. New software is already available to enable control of Lexicon's larger devices and the AMS *rmx.16* and the Quantec *QRS*.

The device also acts as an intelligent FM synthesis programmer using the proprietary Kramer Synthesis Macros, which can turn a simple fader movement such as 'brightness' into a string of FM synthesis system exclusive messages.

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

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

Rane DC 24 dynamic controller

Rane have announced their *DC 24* Dynamic Controller, a multi-function dynamics processor incorporating two channels of compression, limiting, expansion and noise gating, all of which are available simultaneously. A built-in variable-frequency 24 dB/octave crossover offers separate split-band processing of high and low frequencies as well as operation as a biamp crossover/processor.

Rane Corp, 10802 47th Avenue West, Everett, WA 98204-3400, USA. Tel: (206) 355-6000. Fax (206) 347-7757.

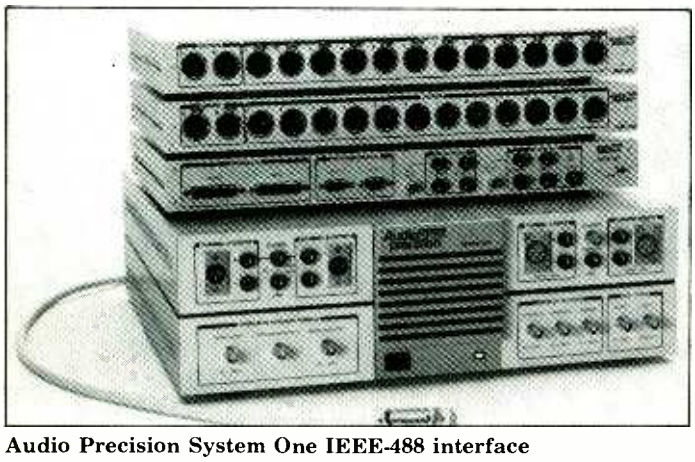
UK: Music Lab Sales, 72-74 Eversholt Street, London NW1 1BY. Tel: 01-388 5392.

Audio Precision System One IEEE-488 interface

The established *System One* PC-based audio test system from Audio Precision is now available with the IEEE-488 interface for integration into automated test systems for telecommunications, avionics, mobile radio, auto radio and high-volume consumer product testing. General system capabilities include measurement of broadband or selective amplitude and noise, total harmonic distortion, intermodulation distortion, frequency, phase, wow and flutter, DC voltage and resistance, and the complete stimulus-response package includes stimuli for all these tests plus sine bursts, squarewaves, and white, pink and ⅓-octave bandwidth noise.

Audio Precision, PO Box 2209, Beaverton, OR 97075-3070, USA. Tel: (503) 297-4837.

UK: Scenic Sounds Equipment Ltd, Unit 2, 10 William Road, London NW1 3EN. Tel: 01-387 1262.



Audio Precision System One IEEE-488 interface

dbx RT-60 option for RTA-1 analyser

A new option for the dbx *RTA-1* professional real time analyser, which adds RT-60 software for measuring the reverberation time of a space in each of the *RTA-1*'s 31 bands, was introduced at the Los Angeles AES. The *Version 2.0* RT-60 option chip set (six ROMs plus additional RAM) is a field upgrade that should now be available from dbx authorised dealers. *Version 2.0* includes all *Version 1.5* improvements, which provide enhanced room-response curve capabilities and add microphone calibration with a database for 10 microphone sensitivity memories, absolute SPL measurement capabilities and a custom printout feature.

dbx Professional Products, PO Box 1000C, Newton, MA 02195 USA. Tel: (617) 964-3210.

UK: Scenic Sounds Equipment Ltd, Unit 2, 12 William Road, London NW1 3EN. Tel: 01-387 1262.

DDA new modules

Several new facilities have been introduced for existing DDA console ranges. The *D* series is now available with eight VCA and mute groups by means of new VCA input modules and VCA master modules; the new input modules also provide a few extra features like separate gain trim for the mic and line inputs. The *DCM 232* in-line console can now be fitted with VCA automation, adding recording and replay of fader and mute information to the existing off-line editing and preparation of channel switch settings, and allowing three levels of operation. Finally, new modules for the *Q* series consoles provide eight mute group select switches and a 10-segment LED input level meter.

DDA, Unit 1, Inwood Business Park, Whitton Road, Hounslow, Middx TW3 2EB, UK. Tel: 01-570 7161. Fax: 01-577 3677.

USA: Klark-Teknik Electronics Inc, 30B Banfi Plaza North, Farmingdale, NY 11735. Tel: (516) 249-3660.

Sarner Audio Visual converter

A new unit that enables A-V users to run AVL-generated multi-image programmes using Arion dissolve units has been announced by Sarner Audio Visual. The 'AVL to Arion converter' lets users switch standards without jeopardising investment in existing programmes. It is located either between the programmer and dissolve units or between the tape machine and dissolves, and gets round the previous problem of non-compatibility between the two systems and allows wider access to the SMPTE facilities of the Arion equipment and its ability to transmit signals over 200 metres of ordinary cable.

Sarner Audio Visual, 32 Woodstock Grove, London W12 6LE, UK: Tel: 01-743 1288.

MicroAudio EQ pods

New from MicroAudio is a computerised equalisation system based on a range of EQ pods, totally tamperproof rackmount equalisers which must be programmed from MicroAudio's *2800* or from their *PC 280* in conjunction with an IBM *PC*; MIDI programming is also possible, and options allow storage and retrieval of multiple EQ curves. Use with the *2800* controller allows Auto EQ which the manufacturers claim makes obsolete the standard method of obtaining an RTA curve and creating a reciprocal EQ curve to correct room anomalies.

MicroAudio Inc, 4438 SW Hewett, Portland, OR 97221, USA. Tel: (503) 292-8896.

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

In brief

- **AKG** are expanding their range of budget line microphones with the addition of two new dynamics, the *D90S* cardioid and the *D95S* hypercardioid. Both are designed for live and recording use and are intended to be rugged enough to withstand hard stage use.
- The **Revox** *C* range of professional tape machines now includes the *C274* and *C278* 4- and 8-channel recorders, the latter on ½ inch tape. Standard features include Dolby *HX-PRO*, seamless gapless punch in and out, scrape flutter idler in the head assembly, constant spooling motor tension, plug-in EQ, varispeed, library wind, record inhibit, and RS232 control of all machine functions. Both machines are 2-speed and have a built-in time and date code generator and reader with search capability. Shortly to be added are low speed logging versions.

ART high definition equalisers

New from ART are two graphic equalisers, termed 'high definition' by the manufacturers. The two models are a 31-band ⅓-octave and a 15-band ⅔-octave version, both incorporating 60 mm faders, switchable subsonic and ultrasonic filters, fail safe hardware bypass in case of power loss, and clip/signal metering.

ART's circuitry is claimed to dramatically reduce adjacent band interaction and increase dynamic range, and constant Q precision filtering and summing networks are used to provide increased accuracy. ART also claim S/N and distortion figures better than many digital specs.

Applied Research and Technology Inc, 215 Tremont Street, Rochester, NY 14608, USA. Tel: (716) 436-2720.

UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Tel: 0753 76911. Fax: 0753 35306.

Fairlight news

The Fairlight *MFX* (music and effects) console

CAPS is the newly-released Composer/Arranger/Performer/Sequencer software for the Fairlight *Series III*. Basically, *CAPS* is an 80-track polyphonic MIDI sequencer that has been integrated into the Fairlight system. Each track may be used to record up to eight MIDI controllers (as well as other MIDI 'events' such as note on/offs) and up to 80 separate MIDI events may be placed on the same microbeat. A microbeat is the smallest possible subdivision of a beat and *CAPS* provides 384 divisions of the beat. Maximum length of a single composition is quoted as 480 measures.

Editing features are comprehensive and include most of the commands you would find on any serious MIDI sequencer, plus a few special features, such as Randomise, Probability and Scale to MIDI Key Number. Quantisation is non-destructive and it is very easy to try various different shuffle feels before committing yourself.

Particularly useful features include the ability to 'undo' (and even to undo an 'undo') and the 'restore' feature, which comes into operation when using SMPTE chase. This will check all patch changes, pitchbends and controller information (such as the position of a synthesiser modulation wheel) and bring the correct things into operation at the required position in the piece you are working on.

Additional features include a Drum Editor, which is modelled on Page R, the difference being that each drum 'instrument' has its own track for ease of editing. A Measure Editor is provided which uses a hybrid form of conventional music notation on treble and bass staves. The Opus Editor gives you an overview of 32 measures of the piece with repeat indicators, 'not last time' bars, and rehearsal figures. The Note Editor clearly displays the pitch, velocity, duration and position of the current note or chord.

Fairlight say that *CAPS* will lock to film with 100% accuracy, unlike other sequencers. Also, tempo is calculated in frames per beat, which is often the preferred method when working to film, and tempos may be increased or decreased in bpm in 1/32 note increments.

The *MFX* (music and effects) console is a dedicated post-production controller. It is aimed at sound editors, dubbing editors, Foley artists, and sound designers.

There are 24 dedicated Sound Keys with velocity and position sensing circuitry. Teamed with the 'shift' and 'control' keys, they provide independent triggering of up to 72 different sound keys.

Cue-List software is provided which enables the user to record all the cues for a scene in realtime in conjunction with these Sound Keys. To get these cues right, the software allows you to overdub and 'drop in'. Once the list has been prepared in this fashion, a command is used to convert this recording of the cues into a file, which may then be finely edited to set exact SMPTE times for events on the list, to a resolution of 80 parts per frame. Refinements such as volume curves and stereo panning may also be added at this stage.

The Fairlight will chase the timecode on a video or audio tape in any of the four timecode standards, and locks up 'within seconds'.

The *MFX* Jogger Wheel combines with the unit's transport buttons to become a complete autolocator for a *VPR3* video machine, or for any tape transport connected to a *Lynx VS1* synchroniser. A mouse controller is also provided.

The *MFX* may be used instead of the normal QWERTY keyboard in any Fairlight *Series III*, providing sound triggering keys, a jogger wheel, a mouse, a synchroniser interface, and SMPTE readouts.

The new *Waveform Supervisor* option for the *Series III* provides increases in speed and flexibility which allow faster voice loading, support for a multitrack hard disk recorder, faster page changes, optical disk acceleration, and doubling of voice memory.

With the *Waveform Supervisor* in operation it is now practical to load voices during sequences, which is useful to allow longer synchronised runs with film or video. The multitrack disk recorder allows you to play up to eight tracks from a single hard disk using a 44.1 kHz sampling rate. Page changes now take a maximum of 3 secs, or less. Also the RAM capacity has been increased to 28 Mbytes by the provision of 4 Mbyte RAM cards. This allows the user to make full use of the 63 samples allowable in each voice.

ESDI disk drives of 380 Mbytes will store up to an hour of digital voice files or disk recordings, together with vast quantities of sequencer data. The read speed of these disks is said to be faster than any other type of hard disk on the market. If teamed with a *Waveform Supervisor*, the speed of the ESDI drive is increased to at least 800 kbytes/s, which is four times as fast as a stereo digital recorder.

The price to Megabyte ratio is the lowest on the market, and if the drive is mounted externally, there is an additional advantage in that you just need to take this disk drive to another Fairlight-equipped facility to continue a project.

The optical WORM disk drive is a storage device that provides a safe, permanent backup of work from which nothing can be accidentally erased. It provides 800 Mbytes of storage, which is more than enough for the whole Fairlight sound library, including all five instalments of the 1988 subscription library.

One optical disk provides over 2 hours of 16 bit digital sounds, ready trimmed and looped, with all the control parameters built in to take advantage of the *Series III*'s extensive performance capabilities. The WORM drive is an excellent upgrade from streaming tape drives, because it allows random access to files, which may be selected from its on-screen contents list.

Again, when teamed with the *Waveform Supervisor*, this drive is transformed into a high performance data retrieval device, with all the ability of the hard disk to audition sounds and load waveforms directly.

Fairlight Instrument Pty Ltd, Rushcutters Bay, NSW, Australia. Tel: (02) 331 6333.

UK: Fairlight Instruments (UK) Ltd, Kimberley Road, London NW6 7SF. Tel: 01-624 6000.

USA: Fairlight Instruments Inc, 2945 Westwood Boulevard, Los Angeles, CA 90064. Tel: (213) 470-6280./110 Greene Street, New York, NY 10012. Tel: (212) 219-2656.

Electro-Voice expands research and development

Electro-Voice, located in Buchanan, MI, USA, have expanded their research and development effort with the construction of new engineering facilities. The three-storey research and development centre has over 28,000 ft² of space and houses over 50 engineers, technical assistants and support staff.

The new facilities allow the complete designing, testing and evaluation of prototypes, as well as offering suitable conditions for fast Fourier and time-energy-frequency testing via a specifically designed listening room and anechoic chamber. Other capabilities include CAD, holography and laser-based analysis.

Ampex announce $17.4m production facility

Ampex Corporation's Magnetic Tape Division has announced that it will begin a $17.4 million investment that will enable it to produce, in high volume, the metal particle tapes, thin coatings and thin base films that will form the core of its next generation of magnetic media products.

The two-year programme includes a new production coating line, a metal particle mix preparation area, expanded clean rooms, new slitters and assembly and packaging equipment, as well as utilities expansion and new waste treatment facilities.

Address changes

• **Century Teleproductions** have announced that their post-production facility is now located at 2000 Universal Studios Plaza, Suite 100, Orlando, FL 32819-7606. Tel: (407) 297-1000.

In brief

• Bill Porter, assistant professor of music at the University of Colorado, Denver, is the first person inducted into the Audio Hall of Fame established by *Absolute Sound* magazine. Porter engineered over 300 records in the top 100 *Billboard* charts working with such artists as Elvis Presley, Roy Orbison and the Everly Brothers.

• British recording group The Outfield has received an Ampex Golden Reel Award for their album *Bangin'*. The $1,000 cheque was presented to the group's chosen charity, the Wishing Well Appeal at Great Ormond Street Children's Hospital, London.

Planned Canadian rehearsal complex

Elmer Fleegle Productions' Loge-Arts complex is planned to become a major rehearsal facility in Ontario, Canada.

Loge-Arts will provide several short term rental studios, some with PA and basic musical instrument packages. Also, a composer/songwriter's electro-acoustic production suite, a small auditorium for large rehearsals, 'live' talent showcases for promoters, auditions and many other uses. There will be equipment storage lockers and a coffee shop.

No commercial sound recording will be available but basic audio and video production will be offered via tie lines for corrective analysis purposes only. Promoters of the venture believe there is an unspoken necessity for a multifunctional facility of this type in Ontario, Canada's premier business market.

The facility will also take on outside work, including advertising photography and film and video production.

Personnel

• **EECO**, Santa Ana, CA, have named George Swetland as marketing manager. Swetland replaces Robert A Switzer who has been promoted to another EECO division. Swetland has been with EECO since 1958 and has held key engineering and marketing positions. He will be responsible for direct sales development and support of all national marketing of EECO/Convergence editing systems.

• **Sony Corp**, New York, has announced that Osamu Tamara will be vice-president of Sony Professional Audio Division. He will handle the strategic growth and direction of the division and will co-ordinate sales, marketing and product development activities. Tamara has been with Sony for 20 years and was previously general manager of Sony Broadcast's audio division in England.

• Leslie B Tyler has been appointed vice-president of research at **Carillon Technology**, San Bruno, CA. Tyler comes from subsidiary dbx where he was vice-president for engineering. He joined dbx in 1977 as a project engineer.

Installations

• **Mitsubishi Pro Audio** have announced recent sales of the following consoles in the USA: a 60-channel *SuperStar* with *Compumix PC* to Sigma Sound Studios, PA; a 52-channel *SuperStar* with Compumix Moving Fader system and a total of 16 dedicated group masters to West Oak recorders, CA; a 52-channel *SuperStar* to Triad Studios, WA; a 52-channel *SuperStar* to Bossa Nova Hotel recording studios, CA; a 36-channel *Westar* with Compumix PC automation to Servisound, New York City. Sales in Canada include: a customised 56-channel, three man *FilmStar* with *Compumix IV* and three *Westar* consoles to Film House, Toronto; a 44-channel *SuperStar* with moving fader automation and two customised *Westar* consoles with *Compumix PC* to Sounds Interchange, Toronto; a 32-channel *Westar* with Audio Faders to Evolution Studios, Toronto.

• A number of **Bruel & Kjaer** *Series 4000* microphones have been installed at Soundmirror, a Boston-based recording and production facility, which also uses Neumann and Schoeps mics.

• Criteria Recording Studios in Florida have recently acquired the following equipment: two **Drawmer** *DS201* gate systems, two **Yamaha** *PCM 42*s, an **Adams-Smith** *Zeta 3* synchroniser, an **Eventide** *Ultra-Harmonizer HD3000* and a pair of Yamaha *NS10M* monitors. Also installed is a pair of tri-amp **Genelec** *S-30s*. Digital equipment includes a **Sony** *3202*, Sony *PCM 2500* Pro R-DAT, Sony *1630* digital processor, ¾ inch U-matic Sony *DMR 4000* and a Sony *DTA 2000*. An **AMS** *AudioFile* digital workstation is also included in the installation.

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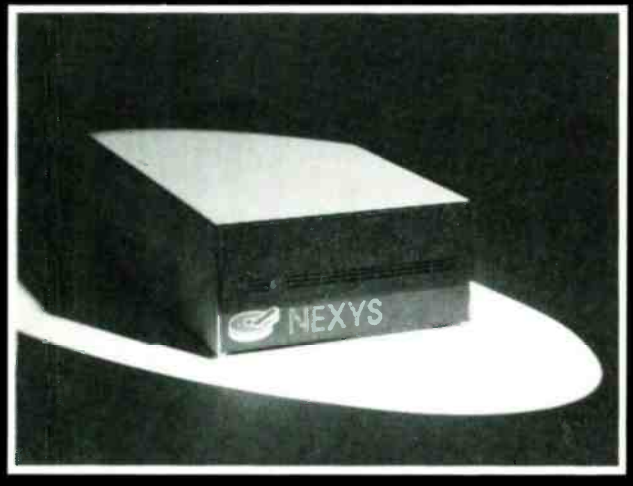

Put your sampler into overdrive with the Nexys SL-60

SCSI, the only interface fast enough for real-time digital audio, is now available for samplers with the introduction of the SL-60. The 64 Megabyte capacity means it can store at least 80 3.5 inch floppy disks. Instead of groping for floppies, simply load sound after sound in just a few seconds. Imagine loading an Emax sound bank in only 4 seconds!

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JARRE ON THE RIVER

Cranes, lasers and the Thames. Mike Lethby talks to the crew at Jean Michel Jarre's latest concerts in London

In the grey drizzle of an October morning the desolate expanse of east London's Royal Victoria Docks presented a bleak spectacle. A mile or so to the west, brash mirror-glass towers and apartment blocks marked the current frontier of the mammoth Docklands redevelopment. But this wind-buffeted demolition site—until recently part of the largest industrial wasteland in Western Europe—has yet to be graced by a Yuppie footstep.

A wilderness awaiting gentrification, it was chosen by Jean Michel Jarre as the perfect site for his latest hi-tech *son et lumière*—providing the appropriate historical and geographical backgrounds in one sprawling package, warts and all.

Two years in gestation, JMJ's *Revolutions* concerts celebrated what he sees as Britain's major social changes over the past 200 years. A team of some 2,500 people, spectacular lighting including £250,000-worth of fireworks designed by Daniel Azencot, around 40 miles of cabling and a uniquely complex sound system brought the dream to reality.

The sound alone called for a PA system to serve an audience spread over half a mile of dockside; an SSL mixing console; an array of 24-track tape machines; and an open-air stage floating on a raft of coal barges.

Originally scheduled for the summer, it was assembled in the context of lengthy political wranglings over safety and crowd control, between the promoters, the local council, the London Fire Brigade and—to much tabloid excitement—JMJ himself.

After last-minute cancellation of the original date Jean Michel called the capital's bluff with a helicopter tour of alternative sites, prompting Newham Council finally to sanction two hastily rescheduled events—brinkmanship that left everyone on a knife-edge up to the final hour.

There was a further complication: according to the participants we talked to, promoters RGE, chosen by the French team for their experience with large non-rock events, found the peculiar logistics and finances unexpectedly daunting, leading to considerable frustration and confusion.

All these things meant that the pre-show site had more of the flavour of digging-in after a 4-minute warning than a run-up to a major event. They also brought into sharp relief the scale of the sound production task: mixing technical realities with political headaches.

On the eve of the first show we spoke to the key people who made JMJ's sound happen. They were Eric Alvergnat (Jarre's production director), Richard Lienard (Sound Hire), David Solari (Autograph Sales), Chris Barron (SSL), Denis Vanzetto (JMJ's FOH soundman and engineer-in-residence), Andy Hilton (Hilton Sound) and Michel Geiss (keyboards consultant to JMJ).

Sound production: the concept

This was the first time that Jarre had done more than one show in one location. But it wasn't planned that way; it was simply the result of, as Eric Alvergnat diplomatically put it, "What's happened in the last three weeks, and security reasons. Usually he only does one."

Lienard: "He's not a live act; he's only done four live performances before this in his life.

"Production is from France, all top guys. The engineers are involved in other things in France but they're all very good to work with: Eric Alvergnat has overall control of the sound production; our responsibilities stop at the desk.

"On the south side there's Spillers' mill, a stack of containers and another mill, plus a scaffolding tower which they've built to provide visual balance. That's the backdrop, facing across the water. The fireworks are let off behind the buildings.

"The grandstands are lined up 30 metres back from a series of raised dockside platforms—old warehouse bases which will provide standing audience areas. The space in between is left clear for crowd and emergency service access.

"We've got seven speaker stations along the dockside facing the grandstands. The speakers are placed on the cranes, to mask the PA in silhouette. We had to pull them down their tracks because their motors are dead.

"One snag was that Docklands Airport had the cranes programmed into their flight control computer to be ignored, so they had to re-program for us. It's horrendously complicated."

Whose idea was it to put the PA on the cranes?

Alvergnat: "At first I thought of putting it on more barges either side of the stage but that would have been crazy. When I saw the cranes I thought of flying the PA from the tops of the

Photos: Mike Lethby

One of the crane-mounted PA clusters

cranes and moving them upwards during the show.

"Eventually I spoke to the engineers who built the cranes about 40 years ago, and I discovered that there was no power in the cranes, so we decided to move them along and build scaffoldings to hold the PA."

It looked quite effective but...

"I'm not happy about the scaffolding, it could have been smaller because the speakers are so small."

What did Richard Lienard know about the previous shows?

"I saw a video of the Houston show so I had some idea of the scale but we got a very rough spec to say the least—'It's at Docklands, this is the area and this is the stage'. We made a pretty good guesstimate so when we got more details it didn't change much.

"The only lesson I got was that there are no lessons—all the shows have been mayhem! They don't expect it to be easy; it's such a massive thing. The communications side alone is frightening; the number of comms channels is unbelievable. Plus all the lasers on top of buildings, et cetera.

"When the first date was cancelled, I couldn't see how anyone else could mount something on this scale in two weeks. The way the wheels turn, you expect six months of negotiation with a council and, however well intentioned they are, the bureaucracy would have ground to a halt.

"They could have picked an arena like Milton Keynes or Wembley, but the visual aspect is very important. Houston was the 'hi-tech' visual; so Docklands is the down to earth version!"

What are the problems of producing sound on this scale?

"Grounding, because of the distances; moisture; waterproofing joins in long cable runs; constantly checking that everything's watertight.

"The biggest problem is the wind; it's a big, open space and the wind blows across the site from the west continuously.

"Access to the site is a problem too, because there's only one entrance. We've got six crew on site. One guy is on PA duty, hopefully with a bicycle because he's got a long way to go(!).

"It still amazes me that with all these outdoor shows no-one's come up with anything better than scaffolding covered in tarpaulins. There must be a market for a decent mixer tower with a proper roof—please start building it tomorrow!"

Has the budgeting been tough?

"It's been pretty tight. Where they can hold it they do but lots of things have been left open-ended: someone says 'we need another grandstand'—another unexpected item on the budget, and that's been their major problem."

Why did Eric Alvergnat choose a Meyer system?

"Basically, because we wanted to use an England-based sound company.

"I made a list of requirements and we asked a few companies for their ideas. The Autograph/Sound Hire project was the most serious, with the best research and, to my mind, the best equipment, best crew and best price."

Lienard: "Although they used Clair Brothers before, they were quite keen to use Meyer; and Jean Michel is into involving the local population. Obviously they couldn't always do that; if they went to somewhere like Rio it would be impossible."

In the event, a combination of cliff-edge timing, the need to cover everything on stage whenever the clouds opened and relentless wind and rain made full production rehearsals impossible.

Alvergnat: "We had a stage soundcheck, and the speaker towers were calibrated and equalised separately. We had a full line check in the machine room and with the SSL desk but we only had 15 minutes to hear everything working. We hoped for more but it was after 10 o'clock which meant a problem for the people living around. And the lights weren't allowed after 10 o'clock because of the airport.

"The biggest job has been done by Sound Hire and Autograph Sales. Sound Hire supplied all the wiring, monitor equipment and PA, and the speaker system was designed by Dave Solari to meet our ideas.

"The result of these two companies together was very good. Considering the weather conditions, the lack of time and the organisational structure they've worked miracles. Miracles go only to the people who ask for them—you could discredit this duplication of people, but they've done a great job."

Afterwards was Alvergnat happy with the way it worked out on the first night?

"Yes, everything was good; no rehearsal but the whole system was together and sounding good.

"The pressure and coverage are very good. The only thing I was worried about was the action of the wind which made it sound almost as though we had a stereo or quad system because of the phasing. But a nice ambience. A good result out of uncertainty."

The widest PA system?

Because the show's aesthetics were so important, the production team placed the PA stacks on seven massive dockside cranes to create a natural skyline.

The system consisted of 116 Meyer *MSL-3*s and 62 sub-bass across the seven speaker positions, one slightly bigger than the others to cater for a huge grandstand at one end.

Distributed over 1,000 metres (⅝ mile), it was the antithesis of a 'point source' system—any listener would only hear the equivalent of two stacks, each stack receiving its own mono mix feed from the SSL. (The engineers hoped to 'bounce' effects along the stacks but lack of time ruled out the idea.)

Lienard: "Inevitably there'll be delay problems for people seated midway between stacks—we can't use delay lines because they'd only make matters worse. But the stacks are about 110 metres apart; if you're in front of one the next one will just sound like a natural echo."

How much power per stack?

Alvergnat: "Roughly 30 kW per stack including subs. But with the Meyer system it's not easy to speak in kilowatts."

Solari: "From our experience with these clusters, about 115 dB continuous at 120 metres is possible, peaking 10 dB above that.

"We expect a fair bit of spillage outside the site but that's not a bad thing because the community here has been expecting it, so it's good that they'll hear sound as well as seeing the lights. We expect the sound to be fairly coherent up to 2 miles to the north; there's nothing much in the way.

"With the Meyer processors we send a flat full-range signal to the towers; each tower is EQ'ed locally for consistency with a Meyer *CP-10* equaliser.

"Grounding has been the toughest technical aspect to deal with, particularly on stage.

"The longest drive from the desk to the furthest PA cluster is about 800 metres. And there's four sets of gennies for power in all, one at each end of the dockside for the towers, one on stage and one for the mixer.

"The natural options are the dry ground below the concrete or the slightly salty dock water, neither of which we were totally happy with.

"The whole grounding strategy had to be planned thoroughly: it would have been a nightmare to track down stray hums on the day, with the complexity of the signal lines. So we've gone for almost totally electronic buffering—the stage is floating in the electronic as well as the maritime sense!

"Richard Lienard's BSS signal distribution system was a key factor. And Jim Cousens, who works with us, was very important in putting the grounding plan together. We haven't had to revise anything; we put it together and it worked straight away."

Lienard: "We're using the BSS system as line drivers—we've got 350 metres of multicore and up to 800 metres of signal lines to the stacks. It makes every job we do very easy; it's extremely versatile. We have two 48-way systems, each one with a possible 36-way monitor split and a 48-way FOH split. All the work's done there; you just plug the multis in and go.

Photo: Mike Lethby

◁ "Everything coming from the stage is ground-lifted to the shore, and everything from the shore is ground-lifted to us. When the system's cranked up you can go to any of the towers and you won't hear any hum.

"All the broadcast feeds come off the FOH auxiliaries; they just get a mix.

"As to FOH effects, apart from the SSL's gates and compressors, all we have are a Lexicon *480L* and *PCM-70*, and a delay. Being keyboard-orientated, most of the effects come from the keyboard stations."

Solari: "The amplifiers were sourced from seven companies, but the strict Meyer-approved specifications meant we had no problems matching them up.

"The whole system was tested piece by piece, getting one bit right before moving on to the next."

What about synchronisation between sound and visual effects?

Lienard: "It's mostly done in realtime, so it's down to the comms system: fireworks are difficult to sync in because they take time to go up and explode, and lasers have to be flashed on and off."

The SSL: stranger in a strange land?

In many ways the major surprise of the line-up was the appearance of an SSL *G* series console as the nerve centre of the sound systems.

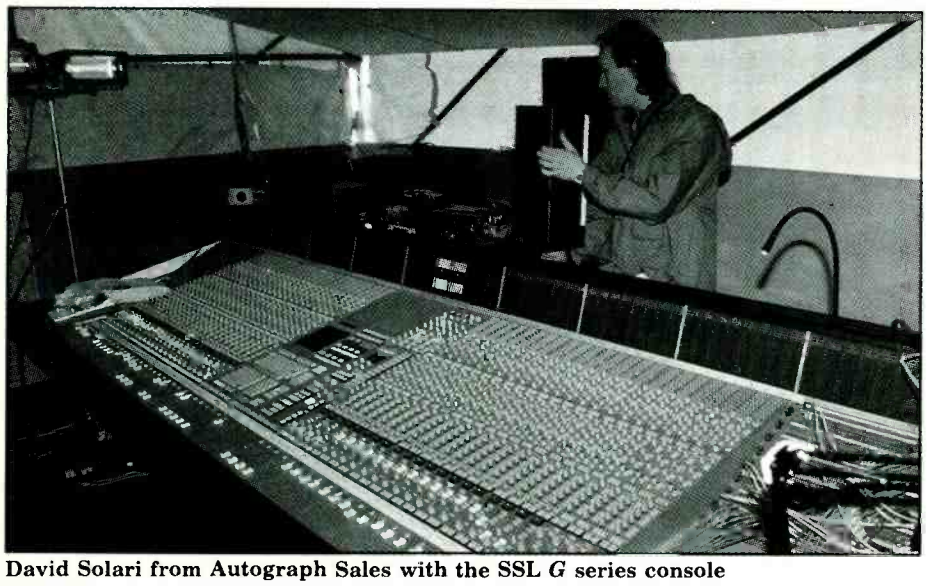


Photo: Mike Lethby

David Solari from Autograph Sales with the SSL *G* series console

SSL loaned their UK demonstration desk for the event, kitted out with most of the options such as the Events system, programmable EQ and stereo modules. It was thoughtfully mounted on wheels to simplify the task of getting it in and out, and fitted with DL connectors so that with a little pre-planning it was fairly simple to set up.

The desk was installed and watched over by SSL's Chris Barron—who refuted the idea that his prima donna might need 'kid glove' treatment.

Barron: "Obviously, being a studio console it's not ideal to have it stuck out in the blowing rain; hence our endeavours to make the mix tower as watertight as possible. But otherwise it performs a whole host of functions that most PA consoles don't—like the automation, which is particularly useful in this situation. It's ideal really, with a lot of pre-production already done in Paris, it's easy to come in, plug in a disk and off we go."

Alvergnat: "Jean Michel wanted a desk with full automation, and one of the engineers suggested SSL. It's probably the best desk available in the world, plus everybody on the team knows it, so we decided to have one."

Vanzetto: "We're mixing sources from live stage, tape tracks and sequenced sounds on stage. So the idea is to use the automation of the SSL to set the cuts and approximate balance. We pre-programme all the cuts, for example choirs and brass, which are silent for long periods.

"We're also recording everything on stage, using the subgroups. That's a mono mix but we can adjust the recall of each part separately.

"It's the first time we've used an SSL live but I'm very happy with it because I know it from the studio."

Alvergnat: "The only problem was that the mix tower structure wasn't ready on time. Mind you, most of the professional people were surprised to see such an expensive desk in an area where it's not supposed to be."

Barron: "Almost everything is automated, and slaved to timecode. We have a video reference from the TV people, from which a Timeline *Lynx* generates the timecode. That's fed to all the *A820*s, the SSL and everyone else for post-production. Any mix information in the SSL is slaved to that timecode signal.

"We have all the dynamics facilities we want on the SSL, so we have very few other effects. A lot of it's pre-mixed on stage and compressed out there."

Was *Total Recall* an important factor?

Alvergnat: "In theory it was. We should have had five days' rehearsal but it didn't happen so we couldn't use all the SSL's facilities as planned. The sound crew and equipment were ready as per the schedule I set out three months ago, starting from show minus nine days. Instead of that we had show minus one to check and that's it. Crazy. All the supplies and sound crew were ready on time; they had to wait for a week for the structure to welcome them."

The Studer factor

Eight Studer *A820*s were loaned by FWO Bauch (UK Studer agent) for the occasion. Some carried pre-recorded soundtracks and SMPTE cue tracks; others were used to record ambient sounds for post-production; the rest provided back-up duplication.

Key elements of the show were pre-recorded on to 22 tracks of multitrack in Paris by the French team, further touches being added in rehearsals at a Dockland's warehouse.

Eric Alvergnat explains the rationale behind the tape machines: "The most important thing as far as we're concerned is the result that people hear; so if for some reason I can't use microphone sources correctly I'll use the tape. I hate to do so but if the mix needs more choir or whatever, I will.

"For the choir, vocals, violin and so forth we have 100 heavy duty microphones ready but because of the weather problems some chorus parts have been taped.

"We specified 24-track Studer machines because Jean Michel has Studers in his own studio."

Vanzetto: "I'll mix the live and tape sound, for example, with the choir when fireworks are going off, because the stage mics pick up the explosions."

Alvergnat: "And we had help from Andy Hilton. From the beginning I told him 'you'll have to have your phone on 24 hours a day' and he's been very useful because on such a system you expect problems in linking everything—he had it all immediately to finish the linking."

Hilton: "As the week's progressed we've provided a sort of 'flying delivery service' to supply all the bits and pieces to connect their bits and pieces. The most important part is a couple of *Lynx* timecode modules—one to link everything and one as a backup.

"They mislaid, or had stolen, one of the Meyer PA equalisers. So we sent Autograph's office keys back to our office; then, by cellular phone, talked our chap into Autograph, turned off their alarm, got a replacement unit, met with a bike courier who had a sneaky way of getting in, and got it in time for the show!

"We've got over 50% of our cable stock down here so it's been a bit of strain on the other jobs we're doing; we've been going from hand-to-mouth to keep it all running."

Which is probably true of most of the people involved.

"I think so; they've apparently stripped most of the staging companies."

Was it a difficult show to plan for?

"Well, our biggest problem was the same as for everyone else here: there was a plan—and then it changed."

On stage, on the waves

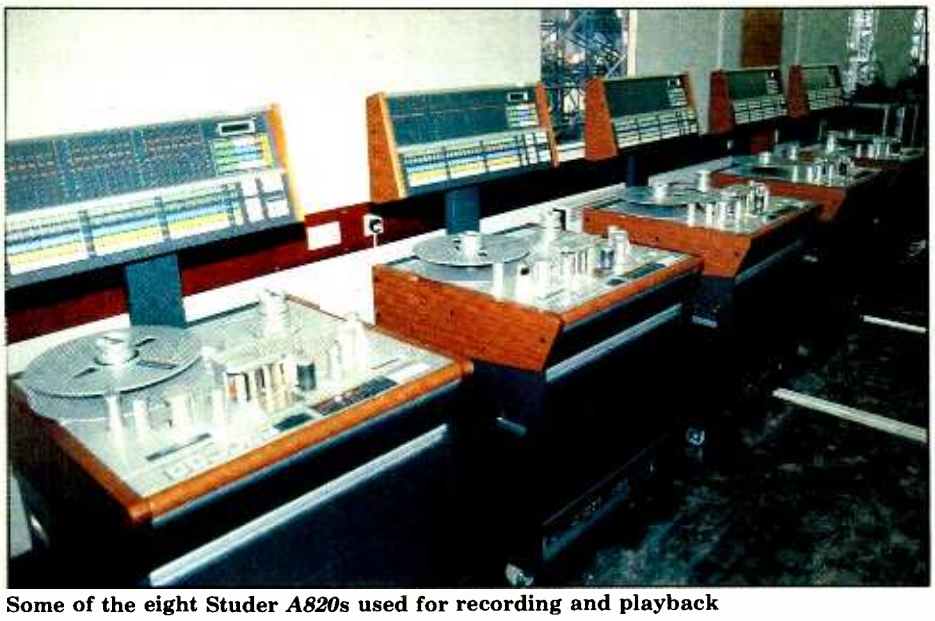
At 40×20 metres and 700 tonnes, it is said to be the world's largest stage. Twelve Humber barges were welded together and topped by a massive truss assembly supporting a multi-level stage platform and some 70 tonnes of generators.

In truth, nothing ever looked less like a rock stage than this low water-borne wedge, encrusted with billowing rain covers, World War II searchlights and an army of half-frozen technicians battling the elements like deckhands from *The Cruel Sea*.

It was designed to be winched back and forth across the dock to give everyone a good look, with an unbroken multicore run to the dockside via a floating mid-dock 'pivot point'—guarded by a trusty waterboatman to prevent crew apoplexy over inadvertent sub-aqua shortouts.

Lienard: "There were major problems getting the barges in; the lifting bridges don't work anymore so they had to throw in lorry-loads of stone ballast to weight them down in the water.

"Another reason for the ballast was loading the ▷



Some of the eight Studer *A820s* used for recording and playback

◁ generators—they had a team to shovel it up the back of the barges to stop the front sinking, and shovel it forwards again when the gennies were moved to the back!"

The whole stage—at Jarre's insistence for visual considerations—had no roof. With the new Autumn dates, the sound team quickly became waterproofing experts. Different waterproofing materials were tested with intriguing results.

Under FFT analysis the 'Featherlite' microphone cover (allegedly a BBC invention) showed a painful HF characteristic. Eventually, humble clingfilm came to the rescue with a gentle −3 dB roll-off at 12 kHz.

Lienard: "The stage is a potential problem if it rains on the day, but it's been fine for them on previous shows. We can cover the PA stacks but the stage might be more difficult."

Salari: "We've had a 4-man crew to waterproof everything to withstand up to 60 mph winds and we've EQ'ed it all with the covers on.

"Safety isn't a problem on stage because everything's grounded properly."

Stage monitoring

Lienard: "For monitors we've got a Yamaha 40-channel *PM3000* with a 32-channel *PM3000* submixer feeding it, plus a 32/8/2 Midas mixdown desk for the choir and orchestra. There are two monitor engineers up there."

Solari: "There's a total of about 500 metres between the stage and the SSL. The first problem was that we had to get 250 metres of it across the water and it had to be able to move with the stage. A 100 metre run goes out to a central pontoon: as long as the stage doesn't drift too far to the east we'll be OK."

Lienard: "The hardware—16 Martin *LE-400* passive wedges at the back; all the other wedges are Meyer *UM-1*s; a Klark-Teknik *DN780* reverb on stage plus compressors on the keyboards.

"It's big but surprisingly sensible. Most of it's DI'ed but there's a little bit of backline for guitar and bass.

"There's clicktrack all over the place and because they're recording the gig we can't have click in the wedges. So all the clicks are done on open-backed headphones. The recording poses a lot of physical problems of its own; there's miles of cables and ambience mics all over the place which go straight into the SSL and out to tape.

"Each of the four keyboard setup goes to its own submixer, with feeds to the stage monitor desk and the SSL. The keyboard monitors are fed with the output of the local submixer and a special feed from the monitor desk, so each musician gets a blend of his own mix and the rest of the band."

The 'rest of the band' was no modest affair either. The scheduled line-up included bass guitar, 'guest' lead guitar (Hank Marvin, a Jarre hero), a drum kit comprising standard and electronic drums, some 12 channels of percussion, MIDI percussion (three people), 20 strings, eight double basses, a cello, a 20-piece choir, an African choir, 20 bagpipes, a horn section and a singer or two. At the last count.

Keyboard curiousities

The array of keyboards employed by JMJ and cohorts on stage runs from the prosaic to the purely theatrical—and it's no less fascinating for all that.

Alvergnat: "Jean Michel has a special team—they're crazy, musical people—who helped to build his instruments. Everything is working, including the laser harp which is very dangerous stuff because you can light a cigarette on each of the lasers.

"When he interrupts one of the rays it triggers a sampled sound; it's very simple and of course it's a very attractive effect. The laser harp itself is under the stage.

"Have you seen the robots and the crystal organ? It's really crazy.

"Michel Geiss is a consultant to Jean Michel; he's a musician and an 'electronician', he looks after all that sort of stuff. There's a team of very talented technicians."

Geiss: "This is what we call the Lum, a visual MIDI instrument in which the position of the hands is detected by photocells with light above the instrument. It's controlling a *DX-7*. The designers, LAG, are based in Toulouse. They who also design sophisticated electric guitars.

"And this keyboard (Elka *AMK-800*) is a MIDI keyboard which English people don't know but it's standard in France and Italy; it has special keys, an exact replica of accordion with the Italian button system and the same facilities as the normal Elka keyboard.

"Also, we have all the musical scores displayed on monitors made with *Personal Composer* on the IBM *PC*. Each musician has his own score.

"And we have four Fairlight *CVI*s on stage to make abstract video effects in realtime."

Vanzetto: "The other special instrument is called Structure Baschet. You put moisture on your fingers and run them up and down these Perspex rods; it creates a unique acoustic sound."

Conclusion

Shortly before Mrs Thatcher's government eradicated the Greater London Council, supporters struck back with posters carrying the words 'Imagine what London will be like run by Whitehall'. The posters were wrapped in yards of red tape.

To everyone involved in the production of the *Destination Docklands* concerts, this may strike a poignant chord.

One: they were the first shows where for most suppliers prestige proved less desirable than a lifebelt and a watertight contract.

Two: in Britain at least, a growing awareness of public safety requirements means that nothing can be taken for granted—whatever the depth of experience on hand.

It must be said that the audiences (totalling around 170,000 over two shows at up to £30 a head) greeted the unique spectaculars with enthusiasm. Yet it was almost a miracle that the concerts came off at all—thanks to the dedication of JMJ's team and the on-site production companies.

The only time the complex sound system didn't function perfectly was when moisture damaged a few monitor cones or caused ground lines to break down on stage. (A source of last-minute panics on Sunday as the team searched for spare 'clean' lines.)

The need to re-cover the stage whenever the clouds opened and the relentless wind, rain and or dust wasted precious time and made full production rehearsals impossible.

To make matters worse, the promoters were reluctant to spend extra money on such essentials as waterproofing; suppliers found promises of prompt payment not met, and understandably declined to part with their wares in the interim. Clearly, a no-win situation. Similarly, the mixing tower was still being built on the first gig day—no fault of the rigging companies who all had many unexpected tasks thrust on them at the last minute.

Before the Sunday gig, amidst a bustle of security checks for the Princess of Wales' visit, with a sharp wind blowing gloomy clouds from the west, and TV crews and photographers swarming by the hundred, we asked Eric Alvergnat for his final thoughts.

"I'd like to congratulate all the sound people involved. We had full sponsoring from SSL and FWO Bauch with very good technicians to operate their equipment."

Among the production team, there may have been a slight feeling of disappointment that after so much effort, commitment and media attention the final event wasn't quite as spectacular as it might have been.

But in the final analysis, a bunch of specialists proved that even under the most difficult circumstances a truly professional result could be conjured up out of almost nothing—and that's saying something.□

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PACE RECORDING

David Hastilow visits this studio based in Milton Keynes

Not so very long ago Milton Keynes was a tiny one-dog village in the middle of nowhere. Then it was 'found' when the powers that be drew a straight line between London and Edinburgh and proceeded to build a 6-lane motorway along it.

In spite of all that traffic less than a mile away the pastoral tranquility has somehow been preserved although the dog now shares his abode with 160,000 people.

Milton Keynes is a completely new concept in urbanisation, consisting of local centres, each with its own amenities, connected by a grid of roadways. Where else would you find a street called V10 or H8, for instance. Between the local centres there is lots of grass as well as lakes for sailing, windsurfing and other water sports, fringed with weeping willows, restaurants and inns. There are canals, where one may drift off into the English countryside in a painted narrow boat, an ultra-modern shopping centre and PACE recording studios.

There's a saying that old drummers never die, they just smell that way but after beating his skins all over the world with Steeleye Span, drummer Nigel Pegrum was neither ready to hang up his sticks nor wave goodbye to the music business.

"Constitutions wouldn't take the constant touring; we went to the States, eight, maybe 10 times and went around the world literally three times via Australia and New Zealand. The words 'home-life' ceased to mean anything but, eventually, the band decided on a two-year break."

Three months after that decision Nigel was already itching to get involoved again. With old chum Geoff Ide from a former band called Halcyon, he set-up a small folk label called Plant Life in 1978.

"Well, you did in those days; all that love and peace, brown rice and goat's milk. The label came about really because of an involvement we had with a band called the Tanninghill Weavers. They were a load of mad Scotsmen making a name for themselves in the UK, who had already toured the States. They didn't have a contract so we took them on and the first thing we did was go to Stonesfield and record them using the prototype SSL desk at Acorn Studios. Yes, I now have the dubious honour of having engineered on the first SSL desk. Noise gates and limiters on every channel. I thought, 'What on earth is this? Amazing!'

"Unfortunately, Colin Sanders of SSL realised that his consoles were destined to become what they are today and eventually his Acorn Studios became part of the manufacturing operation. So, it was back to hiss, hiring 16-track studios for £10-£12/hour. Most of the time the results were disappointing, especially for acoustic music.

"I suppose it was the beginning of the big swing into doing everything with drum-machines and synthesisers and you began to realise that engineers had ceased to learn the proper use of microphones. It meant that in the sort of studios I could afford, the engineers weren't doing what I wanted them to, ie record acoustic instruments and make them sound like Paul Simon's guitar. The results were either highly over-processed or dull as ditch water. Which led me to thinking 'I could do better than that'."

To prove his point Nigel purchased some equipment and installed it in a suite of offices in Hitchin, Hertfordshire.

"The tape machine was a 9th-hand Brenell *Mini-8* hooked into an M&M desk. Fortunately, a chum from the BBC was able to recondition the desk, which was wonderfully thought out as far as the routing was concerned but the components were cheap. He tweaked it all up and we made 10 or 12 albums on that little set-up that sold well in the folk charts—8 to 10,000 each. It was enough to keep two blokes going and buy the odd item of new equipment, such as a Bel flanger and a highly revered Electro-Voice *RE20* mic."

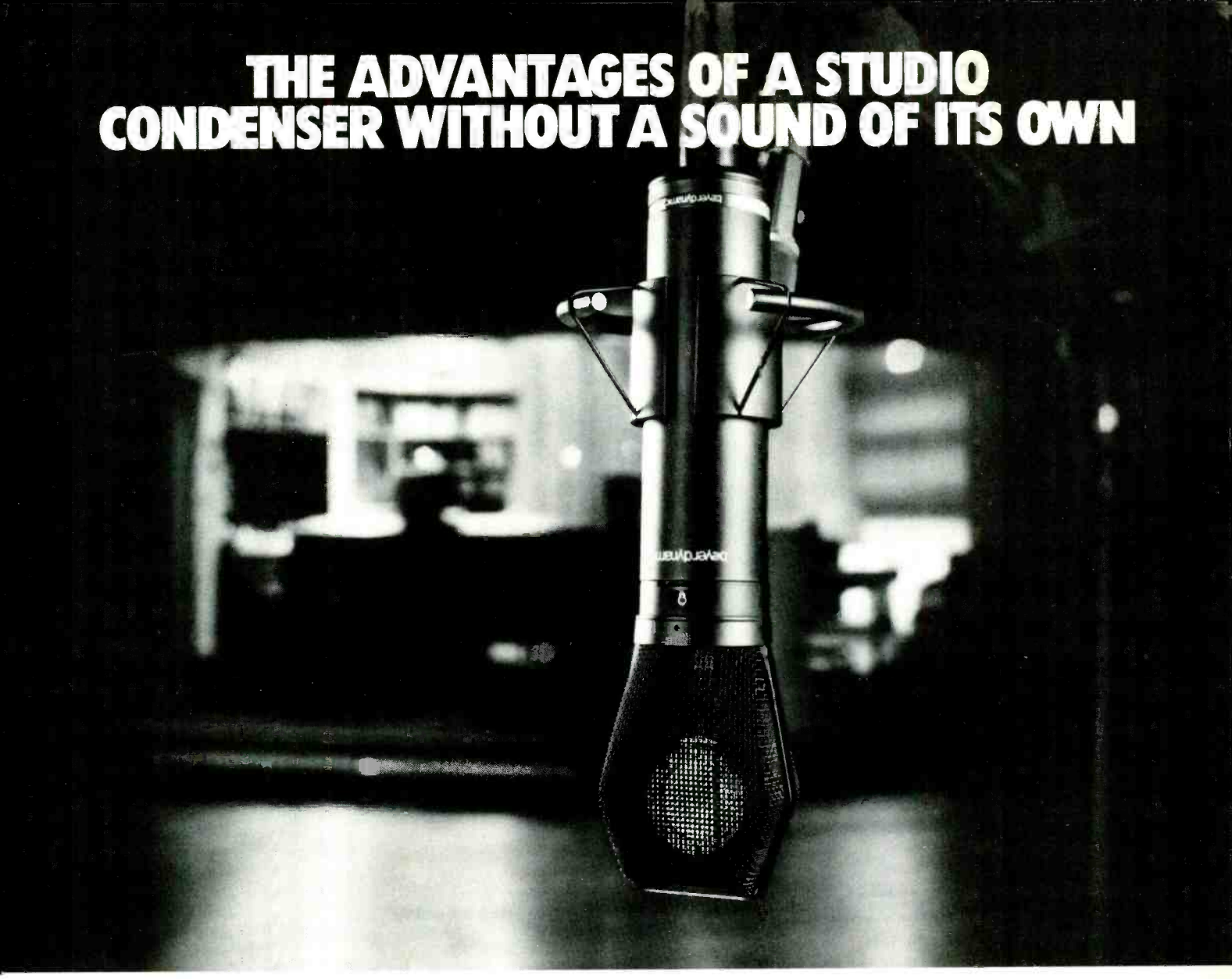
By this time, in nearby Milton Keynes, the tiny village had undergone its first phase of conversion and already woke up every morning to the sound of its own radio station, CRMK (Community Radio Milton Keynes).

"We got this contract to do 15 to 20 new ads per week for the station, from a local advertising agency. It turned out to be a baptism of fire into the real world of 'Get it done now. You've got half an hour'-type recording. It dawned on us eventually though that the commercial sector offered a better living than trying to promote unknown artists, and immediately we began to look around for new premises in which we could install a studio to be just that."

At that time a company called Pace Electronics had begun to manufacture a range of recording equipment and, through a merger in 1981, the resulting studio was intended as a showcase for their products. ▷

Nigel Pegrum and Vince Cross in the PACE control room

THE ADVANTAGES OF A STUDIO CONDENSER WITHOUT A SOUND OF ITS OWN



For all of its virtues, the typical studio condenser imparts a definite character to any recording. These impositions are often considered inevitable technical imperfections: accepted, ignored or tolerated by audio engineers.

Characteristic anomalies of condenser performance such as exaggerated high end response or distortion have even been rationalized as compensation for the high frequency losses inherent in typical analog formats. Nowadays, however, they are increasingly viewed as unnecessary intrusions in critical analog and digital recording situations.

A Condenser For The Digital Era: The Difference is Nothing. *The increased dynamic range of digital recording is perfectly complemented by the self-effacing nature of the MC 740. The microphone is virtually inaudible. No coloration, no self-noise — no sonic footprint, not even a fingerprint. All five of its pickup patterns are equally uniform, identically transparent. We feel your prior experience with large diaphragm condensers will confirm this as a unique achievement.*

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Accuracy And Versatility Without Compromise. *Uniform (<2 dB: from actual machine specs, not just published specs) frequency response curves for all five polar patterns may seem a remarkable breakthrough. To Beyer, this is simply a design criterion for the microphone. Similarly, there is no contradiction in the fact that the 740 is exceptionally sensitive, yet also withstands extreme SPLs (up to 144 dB with the 10 dB attenuator in circuit).*

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◁ "It included a mixing console with, of all things, computer routing—at that time totally unheard of. And all for four and ninepence (approx 24p). Regrettably though, it was a complete and utter failure and didn't work, to the detriment of our first recording session with some Germans who'd come over to the UK specially."

Pace Electronics folded but the studio retained the name and its present location in Neath Hill local centre, Milton Keynes.

"All that equipment went too, virtually straight after the Germans left. I then zoomed over to Soundcraft saying 'I need a desk, NOW!!'. They didn't know me from Adam but an hour later I walked out of there with a series *4000* console, for which I am eternally grateful. We still had the Brenell *Mini 8*!"

The studio workload increased considerably, due in no small way to the energy and keyboard's skills provided by Andy Richards then teaching piano and often travelling to the studio from his home town of Stoke-on-Trent.

"He was immensely talented, having incredible command over the synthesiser medium. He went on to work with Trevor Horn for vastly higher sums than we could afford to pay on the Frankie Goes to Hollywood *Relax* single."

Then Vince Cross, who'd been writing music for and a touring with a contemporary dance troupe, approached Nigel with an album project. This called on the talents of blues singer Melanie Harold and guitarist John O'Connor, latterly of *Star Trekkin* fame. Vince picks up the story.

"It was a compilation of all those songs, which the beatniks of the '50s and '60s regarded as sacred ground—'thou shalt not treat these songs in any other way' type of thing. Nevertheless we gave them a slightly daft treatment. It reached No 2 in the folk charts and *Melody Maker* devoted half of their folk page to saying how dreadful it was. This of course, guaranteed its success.

"These buildings were intended, by the Milton Keynes forward planning committee, to be 'artisans' workshops. All the rest are either building societies or travel agents, apart from one neighbour. But I'm loathe to describe us as being next door to the guy that makes false teeth!"

"It was the idea that one could 'paint' with sound using multitrack recording that I got addicted to."

The compilation album project also led Nigel and Vince into a closer working relationship, wherein Vince composes and scores the music while Nigel takes it that step further using the technology. Following recent refurbishment this now comprises an Otari *MTR-90*, Soundtracs *IL2824* console with *Tracmix* automation. Yamaha *NS10* nearfield monitoring, Tannoys, a variety of keyboards and samplers, sequencers, and racks of effects. These include Yamaha *SPX90* and *REV7*, and units from Lexicon, Rebis, Drawmer, MXR and Bel. There is also Dolby *A* for mixdown. Richard Robinson is the technician and engineer. Both are pleased with the latest refurbishment.

Pegrum: "When it came to re-equipping I had to balance machine against desk. I could've purchased, second-hand, any one of a whole range of boards, the name of which alone would've brought work into the studio. But I saw the Soundtracs and knew it was a console I could spend 90% of my working life with. And packaged together with the Otari *MTR-90* multitrack I think is a good combination for our niche in the marketplace."

With windows in both the control room and studio looking directly over the local centre square there is, indeed the atmosphere of a thriving community. People passing by are able to peer into the control room across the reels of the stereo mastering machine or the cymbals of Nigel's drum kit.

"That triple-glazed window gives a great ambience for drum overheads. And although this studio area isn't really big enough for a whole 'live' band the acoustic isolation achieved by building a complete inner shell could probably handle the noise level.

"I had only a smattering of knowledge regarding studio construction so I read a book on sound studios and tried to attain the theoretical ideal. These buildings were intended, by the Milton Keynes forward thinking planning committee, to be 'artisans' workshops. I think now we're the nearest thing to that ideal too. All the rest are either building societies or travel agents, apart from one neighbour. But I'm loathe to describe us as being next door to the guy that makes false teeth!

"Isolation from upstairs wasn't as critical as stopping noise reaching the outside world. We needed to keep our neighbours happy. But our property allocation included the first floor offices and other ground floor rooms for tape duplicating, which is a good bread-and-butter earner. Most of our work in that direction is for computer program duping. In fact, I think we were the first ever to do that, for ICL. They came to us with a computer program on tape and asked us to make six copies. We did and they took the dupes away for testing. They returned and asked for 60, a week after that 600 and a week after 6,000. It's been increasing ever since. We must have been in right at the very beginning of the computer games boom.

"We also do work for the nearby Open University, Oxford University Press and recently, all the voice recordings for the British Telecom *Healthcall* service. The actress who came in to read couldn't believe it when she found herself having to talk in great detail about sexual problems, among other things.

"One project which really did help us immensly in developing our engineering and production skills was for Rediffusion. They have a large requirment for background 'muzak' which actually consists of cover versions of popular hit records re-recorded as closely to the original sounds as possible. We were given whole lists of titles to be completed in 10 days. Try recreating *Thriller* or the Rolling Stones' *Undercover*, which sounds like 950 stoned people hitting a lot of things, using, in those days, a Tascam 16-track. *Thriller* was a joke. They probably used 25 *DX7*s MIDI'd together on the original recording. We used a comb and paper! We didn't sleep a lot but, my goodness, those 10 days a month were fun days."

The duo have also always had connections with gospel music too, and Nigel's Plant Life partner Geoff had diversified into video production.

"That has also provided us with a throughput of music for soundtracks for TV commercials. We've probably done well over 200 TV ads since we've been in these premises, including some for the national networks."

Although their facilities include a Yamaha *QX5* they admit to rarely resorting to sequencer-based music composition.

"Mainly because they tend to make everything you do sound like everyone else, we always avoid using it wherever possible. If you have an idea, it's impossible to realise it, using a sequencer, for about an hour; there's no immediacy of creativity. We prefer to work the old way. The criterion has always got to be, the time something takes and the quality you're going to get out. If you're prejudicing quality by not sequencing then obviously, you should sequence, but if you're continually laying down brass or other orchestrations, you might as well get good enough at just playing the parts in at the time, and they'll sound more realistic too. We use real instruments wherever possible, be it a string quartet or violinist. After all, we are protecting 'live' music. A 'Mantovani' feel is then easily achieved by putting a block of string synths behind the live takes."

To further enhance 'naturalness' in their sounds PACE have recently purchased a *PCM 70*. But, like just about everyone else from home studios upwards, eagerly await DAT mastering.

"We're particularly interested in the fact that it's uncomplicated. Most of our work goes out to broadcast companies, both radio and TV, and all they're interested in is 15 in/s, CCIR, no Dolby. Other digital mastering systems seemed a little too complicated, although they offered greater editing and drop-in capabilities, but on our budget they're really out of the question. So, for many reasons, DAT looks ideal.

"As with all our other purchases in a long equipment evolution, it will be interesting to see if we can maintain our financial solvency whilst moving up again. With the Soundtracs/Otari combination it was marvellous to hear the sounds coming back off tape and through the board, sounding exactly the same as they'd been recorded. With DAT added to that who knows where the combination will take us?"□

PACE Recording Studios, 15 Tower Crescent, Neath Hill, Milton Keynes, UK. Tel: 0908 663848.

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DIGITAL INFORMATION EXCHANGE

The DIE was held for the fourth time in London at the end of last year. David Mellor reports on the changing face of the audio industry

It seems the more information you have about digital technology and applications, the more you need. Perhaps one of the most important abilities of the aware sound engineer is the differentiation between knowledge useful in the workplace and that which is the province of design and production engineers. At the DIE both kinds of knowledge are on offer. Take what you need and file the rest for possible future reference.

Day 1 was devoted to broadcast applications. Like it or not, the previously insular sound and video, studio and broadcast fields are rapidly coming together onto a multi-media common ground and for studio personnel Day 1 offered a fascinating insight into these related fields.

Following a welcome by Ian Jones from HHB* and a brief introduction from chairman Nick Hopewell-Smith, the first presentation was from Neil Gilchrist of BBC Research on Digital Stereo for Television.

Transmitting digital stereo into the home is not a straightforward matter: 16-bit stereo, as we know and love it in the CD format, is ruled out because it cannot be fitted into the existing bandwidth available for each TV channel Gilchrist first outlined the possible alternatives, such as the pilot tone system as used in stereo FM radio, which would be susceptible to noise and distortion. Also the Sound in Syncs system, which is already used for programme distribution but which cannot be made compatible with all existing TV receivers.

NICAM 728 is a development of the BBC's *NICAM 3* system, which uses near instantaneous digital companding to provide a rugged signal, decodable in a *NICAM* receiver, yet able to co-exist with the FM mono signal as transmitted currently, and can fit into the television bandwidth. Gilchrist explained how a carrier may have its phase shifted to any of four states to convey blocks of bits, representing the sound signal.

TV viewers in the London area, if they have a *NICAM*-ready TV or video, can already benefit from unannounced test transmissions in digital stereo. A VHS cassette with *NICAM* sound played as part of the presentation demonstrated that the system is an order of magnitude better than a conventional VHS audio track and likely also to be superior to so-called 'hi-fi' VCRs.

Mike Bennett of Sony Broadcast, UK, explained how well digital technology is penetrating Eastern Europe. Many countries are recording digitally, in stereo and on multitrack, and are manufacturing CDs. Two problems—it can take up to four years to order a piece of equipment from the West, getting the necessary licences and foreign currency. Also, there are very few CD players as yet, and therefore there is no home market.

Al Hart from Modern Videofilm in Hollywood, USA, is engaged in bringing that bastion of archaic technology, the film industry, into the late 1980s. Hart explained a few home truths about the 6-track magnetic film recorders currently in use, eg, it can take up to 800 reels of mag film to make up the sound for a feature film, and also how lucky you will be if you are not plagued by problems such as noise and azimuth misalignment. Hart's concern was to get digital technology in the system at a point where it would stop the quality rot—at the dubbing stage.

Although the DIE is not used to seeing participants' home movies, Al Hart's video ('home movie' is his description) of two of Modern Videofilm's sound editors was illuminating. Particularly the use of the *Synclavier* for adding sound effects. The time saved purely in calling up effects is considerable. One man-week of production on the *Synclavier* is equivalent to five or six man-weeks using conventional mag film techniques.

Hart's presentation included examples of how their Sony *3324* multitracks are interfaced with other equipment such as NTSC and PAL video. He also used a diagram showing the *3324* linked to a Magna-Tech film recorder. It seemed, from what he was saying, a little like matching a Porsche engine to a horse and cart. But as long as mag film remains the standard medium of interchange in the film world, it will be necessary.

Cary Fischer of Sony

John Watkinson's presentation, 'Digital VTR in Practice', clearly explained the basics of the cassette-based *D2* format. Also, how tracks may be recorded on tape without a guard band between them by the use of two sets of heads set at slightly different azimuth angles. The recorded track can actually be narrower than the head. Fascinating stuff, and employing technology similar to that of R-DAT—but on a larger scale. Even more fascinating is the prospect that the *D2* format could in theory be reconfigured as a 100-track digital audio recorder. "But who would need a hundred tracks?" was John's comment, with one eyebrow raised.

Bill Aitken of Quantel, UK—the company responsible for the famous *Paintbox* video artwork tool—brought with him a showreel demonstrating the capabilities of the *Harry* hard disk-based video effects system. If you think you are getting tired of tricky video effects, this is the one you have to see. Quantel's aim was to produce an editing and effects system which could compete with the naturalness of the film medium. The editing screen display shows 'film clips' which can be electronically cut, joined and processed in a variety of ways.

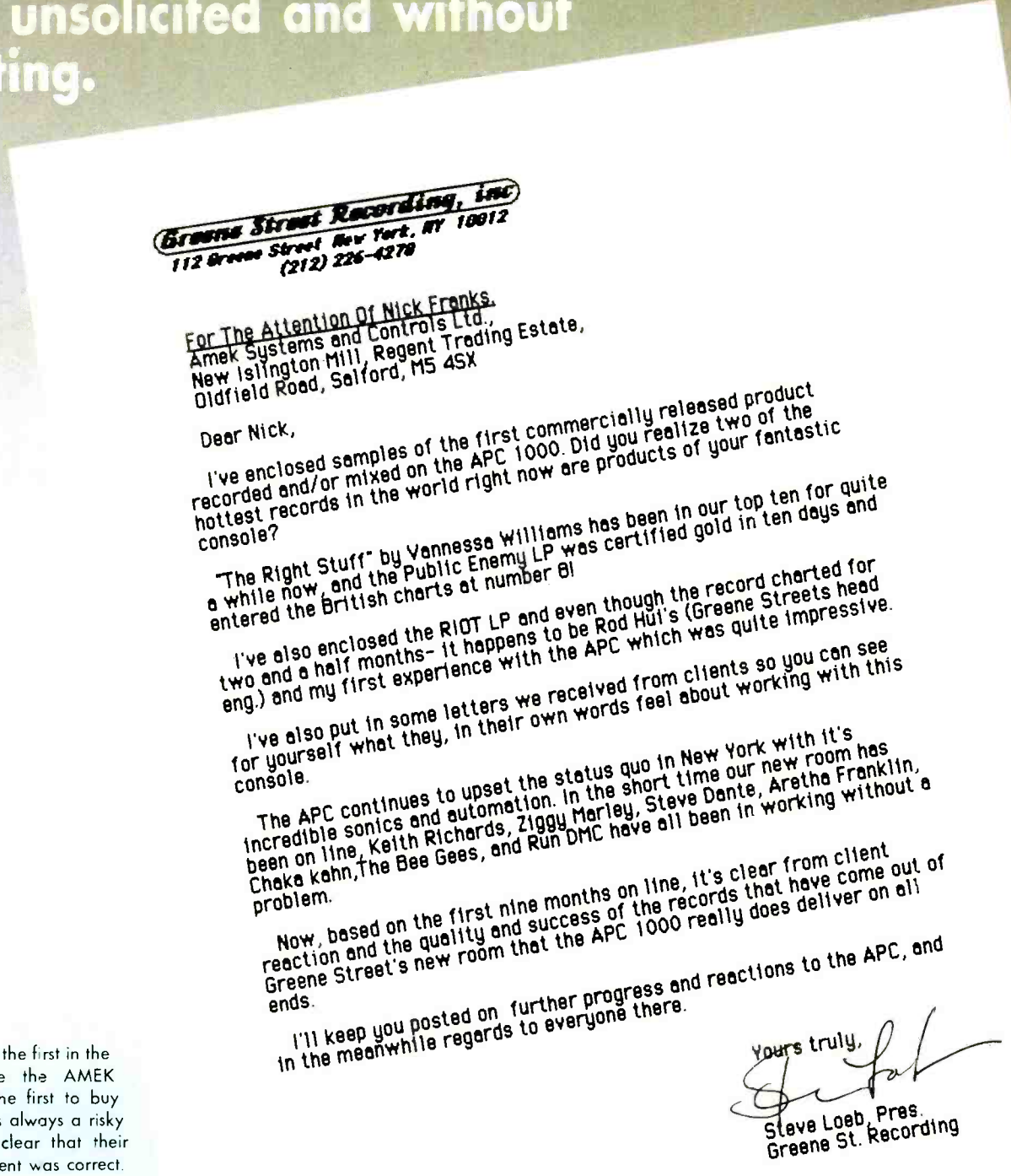
HarrySound is the audio complement to *Harry* and is a hard disk-based audio editing system. Here, the display shows six sound 'reels'—the analogy being with conventional film sound procedures.

Although the *Harry* and *HarrySound* displays traditional methods of operation, the advantage is that sound and vision can be manipulated together, rather than separately as is current practice.

The day ended with Phil Wilton of Sony Broadcast, UK, describing an HDVS (High Definition Video System) production with digital audio of Genesis in concert at Wembley Stadium. Two large HDVS monitors were wheeled in and the lights dimmed. The difference in picture quality between HDVS and old-fashioned PAL has to be seen to be believed. Phil's argument was that such picture quality demands the highest possible sound quality, and judging by the interest the system generated, the audience took the message to heart.

Day 2 started with Bob Ludwig of Masterdisk, USA, giving us an update on mastering in the US. A series of colourful pie-charts showed the audience the increasing proportion of Masterdisk's business coming from digital—as one might expect. As well as confirming what we knew already, Ludwig's presentation was packed with interesting details that you probably wouldn't

This letter was recently received by AMEK, unsolicited and without prompting.



Greene Street Recording, Inc
112 Greene Street New York, NY 10012
(212) 226-4278

For The Attention Of Nick Franks.
Amek Systems and Controls Ltd.,
New Islington Mill, Regent Trading Estate,
Oldfield Road, Salford, M5 4SX

Dear Nick,

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Yours truly,

Steve Loeb, Pres.
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hear about elsewhere, such as the fact that Masterdisk do more business with the Mitsubishi *X80* than with the more recent *X86*. Also, out of 1,000 mastering projects, only 11 came in the Dolby *SR* format.

Ludwig's talk was entertaining, and a useful insight into what is happening in this particular section of the audio industry.

David Ward of Mitsubishi, UK, contrasted different methods of music recording, looking from the perspective of a manufacturer of digital multitrack. Three basic types were defined: the tape transport type of recorder, which would include systems like the Solid State Logic *01*, which behave in a similar manner to a tape machine remote although actually hard disk-based; type two is the desk top multifunction terminal with hard disk and RAM, where the features depend on what the manufacturer considers important; type three would be the MIDI-controlled keyboard, where the musical information is pre-recorded (sampled) or synthesised, and recording takes place by logging MIDI data.

Ward brought things down to basics by asking what was it was that all these recording methods had to do? It was to capture spontaneous musical creativity. The advantage of multitrack is that at the current state of development it is a better artistic tool and imposes fewer constraints than hard disk systems. The point was made that you didn't necessarily have to choose one or the other, perhaps a combination of systems may be more appropriate.

An interesting point was raised, during questions on this presentation, on the subject of noise reduction for digital. Apparently, people are using NR to gain a worthwhile lowering of the noise floor. Other advantages are that at low levels, it can simulate bits being used to describe the signal. Also, sources of noise reduction error are removed by using a digital recorder with a flat frequency response, and having a low noise level to start with. Is there a possibility we may see a noise reduction system dedicated to digital recording?

What Jeff Baxter, ex-Steely Dan member, was doing speaking at the DIE seemed to be a good question—before he took the rostrum. Apart from extolling the virtues of low cost recording, as in the Akai 12-channel *DR 1200*, he stimulated a flurry of questions from the floor.

The second of John Watkinson's excellent presentations was on the subject of hard disks—a topic of increasing interest. A hard disk is pretty much like a floppy disk in concept, except it is totally enclosed, built to tighter tolerances, and has several disks stacked up on one common spindle. Digital audio can be recorded on the disk, with an access time to any part of the recording less than 10 ms. Compare that with tape.

A hard disk can be looked upon as a bucket for data representing digital audio. The same hard disk could contain one long track, or several shorter tracks. The only limit to the potential number of tracks is the rate at which data can be read out.

To a hard disk recording system, it doesn't matter where the data is located on the disk. Editing, or crossfading two takes together, is only a matter of reading out the data from the takes in a different way. The existing data doesn't have to be changed, only the instructions on what to do with it need be stored. Limitations arise when you need to do more processing on the data than the system can cope with. For example, a 4-track crossfade at 0.99x normal speed takes a lot of computing power.

Day 2 also included Carl Schofield explaining the *Audio Tablet* hard disk-based editor, Karl Otto Bader on Studer's DASH editor, and Steve Jagger with an informative description of the AMS/Calrec *Logic 1* and the reasoning behind it.

Day 3: It seems that the most talked about presentations are the ones that generate debate between the audience and the speaker. That point was obviously understood by Cary Fischer who explained the key features of the new Sony *3348* 48-track recorder, and then pretended not to know of a sensible use for one of them.

The *3348* is the fulfilment of the promise of the multitrack DASH format, filling in the spaces left on the tape by the 24-track *3324*. Twenty-four tracks of digital audio may be recorded on the *3324*, and then the tape put on a *3348* and tracks 25 to 48 recorded. Or looking at it the other way round, 48 tracks can be recorded on the *3348*, and then tracks 1 to 24 can be replayed without

Alan Jubb of Neve, UK

Sam Toyoshima

difficulty on the *3324*. Fischer usefully explained that this was not clever trickery but simply the full exploitation of the DASH format as originally devised.

Extra features include a 20 s RAM memory, which can be used to relocate audio on the tape (John Watkinson speculated during questions whether future options might include a hard disk!). Also there is something known as 'digital ping pong' whereby any combination of two tracks may be digitally copied, with no processing delay, to any other combination of two tracks. Ideas from the floor on what use this might be put to included making safety back ups before drop-ins (but surely the autolocator provides a non-destructive rehearse function?) and making compilations of vocal takes in the digital domain (losing the level matching abilities of going through the console). A third proposed use was re-ordering tracks to make the track sheet neater. My guess is that the function is there so that important tracks can be relocated to tracks 1 to 24 if necessary for playback on a *3324*.

Alan Jubb of Neve, UK, gave a history of *MADI*—proposed standard format for multichannel digital interface. *MADI* is the brainchild of engineers from Mitsubishi, Neve, Sony and SSL. Jubb explained how it was thought that the take up of digital multitrack was being slowed by the difficulty of transferring digital audio from one format to another. The *MADI* standard had to meet several criteria: a high probability of industry acceptance; based on readily available components and not on proprietry designs of *MADI* group companies; a short development time; economic implementation; transparency to the AES/EBU interface; at least 32-channel capability.

Jubb gave an informative and interesting explanation of this important topic.

Sam Toyoshima, well-known for his studio designs, followed, giving a report on what is happening in the Japanese record market and recording industry and the place of digital audio in Japan. His presentation ended with examples of the different types of music popular in Japan, together with photos of some Tokyo studios.

John Stadius of Soundtracs, UK, and Dave Whittaker of Harman UK presented what they called the 'New Way' of recording using a *Direct-to-Disk* recording system and a relatively low-cost high quality mixing console such as the Soundtracs *Eric*.

Richard Salter of Sony Broadcast, UK explained the 'Total Sony' concept they use within the company. Basically, the object is to have the ability to use all the vast resources of the Sony company in any division. For instance, expertise in the video or domestic audio fields can be put to use in the professional audio division where appropriate.

One product of this collaboration is the *SDP 1000*, a prototype digital equaliser demonstrated by Andy Tait. It features comprehensive parametric EQ and filters, together with a dynamics section. Most important is the user interface consisting of a workstation-type unit with a tracker ball, and a very useable video display. You can see and hear the EQ and dynamics curves you are creating. Timecode-based automation is also a feature of this unit.

The final presentation was by Paul Lidbetter on Neve's development tool, *Casper*. With *Casper*, Lidbetter demonstrated the effects of instantaneous switching of gain and EQ, also the offensive nature of 'zipper' noise in digital faders. Of course, Neve's solutions to these problems were demonstrated too.

Day 3 concluded with another demonstration of HDVS, for the benefit of the many studio people who had missed out on Day 1.

Summary: If there are conclusions to be drawn from the three days of the Digital Information Exchange, the most important might be that video may no longer be considered as a poor relation to sound (or vice versa). The developments in this parallel field *are* going to make a difference to the way we handle audio. Advances in technology are increasingly pushing forward the rate of change in sound engineering practice. If many of these developments are first appearing as by-products of video recording and processing techniques then we must be aware of them at their earliest stages. With intelligent presentations and useful questioning from the floor, the DIE will continue to be an important source of information.□

*The Digital Information Exchange is sponsored by HHB Hire & Sales and Sony Broadcast in association with *Studio Sound*, *Pro Sound News* and *Broadcast Systems Engineering*.

Barry Fox

A question is thrown over the bugging expertise of *Spycatcher*

The House of Lords has now said Britons can join the rest of the world and read *Spycatcher*. For many people the experience will be a let down. But those with an interest in audio technology may find the book well worth reading, simply because of the hilarious nonsense author Peter Wright spouts.

If we are to believe what he says, Wright worked during the war on demagnetising ships to fool mines. In 1949, he was with Marconi, researching radar. Switching allegiance to MI5 and MI6, Wright's first job was to develop new microphones and look into ways of getting sound reflections from office furniture. His description of this work is extraordinarily muddled.

In 1951, the Americans had just debugged their ambassador's office in Moscow. They found a microphone-transmitter by using the standard howlround technique of sweeping the room with a variable frequency receiver, which feeds back when it matches the transmission frequency—like a microphone too near a loudspeaker. Wright refers to the howl frequency as "1800 MH". He describes the bug as a metal mushroom with diaphragm and aerial. By tightening a metal plate he was able to tune the signal to "800 megacycles".

Wright explains that when soundwaves impact on a taut surface, thousands of harmonics are created. He muddles together the behaviour of sound and electromagnetic radio signals, talking about activating the microphone by microwaves. Perhaps he is trying to describe the technique of beaming microwave signals at a target, which converts the signals into useful electrical power, just as a piece of metal inadvertently left in a microwave oven will spark alarmingly.

But elsewhere, Wright says, he spent "a lot of time researching ways in which innocuous objects, like ashtrays or ornaments, could be modified to respond to soundwaves when radiated with microwaves".

Of course sound can be gathered with a parabolic reflector but only where the wavelengths are less than the aperture of the dish. NBC used large parabolic reflector microphones in 1931 during a broadcast from the Philadelphia Metropolitan Opera House, to pick up the sound of soloists. Making something secret does not alter the laws of physics. Even with a 1 metre dish response falls off below 1 kHz.

To bug a room at Claridges Hotel, in which Nikita Khrushchev was staying, Wright says he used a telephone tap activated using "shortwave high-frequency megacycles". It is hard to imagine any scientist or genuine electronics expert using such sloppy terminology. But this is exactly how he repeatedly describes himself.

When Wright talks mysteriously about ashtrays or ornaments modified to "reflect sound" and "respond... when radiated with microwaves" he may well be trying to explain a well known phenomenon. When microwaves resonate in a tuned cavity they can be modulated by movement of a membrane which seals the cavity. If the membrane is vibrated by soundwaves the device becomes a microphone.

Ten years ago, in his book *Inside Story*, Chapman Pincher gave a very clear description of this technology. The Kremlin had presented the supposedly bug-proof American Embassy in Moscow with a memorial plaque. Inside there was a resonant chamber and diaphragm. The Russians beamed powerful microwave radiation into the building from across the street. This excited the resonant chamber while the diaphragm vibrated in sympathy with speech soundwaves in the room. The modulated microwaves were then picked up by a Russian receiver outside. So anyone talking in the room was bugged. The system was widely used by the KGB, which not unnaturally alarmed Western diplomats when they found they were being bathed in potentially dangerous microwave radiation.

It would have been fairer on *Spycatcher* readers if Peter Wright and his collaborator had simply quoted from Pincher's book, instead of confusing the issue with their own garbled descriptions of well-known technology.

When MI6 interrogated Kim Philby in 1955, Wright wanted to get "as high a quality recording as possible" so he obtained a BBC microphone. Then he put it underneath the floor boards and fed the signal by telephone line to Leconfield House, where the sound was recorded on dictaphone cylinders and acetate discs. All this must have seriously degraded the sound of the microphone, apparently for absolutely no point whatsoever, because with three MI6 interrogators quizzing him, Philby was hardly unaware of what was going on.

Wright then spent years developing a device called a MOP. This, he says grandly, makes a microphone cable do two jobs at once. It transmits captured sound and receives power. MOP, says Wright, "promised to revolutionise MI6 activity by removing the extra leads, which are always likely to betray a covert microphoning operation". The revolutionary device was "eventually successfully manufactured" by MI6.

The phantom powering of microphones is as old as the telephone itself. DC power travels down all telephone wires, where it is modulated by the carbon or capacitor microphone in the handset.

Bell Labs in the USA was using a high quality capacitor microphone for broadcasting in 1928. German firms were making them for Europe in the 1930s. The BBC had them. The DC supply came down the audio cable from batteries or a rectifier.

By the time Wright was beavering away on MOP, the EMI laboratory at Hayes had already made a portable mixing console, for early stereo recordings. Each microphone input had a switchable DC supply. Wright should have been aware of EMI, at least.

Facing the problem of transcribing a bug recording in which several people are speaking into the same microphone, Wright went to an audio show at Olympia. There he bought a domestic tape recorder, designed for early stereo tapes made by EMI.

The left and right channel recording heads were separate and spaced slightly apart. When playing a stereo tape made on a similar machine, all is well. But playing a mono tape will produce the same sound twice, delayed by a few milliseconds. Wright says the echo effect from his "binaural tape enhancer" made "even the worst tapes much easier to understand".

It is well-known that jumbled recordings sound clearer in stereo, because two microphones have provided two sound perspectives. To check Wright's claim I built a system that mimicked Wright's. It had a Dolby cinema Surround Sound decoder to give a delay, variable between 15 ms and 30 ms, on one channel. Listening on headphones to poor quality radio speech, I found that using the delay made things even worse.

During the war French Resistance workers found out how to listen to BBC broadcasts, which were being jammed by the Germans. They used two radio sets, each tuned to a different station broadcasting the same programme. Although both stations were jammed the speech on each was the same, whereas the random noise of jamming interference was different. So the speech stood slightly proud of the noise.

British Signals engineers discovered by chance that the clarity of speech was further enhanced, if the signal from one transmitter happened to be *very* slightly delayed by the extra time taken for the electric signal to travel by land line from the BBC's studios to different transmitters. It put an 'edge' on the sound of speech, which helps it cut through noise. Because electric signals travel so fast in a wire, the delay between even widely-spaced transmitters is in the order of 1 ms or less. Mechanical delays, as created by the use of a 2-head tape recorder, are much longer and create a different effect, more like a stutter or echo.

Wright claims that it was he who suggested to Sir Roger Hollis, Director-General of MI5, how a radio receiver can be traced. Any receiver contains an oscillator. It produces a high frequency signal, which is mixed with the radio signals to create a 'beat' signal of lower frequency. Unless it is very carefully screened (as in military equipment) the receiver also transmits. (Wright wrongly says it radiates "soundwaves".)

Looking for a spy receiving Morse from Moscow, MI5 built a van with plastic sides, transparent to radio signals, and fitted it with a receiver tuned to detect oscillator signals. Wright and his team parked near Clapham Common. They knew the transmission only lasted 20 minutes and tried to track it down by driving north, south, east and west, listening for the signal to become fainter or stronger.

In telling this tale, Wright appears blissfully ignorant of the fact that in the '30s the Post Office was using exactly the same technique to track down people without radio licences. Since the '50s the system has been used to trace unlicensed TV sets.

Spies Peter and Helen Kroger used a high speed

transmission technique, similar to that used by Germans during the last war. A message is recorded on to tape and played at high speed. The received signal is recorded on tape, which is then slowed down for replay. Wright talks about a bottle of magnetic oxide being used to print the Morse from the high speed message on to a tape, so that it could be read without being transferred to a tape recorder and slowed down. It is a well-known technique in the recording industry to display the magnetic pattern on a tape by coating it with iron dust or liquid suspension. Cut and splice video edits were once done this way.

But Wright describes it as a "new technique", which explained why he had failed to detect any transmissions to the Kroger house.

Why coating tape with iron dust instead of playing it on a recorder should conceal a transmission, is not explained. Later, Wright says MI5 was unable to detect the Krogers' transmissions, because they were at high speed. High speed transmission reduces the time needed on air. This makes detection more difficult but not impossible.

When the Russian Embassy in Ottawa burned down, the Canadian Security Service decided to bug the new one while it was being built. On Wright's advice the Canadians buried microphone cables in a ⅓ m of concrete. MI5, he said, had developed a new thin cable that gave off far less electromagnetic radiation. But microphone cables carry low level electrical signals and are screened with metal braid to prevent external interference corrupting the wanted signal. The amount of radiation leaking out from a good quality screened cable is so slight that they can be run alongside one another, without any mutual interference. Wright and MI5 need only to have talked to the BBC.

A cable relaying a "broad band radio frequency tap" is fitted with "special blocking condensers... to ensure it was one directional". Perhaps he means filters.

In a bugging situation, metal window frames "dampen the electromagnetic field emitted by the microphones", although an air path carries sound. Even if the microphones did emit radio waves, surely they would leak through the sound path.

And so it goes on, as Wright skates over technologies he appears not to understand. If the author were the trained scientist he repeatedly and immodestly claims, how can he offer so many garbled explanations and use such clumsy terms?

One possible answer is that Wright grossly overestimates his own abilities. Either he is fantasising over his responsibilities, or possibly he was able to bluff his old school tie superiors, who had absolutely no technical expertise. Because of secrecy, no-one outside was in a position to tell Wright he was bluffing. With an uncontrolled budget and an obsession over secrecy, MI5 could afford to re-invent wheels far less efficient than those already in everyday use by broadcasters and recording engineers.

Or perhaps, the whole farrago is a deliberate charade, designed to disinform. Get someone to write a book about a few open secret scandals, drop in a few selected red-herrings and try very publicly, but unsuccessfully, to suppress it.□

Martin Polon

Things that go bump in the studio. A warning of the effects of RF interference. Comment from our US columnist

It was a mild day in Los Angeles, June 1991. The last decade of the century of technology had begun. Todd Smith felt good all over. He had worked very hard to build his new studio. He had fought a tough battle to locate in the quiet Los Angeles suburb of Burbank. He had argued successfully that there was a business trip on the main drag, Ventura Boulevard, a block away. The building that he had renovated had lived most of its 28-year existence as a neighbourhood convenience market. Now it was going to help make the most beautiful music in the city.

He had spared no expense in rebuilding the market into a studio. He was a firm believer in the new 'small studio' revolution and had decided to achieve digital recording capability and multitrack mixing capacity with the new high quality, less-expensive hardware that was mass produced for the so-called 'home' studio. He would have DATs, 12-track digital recorders using 8 mm video cassettes, dual 8-channel digital consoles automated with a personal computer. He would also have greater mixing capacity than analogue consoles. He also wanted the building itself to have every possible convenience as well as business necessity. The remote van would enter and leave the building noiselessly via a superb new silenced roll-up garage door. All the computers in the facility used the new cordless keyboards. The architect was given a free hand as was his studio business manager. The end result was a superb mix of form and function.

The first session in the new facility was to be Todd's day of triumph. An up and coming folk/country group was ready to roll in Studio Two. A post-production session was set up in Studio Four with its state-of-the-art surround sound decoding monitoring system. The office was busy and all of it made Todd feel as if every one of his dreams had reached fruition. All of the equipment had been 'shaken down' the night before and nothing could spoil this ultimate moment. Both sessions were well underway when the first sign of trouble reared its ugly head. Studio Four had progressed in the session to the second 'cut' on the agenda when an intense crackling sound appeared very briefly on all of the tracks. A complete run down would not duplicate the noise, yet 40 minutes later as tape rolled again, the crackling returned for another brief encore. Compounding this, Studio Two began to complain about a loud buzz that cut through all the tracks at their inputs. The buzz was intermittent but the 'techs' thought it happened only when Studio Four was in production. Then to top it all a series of momentary 'zaps' sounding like a munchkin's chainsaw entered the audio channels in both 'on-air' studios. These connected sounds ran almost continually for about 10 minutes then stopped cold. Todd had called his business manager out of the office to hear the cacophony but it had all stopped before he entered the room. The two just stared at each other. Todd sat down with his head in his hands.

Now, the first of you to solve this puzzle will win the right to try to prevent this *Electronic Nightmare on Studio Street* from happening. You think 'Freddy of the knives as fingers' is frightening? You should see the politicians and lobbyists who are threatening to destroy the sanctity of the frequency spectrum and make RF pollution equal in impact to its land-based cousin. The problem above emanates from the likelihood for newly won freedom of electronic equipment makers in the 1990s to use the entire frequency spectrum with significantly lessened restriction. There is a strong possibility of a sell-out in the United States. This would impose a set of eased standard limits that apply to all unlicensed RF applications without review as a way of reducing the amount of regulation needed, as well as pleasing the powerful lobbyists from the consumer electronics makers. This sorry state of affairs appears to be on a non-reconcilable course that will unleash the productive powers of the Far East to bombard the United States with a whole new range of wireless products.

Oh yes, the answer to the studio owner's problems above. The new high-power remote for the garage door opener caused the crackling in Studio Four: the wireless remote on the vectoring of the surround sound decoder in Four interfered with the equipment in Studio Two; and the cordless keyboard on the office PC blasted into both studios as and whenever it was being used. This fictional narrative is not very far from reality with today's lax spectrum pollution standards. According to scores of experts who have filed testimony with the US Federal Communications Commission (FCC) on this topic, after the revision of the rules, the likelihood for just this kind of interference will increase by several thousands of percent.

What specifically is happening is the combination of an effort by the budget deficit-ridden US. To reduce its workload in dealing with requests for each product working low-power RF and a quantum jump in manufacturers who think the bands should be wide open for low power RF devices. But what constitutes low power and by whose definition? Everybody has a different agenda and the audio industry has no agenda at all. The consumer electronics manufacturers and business equipment manufacturers want to solve the problems of directionality posed by the superb non-polluting optical links that have served to handle remote controls, etc, to date. The government agency wants to clear its staff of having to process each usage of the frequency spectrum by low power devices. On some levels, the political thrust of deregulating has made it fashionable to consider dropping all but the most rudimentary controls. This is not an indictment of the FCC's technical staff but rather of the politics of the Commission's appointed leadership, whose direction has been to favour business over regulation as a kind of party politic.

A long-time observer of the US electronics industry commented on the current state of affairs: "The big Japanese and Korean equipment makers as well as the OEM job shops in Hong Kong, Singapore and Taiwan are foaming at the mouth to start using RF for remote control and for remote signal transmission. An enormous range of products is already in the pipeline just waiting for the FCC to open the floodgates. Wireless earphones, remote controls on everything from combination microwave ovens/colour TV sets—the couch potato special to lawnmowers, remote keyboards for computers at home and in the office, wireless loudspeakers, wireless security system components, wireless elderly safety call units, wireless child trackers, etc. Nobody knows how these things will affect any other user in the same band or even the spectrum. They are clearly going to increase background noise and the power level will allow reception anywhere from 75 to 250 ft. Worse, the allowed levels for unintentional RF radiation from devices such as touch-on lamps, toys and other devices will be the same as for unlicensed transmitters.

"There are Japanese companies that have broadcast product divisions that will be directly impacted by the new RF wireless remotes on TV sets. The consumer products division is bigger, wants the greater range offered by the RF remote over optical remotes and will do anything it can to sell the assigned product. The broadcast/pro-audio division will find its wireless mics interfered with, its amplifiers and mixers inhibited by unwanted pick-up and so on and so forth."

The impact on foreign marketplaces could be equally as devastating. It would be nice to think that this lunacy would stop at America's door but that would be wishful thinking indeed. The large consumer electronics equipment and office computer makers will push these features worldwide since consumers want the longer range and convenience offered by RF products. It is such a shame that a few cranky customers have made the manufacturers overly sensitive to the minor range and directivity problems of infra red devices. The use of invisible light allows unlimited control and communications options, yet poses no threat to any other electronic device nor causes spectrum pollution. Unfortunately, in the minds of the CE equipment makers, RF remote control and RF signal linkages have the same brawny 'macho' as 300 W/channel power amplifiers for the home and have about the same amount of real justification. The appropriate foreign governments will be petitioned to allow the use of such devices and the justification will always be the same: "They use it in America and it works just fine." So if the equipment makers ▷

A LINK HOUSE PUBLICATION

STUDIO SOUND

AND BROADCAST ENGINEERING

1988

A Year in Focus

Genetic's Martin Rushent relaxing with the studio's new Mitsubishi X86 2-Track Digital Recorder. The X86 joins the Mitsubishi X850 32-Track Digital Recorder purchased by Genetic earlier in the year.

Don't you wish you had a Mitsubishi ?

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Index to Volume 30

A guide to features, reviews, etc, published during 1988 together with brief reference to content. In the right hand column, the first two digits refer to the month of publication and the rest, the page number. Three of our major contributors also give their views on events past and trends for the future

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Barge Records, UK. Tel: 051-493 1166. 2/12

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Fabritrak, Fabritrak House, 21 High Street, Redbourn, St Albans, Herts AL3 7LE, UK. Tel: 058 285 4626. 3/19

Fane Nederland, Julianaparklaan 2, 3534 AN Utrecht, The Netherlands. Tel: 030 421142/421162. Fax: 030 435004. 4/14

FM Music, 129 Walham Green Court, Moore Park Road, Fulham Broadway, London SW6 2DG, UK. Tel: 01-381 0108. 3/19

Hinton Instruments, Oldford, Nr Frome, Somerset BA11 2NN, UK. Tel: 0373 51927. Fax: 0373 830679. 12/16

HM Electronics, 6675 Mesa Ridge Road, San Diego, CA 92121, USA. Tel: (619) 535-6060. 2/12

Jay Cee Music, UK. Tel: 051-493 1166. 2/12

Lakeside Associates, 1540 East First Street, Suite 243, Santa Ana, CA 92701, USA. Tel: (714) 836-6496. 7/12

Larking Audio, 15 Cam Square, Wilbury Way, Hitchin, Herts SG4 0TZ, UK. Tel: 0462 422466. 9/28

London Microphone Centre (LMC), Unit 10, Acton Vale Industrial Park, Cowley Road, London W3 7QE, UK. Tel: 01-743 4680. Fax: 01-749 9875. 12/16

Master Blaster Europe, Nijverheidswig 13, PO Box 275, 3760 AG Soest, The Netherlands. Tel: 2155 20101. Fax: 2155 22806. 7/12

McKenzie Acoustics, 286 Bradford Road, Batley, W Yorks WF17 5PW, UK. Tel: 0924 477102. Fax: 0924 471799. 10/18

Musicable, Park House, 20 Park Close, Pinxton, Notts NG16 6QQ, UK. Tel: 0773 861690. 9/28

Musicomp, 3 Petley Road, London W6 9SU, UK. Tel: 01-386 8019. 10/18

Neve Electronics, 260 W 52nd Street, Suite 25E, New York, NY 10019, USA. Tel: (212) 956-6464. 1221 16th Avenue South, Nashville, TN 37212, USA. Tel: (615) 329-9584. 7/12

Porky's Mastering Services, 55-59 Shaftesbury Avenue, London W1 77AA, UK. Tel: 01-494 3131/5. 8/8

Professional Sound Corp, 10639 Riverside Drive, North Hollywood, CA 91602, USA. 4/14

Rebel Audio, 286 Great North Road, Five Dock, NSW 2046, Australia. Tel: 02 713-6866. Fax: 02 713-1727. 6/18

Roland UK, Amalgamated Drive, West Cross Centre, Brentford, Middx TW8 9EZ, UK. Tel: 01-568 4578 (music sales); 01-847 5665 (digital group sales); 01-568 1247 (general/customer services). 9/28

Sony Belgium, Luchtschipstraat 55, B-1130 Brussels, Belgium. Tel: 02 721 49 50. Fax: 02 721 38 43. Telex: 62686. 6/18

SSL, Oxford, UK. Tel. 0865 842300. Fax: 0865 842118. 12/16

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Stirling Audio Studio Centre, UK. Tel: 01-624 6000. 6/18

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Tapetalk, UK. Tel: 0908 274466. 5/16

Tapetalk, 30 Brampton Centre, Brampton Road, Wath-upon-Dearne, Rotherham, South Yorks S63 6BB. UK. Tel: 0709 878623. 8/8

The Sound Department, Unit A1, Askew Crescent Workshops, Askew Crescent, London W12, UK. Tel: 01-740 1313. 3/19

The Sound Practice, The Studio, Spring Street, Rugby, Warwicks CV21 3HH, UK. Tel: 0788 541133 (multi-line). 3/19

Totalsystems (Tendrashaw), 41 Windermere Avenue, Kempshott, Basingstoke, Hants RG22 5JH, UK. Tel: 0256 468555. Telex: 858893. Fax: 0252 620729. 4/14

Turbosound, Star Road, Partridge Green, West Sussex RH13 5EZ, UK. Tel: 0403 711447. 9/28

Vitavox, 5 Elstree Way, Borehamwood, Herts WD6 1SF, UK. Tel: 01-953 4151. 9/28

Whiteley Electronics, Victoria Street, Mansfield, Notts NG18 5RW, UK. Tel: 0623 421300. Fax: 0623 420484. 10/18

Agencies

ADA	7/14
Acorn Computers	8/7
Allen & Heath	9/14, 10/16
Alphaton	11/23
AMS/Calrec	9/14
Anixter	10/16
Annis	5/16
API	1/12
Apogee	7/14, 8/7, 10/16, 12/16
Apple UK	10/16
ARX Systems	11/23
ATC	2/15, 5/16
Audio Logic	8/7
Audio/Digital	7/14
Ault Inc	12/16
Beyma	12/16
Brahler ICS	8/7
Bruel & Kjaer	5/16, 11/23
BSS Audio	10/16
Cadac	8/7, 2/15
Carver	6/22
Casio	8/7
Cipher Digital	7/14
Clive Green & Co	10/16
Court Acoustics Sales	4/23
DDA	1/12, 3/19, 4/23, 10/16, 11/23
Digidesign	7/14
Dod	8/7
Dolby Lab	6/22
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A LINK HOUSE PUBLICATION

Authors

A Momentary Lapse of Reason—the tour at Wembley

"Neve Je t'aime!"

Polygone Studios has received a design award for their new purpose built studio complex. The studio was "Number One" in France for the number of hits recorded in 1987. "The biggest hit of the studio has been the Neve V series."

Jacques Bally Studio Owner.

"Neve V series Je t'aime!"

Jacques Hermer Chief Engineer.

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Blackwood Studios uses the Neve V series for music recording and for live broadcasts from the nearby music club.

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Helmut Edinger
Studio Manager

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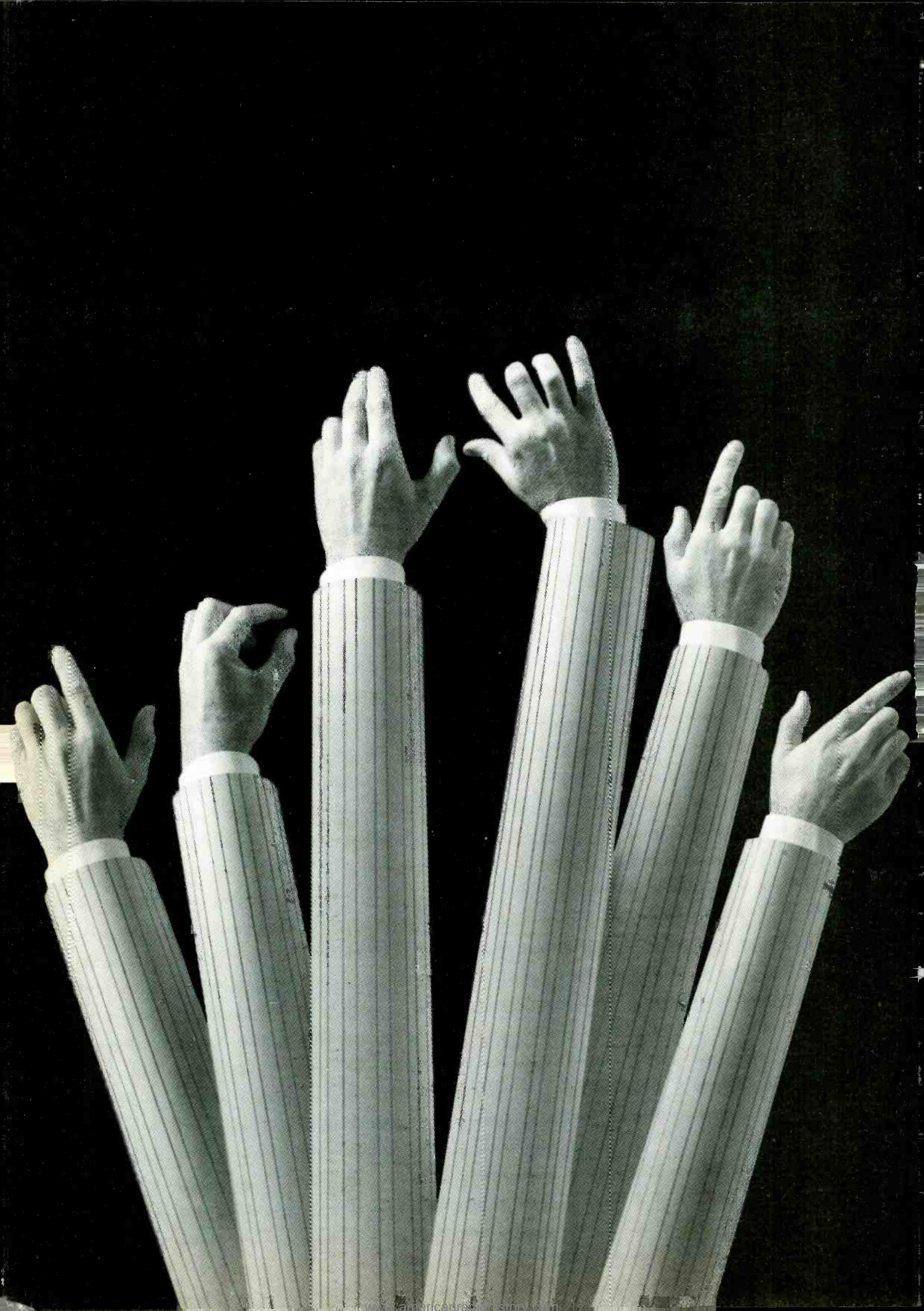

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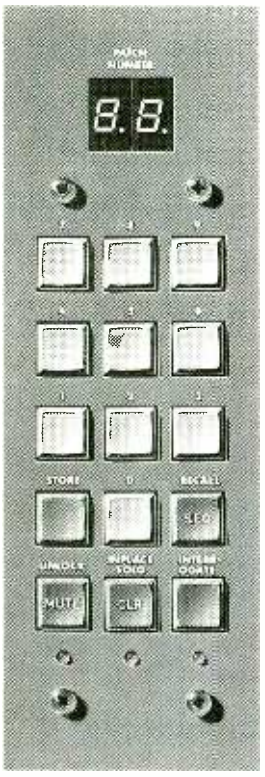

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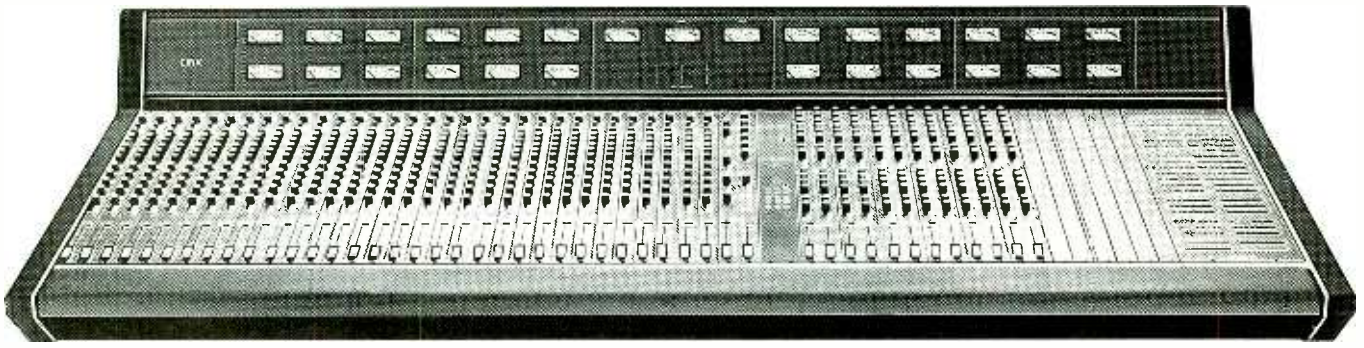

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General news

Studio One at AIR, London (see Features)

This letter was recently received by AMEK, unsolicited and without prompting.

Greene Street Recording, inc
112 Greene Street New York, NY 10012
(212) 226-4278

For The Attention Of Nick Franks.
Amek Systems and Controls Ltd.,
New Islington Mill, Regent Trading Estate,
Oldfield Road, Salford, M5 4SX

Dear Nick,

I've enclosed samples of the first commercially released product recorded and/or mixed on the APC 1000. Did you realize two of the hottest records in the world right now are products of your fantastic console?

"The Right Stuff" by Vannessa Williams has been in our top ten for quite a while now, and the Public Enemy LP was certified gold in ten days and entered the British charts at number 8!

I've also enclosed the RIOT LP and even though the record charted for two and a half months- it happens to be Rod Hui's (Greene Streets head eng.) and my first experience with the APC which was quite impressive.

I've also put in some letters we received from clients so you can see for yourself what they, in their own words feel about working with this console.

The APC continues to upset the status quo in New York with it's incredible sonics and automation. In the short time our new room has been on line, Keith Richards, Ziggy Marley, Steve Dante, Aretha Franklin, Chaka kahn, The Bee Gees, and Run DMC have all been in working without a problem.

Now, based on the first nine months on line, it's clear from client reaction and the quality and success of the records that have come out of Greene Street's new room that the APC 1000 really does deliver on all ends.

I'll keep you posted on further progress and reactions to the APC, and in the meanwhile regards to everyone there.

Yours truly,

Steve Loeb, Pres.
Greene St. Recording

Greene Street were the first in the world to purchase the AMEK APC1000. To be the first to buy "new technology" is always a risky business, but it is clear that their commercial judgement was correct.

The list of APC1000 owners is now growing fast as more people become aware of the creative and commercial possibilities from this powerful tool.

Contact us now and find out more about what we can do for you.

AMEK APC 1000

Head Office, Factory and Sales: Amek Systems and Controls Limited, New Islington Mill, Regent Trading Estate. Oldfield Road, Salford M5 4SX, England. Telephone: 061-834 6747. Telex: 668127 AMEK G. Fax: 061-834 0593.

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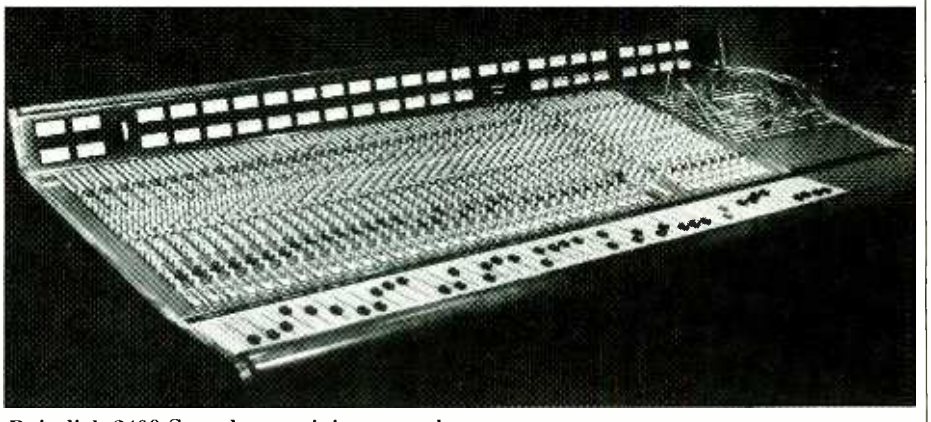
Letters

Music news

Perspective

Product news



Raindirk 2400 Symphony mixing console

Audio Design PRODAT 1 version of Sony DTC1000 DAT recorder

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IT DOESN'T MAKE A BAD STUDIO GOOD. IT MAKES A GOOD STUDIO BRILLIANT.

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Barry Fox returns to the topics of '88

The year's business

Wouldn't it be nice if the electronics industry called a truce for a year, lay on the beach or went to the pub and stopped developing any of this new technology?

They won't. So 1989 will see the public even more puzzled about what to buy and whether to wait, and the broadcast and professional studio industry obliged to junk perfectly good equipment even faster than ever before.

1988 will go down in history as the year when DAT finally flopped as a domestic format. DAT first hit problems when the Japanese electronics shops said they were too busy creating a market for CD audio and 8 mm video, to welcome a completely new format that looked to the public like a bit of both.

Then the record industry took up arms, branding DAT as a vicious villain. If you believed what the record companies said, then once DAT as launched no-one would buy CDs any more—they would just tape them. The IFPI and RIAA latched on to Copycode, originally developed by CBS to prevent the dubbing of LPs on to analogue tape, and it took the American Government, and a report by the National Bureau of Standards, to knock the silly system on the head. I for one still await an apology from the IFPI and their President Nesuhi Ertegun for not just ignoring what we tried to tell them about the technical shortcomings of Copycode but suggesting that we were in cahoots with the Japanese.

With Copycode discredited (and with it the ears of Nesuhi Ertegun, the IFPI and front man George Martin) DAT looked for a while as if it might just have a chance. But endless talks between the hardware and software industries about adoption of the Philips *Solocopy* system, which prevents a DAT recorder from copying tape copies, left the format still on hold.

The Japanese Government, embroiled in arguments over international trade deficits and tariffs, saw the DAT debate as a mountain made out of a mole hill. Cool it, they told the electronics companies. And verily the electronics companies did cool it, because by the middle of the year they had seen something much more important on the horizon—recordable/erasable CD.

This followed the clumsy announcement by Tandy in America of *Thor* CD. It was the first time ever that Tandy had announced a product that didn't exist. But it made world headlines. Subsequently it turned out that Tandy had bought a patent licence to use existing technology. At the last check, there was still no sign of any patents on *Thor* in Tandy's own name.

But at least Tandy is now playing truer to form. The company refuses to say anything about *Thor*. This either means that Tandy now realises it hasn't a hope of selling *Thor* at the low price promised—or it means that Tandy is now confident it can sell *Thor* at the low price promised. Take your pick.

Whatever the answer, it's probably irrelevant. The Japanese, along with Philips and Thomson in Europe, have been working on record/erase optical discs for at least a decade. The projects all went on the back burner a few years ago when DAT looked likely to sweep the world. Now DAT is dead as a domestic product, the Japanese have put record/erase optical disc technology back on the front burner. Their political experience with DAT will prove very valuable when the time comes to launch recordable CD.

Meanwhile the broadcast and studio industries benefit from work done on the development of DAT as a domestic product. A DAT deck now freely available to professional users at around £1.500 does just about everything that a £25,000 U-matic PCM system will do.

Do you seriously think that Sony would have spent all that money on developing DAT just to kill sales of far more expensive pro equipment?

The manufacturer's only hope of earning fat profits from DAT is to charge a fortune for timecode. That would leave the format with only one, incurable, disadvantage.

The cassette is so small it's all too easy to lose a master tape.

"The manufacturer's only hope of earning fat profit from DAT is to charge a fortune for timecode. That would leave the format with only one, incurable disadvantage."

1988 saw turmoil in the satellite field, which shook down to a straight fight between the Luxembourg satellite Astra, due for launch this winter, and the official British satellite to be launched by BSB late in 1989.

While putting on a brave face and pretending that Astra is no threat, BSB has spent money like water on creating a high profile image. With the Astra satellite up as planned, Rupert Murdoch is now broadcasting four Sky channels of entertainment in bog standard PAL TV format, without soft scrambling or hard encryption. It is hard to see how BSB can hope to succeed with a launch nine months later in the new MAC format and with at least some programmes encrypted.

Add to that the fact that Astra is transmitting from 19°E and BSB from 31°W, which means that viewers will either have to use two dishes or a complicated steerable mount if they want to view from both. It's the old VHS versus Beta story, all over again.

BSB spent 1988 talking about the better pictures available with MAC and the smaller, flatter aerial viewers can use with a higher powered satellite.

True. But the general public is traditionally indifferent to picture quality (witness the success of VHS over Beta) and can hardly be expected to delay purchase of a satellite system for nine months just to save 30 cm on aerial size.

The big question is how long it will take BSB's investors to wake up and pull the plug with Astra on air. At least those who have worked for BSB have the consolation of knowing that they have taken home inflated salaries for a couple of years.

Technically, the decision by Rupert Murdoch to use clear PAL instead of encrypted MAC is a backward step into a blind alley. The adoption of MAC lays the groundwork for high definition television, and radio by satellite, because the system offers much wider video bandwidth and up to eight channels of high quality digital sound.

But in the long term, Rupert Murdoch's clear PAL decision is irrelevant. Murdoch will give away entertainment for just as long as he needs to blow BSB out of the sky, and no longer. Once BSB's guns have been spiked, he will look for a way of charging for some programmes on subscription or pay-per-view basis. By far the easiest way to do this is to switch transmission standard from PAL to MAC and take advantage of the hard encryption and conditional access systems available for MAC. Robert Maxwell and others using the Astra satellite will doubtless follow suit.

This poses the question of which encryption system they will use. Currently there are two front runners, Eurocrypt from European manufacturers such as Philips, and Eurocipher, which is a European version of the Videocipher system made a *de facto* standard in America by General Instruments.

BSB has primed the pump for Eurocipher, putting up hard cash to ensure that hardware is available in time for the BSB launch. Even if BSB never launches, the work on Eurocipher has been done. Eurocrypt remains an unproven paper proposal.

There is more to encrypting signals than writing a computer program to scramble the picture lines and data. You need manufacturing expertise and a centralised billing system. And you need defence against pirates who, given half the chance, will clone receivers to defeat the system. Videocipher has already climbed a painful learning curve in America and much of the experience will translate to Europe with Eurocipher.

By Spring 1989, Philips and Polygram will have a better idea of whether their new video disc format, CD-Video, stands a chance of commercial success. The European launch in early October 1988 was almost a year late, after problems with player design and disc mastering. So it did not attract anywhere near the support originally promised when the format was first announced 18 months earlier.

By launch time only Pioneer had committed to back Philips with Combi players and only Philips' own subsidiary, Polygram, was providing the software. Film companies, and the other record and music video companies, were all waiting to see how hardware sales went. The other hardware manufacturers, like Sony, were waiting to see what kind of software was available.

Although the idea of a CD-V Combi, which plays all sizes and types of laser disc, is undoubtedly attractive, the format cannot succeed unless, or until, the hardware/software vicious circle is broken. If players sold well this winter, on the strength of Polygram's software, and if the film companies and other record companies do climb on board to provide software, which encourages Sony, Panasonic and the other Japanese hardware companies to offer players, then CD-V could take off.

> "Young fans of pop groups may be prepared to pay the extra for a video disc, but most young pop fans are unlikely to have the money to buy a player. So they must rely on their parents buying one. . . the software catalogue will have to have a very wide appeal."

This would then finalise the marriage of audio and video, in many respects taking music back to where it was 100 years ago before the gramophone became a way of life.

In those early days, music was something the public paid to see performed live. So, by definition, music was an audio-visual medium. Then the gramophone made music an audio-only medium. Many people listened, without ever seeing a performance. Pop promo videos for TV changed the rules, making visuals vital.

Now CD-V changes all the rules again. The sound performance on a CD-V music disc must stand in its own right so that people who buy discs *with* pictures will be happy to listen to them *without watching* the pictures. But the pictures must be sufficiently interesting or exciting to warrant the higher purchase price.

Whereas young fans of pop groups may well be prepared to pay the extra for a video disc, and the chance to see their idols performing, most young pop fans are unlikely to have the money to buy a CD-Video player. So they must rely on their parents buying one. And parents will be unlikely to buy a CD-V player to watch pop videos. So the CD-V software catalogue will have to have a very wide appeal. So far it hasn't.

Yes there are operas. But to be visually dramatic they must be mimed to playback. And your average opera star is pretty hopeless at miming.

1989 will decide whether CD-Video turns out to be a turkey, or a valuable new work-source for studios.□

◁ more constructively. For example, the new *F2* system from Martin Audio allows components to be installed in a basic 'rack' cabinet as required.

It is all very well to keep adding cabinets together but there comes a point where the horns will be carrying further than the direct radiators (in spite of coupling) and more control over directionality and coverage becomes necessary.

This problem arises far less with all-horn systems but it is still desirable to have control over at least the far and near fields.

Crucial to good live sound reproduction is amplification and there is a lot of work going on at the moment to find out just what makes a power amplifier 'sound good' while being neutral to the signal, reliable under all conditions and able to drive into reactive loads (protection capacitors for compression drivers can do nasty things to amplifiers). Attitudes towards amplifiers as well as technologies have changed quite a lot in recent years and the end user is now faced with some serious choices.

The area where things are poised to change most is in system control consoles, effects equipment, etc. MIDI has enabled outboard equipment to be pre-programmed and cued in via a MIDI controller, thus avoiding a certain amount of knob-twiddling and allowing complete effects changes to be cued in during performance at the touch of a button.

Live sound engineers have looked on forms of automation for their consoles with a certain amount of justified defiance but it is bound to arrive. The big question is—in what form?

Live sound encompasses more than rock concerts and a certain degree of automation will be beneficial to theatre sound, where the program will be following a set list of scene changes. It is hardly surprising, therefore, that the live sound consoles already existing with automation have been designed for theatre use, where parameters such as channel level, routing, mutes, etc, are called up in a series of 'snapshots' with the operator having the facility of manual override if needed.

The SAJE *Memory* console, which relies exclusively on software for its configurations and is open to dynamic automation, has now reached the stage where it can undergo on-site trials. The first console has been installed in the Bobigny theatre in Paris. The next step will be to see how it stands up to the rigours of the road.

Perhaps the live sound console has now reached its limit in its present form and a more efficient method of control is needed. The present up-market consoles appear to have an increasing collection of 'wouldn't it be nice if' features that are ergonomically unworkable and one can't help thinking that 'less would be more' in many instances.

Any automation will have to incorporate instant manual override as well as defaulting to a manual condition—however basic—in case of failure. You can't tell 50,000 spectators to go and have a coffee while you call the maintenance engineer. The human interface is something that will have to be considered very seriously, as will the implementation of the desired features. For instance, more auxiliary buses is fine but do you really need individual pots for each one?

No doubt some designers would say that engineers have unfounded fears on the reliability of the mighty micro and that there are links in the chain that are much weaker and would have equally catastrophic effects (though I doubt whether serious sound reinforcement companies would work without a spare console power supply, for example). The question that pops up in many people's minds when computer control is mentioned is nearly always: 'what happens if the computer goes down?' It's a bit like the argument over marine steam and diesel engines: you can nearly always keep going with the former in one way or another but a grain of sand in a diesel engine cylinder and it stops dead!

It is interesting that the spearhead of the development towards microprocessor-controlled live sound consoles is from France, with SAJE, Abac-Rustin and Ateis being the front runners. All systems feature a different approach with Abac-Rustin concentrating more on an integrated console to provide a common control system for audio, lighting, video, etc. *(Don't forget the non-console automation systems such as the Stage Accompany-type, Ed.)*

> "Live sound engineers have looked on forms of automation for their consoles with a certain amount of justified defiance. A certain degree of automation will be beneficial to theatre sound, where the program will be following a set list of scene changes."

> "Any automation will have to incorporate instant manual override as well as defaulting to a manual condition—however basic—in case of failure. You can't tell 50,000 spectators to go and have a coffee while you call the maintenance engineer."

The market

Live sound encompasses a whole variety of work even though the accent does tend to fall most on rock concerts and tours. Many of the other activities tend to maintain a discreet distance though sound reinforcement companies are beginning to appreciate that there is a lucrative market in conferencing, A/V presentations, theatre, etc, and are turning their attention to this field.

One area that has quietly been nudging its way in and holds great promise for the future is reinforcement of classical music, with the accent firmly on 'reinforcement'. With concerts moving out of the opera houses and concert halls towards a wider audience, there is a need for quality sound reinforcement and some major companies now have classical music departments.

Though there is a certain amount of opposition from purist elements, this tends to stem from disastrous experiences in the past and is now being overcome by performances that show it can be done properly and greatly enhance the performance for the listener.

Personnel

Not so long ago the PA engineer set up the system and mixed the concert—now the roles are becoming more diversified.

The system engineer (usually with the hire company) has noticeably gained in importance and is responsible for setting up the system and making sure it does what the customer wants—as well as being able to take over in time of crisis. We are also seeing assistant engineers more where each person has his own mix responsibility, rather as in film re-recording.

A new area of development is specialised system equalisation, typified by the SIM process, where a highly trained engineer adjusts the sound reinforcement system for response and intelligibility, and monitors and compensates system response during the performance, thus taking this responsibility out of the balance engineer's hands.

Summary

The future of live sound seems very bright when looking at the possibilities it offers and the coming year should see some interesting developments in equipment. The move is undoubtedly towards a more centralised control of the mixing and outboard functions (this is already typified by the remote control possibilities of some power amplifiers) and only time will tell which approaches will find favour with the engineering community.

Live sound applications will also continue to diversify, pushed by both economic necessity and developing sectors within the market, and it is to be hoped that this will lead to a greater recognition in the world at large that the live sound industry is in fact—an industry.□

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STUDIO SOUND— SUPPLEMENT

Advertisement Index

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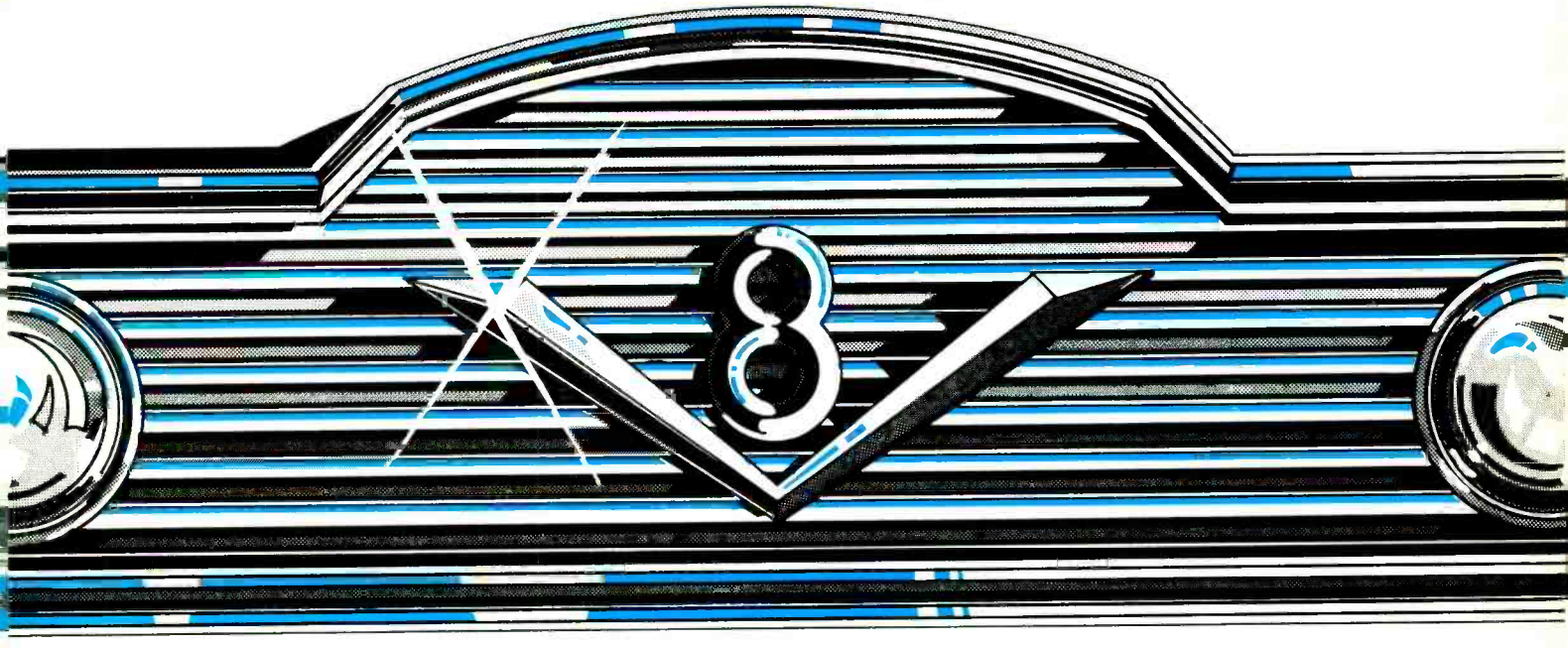

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can foist these RF products past the FCC, there is a strong likelihood that Canada and the EEC countries will be seeing these products in their homes in the near future—not to mention the rest of the world.

The direct threat posed to the audio community is threefold. First, specific licensed RF services used in audio systems will be subjected to both the spectre of increased interference and the effects of a general raising of the background RF noise level. Clearly, wireless microphones are in for it in this new environment. Even today, when a travelling company plays a new hall or a TV news team reports from an unfamiliar space, RF noise pollution frequently kills the system. But a touring company can hunt down offending sources and silence them. If the new range of RF products reaches the marketplace, an unknown device in an adjacent building can lie silent until the night of the performance or until the news crew is rolling tape. Another licensed service scenario encompasses studios equipped to make use of satellite feeds for the purpose of combining tracks from artists in different locations nationally or worldwide. RF interference here would be disastrous to the tracks being recorded and so costly as to cloud the imagination. Studio-to-transmitter links from radio and TV stations are yet another licensed category that could suffer in the new regime.

Curiously, the proposed rule change in the United States does recognise the primacy of the licensed service. So the owner of the satellite system or of the wireless microphone, or the broadcaster whose link has had their signal integrity violated, are licensed via the Commission. They will have the weight of Federal law behind them if they should try to fight a specific source or sources of interference. However, the task of filing first with the Commission and then turning to the civil courts to gain relief from the interference is both daunting and expensive, requiring extensive use of outside counsel. In addition, a studio owner could find himself in the position of suing the consumer arm of a large equipment maker as the manufacturer of the offending product. The professional unit of the same company might just supply him with all his digital and analogue tape recorders. The same dealer might owe the credit arm of the company in question several hundreds of thousands of dollars.

Secondly, the problem of induced, detected and otherwise received RF information in audio components could well assume landmark proportions. We have seen a proliferation of plastic and wood in component cases, covers, panel and assemblies. The materials offer many attractive qualities and have not proved to be a shielding problem with current RF levels extant. However, with a greater concentration of devices all operating at significantly greater levels, the effect of such pollution on audio operations could be substantial. Circuit design is another area of concern. Virtually throughout the industry, designers, and now designers with CAD/CAM systems (Computer Assisted Design/Computer Assisted Manufacturing), have a given level of reference for RF energy to be excluded from their products and systems. If in fact, the RF noise floor were to rise and/or specific RF noise peaks were to reach higher limits, then the potential for serious disturbance of a broad range of professional audio products would be substantial.

> "The old studios did look like Flash Gordon's 1936 spaceship but when you grounded the steel cases, RF interference was known as: 'What?'"

A top audio electronics designer at a well-known company pondered the problem of RF interference: "We have been living with the knowledge that we have an orderly RF world. Now, to be completely honest, the RF noise floor at television stations has been rising, what with the master antenna distribution systems and in-house microwave and satellite capacity and certainly the energy at transmitter locations has been a problem but we still have had defined parameters. Now we are being told that a range of devices, which may well end up in the same environment as our audio equipment, could penetrate our products with interference, anywhere at any time. The problem is that you might have a TV set in a producer's office at a TV station or at a post-production facility with an RF remote control or a personal computer with a wireless keyboard in the office of a studio less than 5 ft through the wall from the mixing console. We have made our products beautiful to look at and ergonomically superb to the human interface but without the absolute protection of the Faraday cage one gets with a 360° steel enclosure. The old studios did look like Flash Gordon's 1936 spaceship but when you grounded the steel cases, RF interference was known as: 'What?' It's a real toss-up in terms of what will happen to plastic and synthetics in cases and enclosures but my vote goes with the interference.

Thirdly, all the studio wiring practices currently extant would in all likelihood have to go out the window in a 'dirty' RF environment. This is not a new problem and the audio industry, like the television broadcaster, is waiting for fibre optic transmission systems to be cost effective for in-house cabling of a television or audio 'plant'. Fibre, of course, is completely interference resistant and is currently in use in high level RF environments by several of the seven regional Bell operating companies and ATT (known on Wall Street as *Snow White and the Seven Dwarfs*).

Portable recording applications would appear to be the most likely area for discomfiture as standard operating procedure in the brave new world of RF interference. Permanent installations would eventually debug their RF problems and carefully police anything brought anywhere into the plant. Audio activities in spaces that share common walls with other tenants have more risk, especially with the new generation of ultrafast (20 MHz and up) personal computers and the wireless keyboards. Computers are one of the worst sources of RF noise in the marketplace. Again, in a permanent setting accommodations can be made. But for the portable recordist, a complete reconnaisance of the vicinity must be made and the careful placement of equipment undertaken to isolate from a possible disturbance during recording.

The home represents the catastrophic culmination of all that could be. The bottom line here is for an electronic future marred by a multitude of devices that have the ability to interfere with other devices over a range of 250 to 500 ft. There is nothing wrong with the design parameters used by consumer electronics equipment makers once the lid is off the spectrum. They want these devices to be able to send signals as in remote speakers, or control items such as video centres with acceptable distance capabilities. The only way that can be achieved is to allow higher powers than at present. No testing has been done to measure the susceptibility of various kinds of audio equipment—professional/semi-professional/consumer—to this kind of RF energy. The concept that seems to be the guiding light here for both the FCC and the makers of these gadgets is the limited range of the devices. Nothing planned will be allowed to cause city-wide interference. Only with a range of half a city block or less will the interference be a problem and only then intermittently. Almost nobody uses these devices at continuous service ratings day after day.

The final answer to this problem is to not let it happen. We are talking here about what could happen within the next 12 to 18 months in the US, and two years elsewhere, if the FCC opens the flood gates because of a pro-business attitude by political appointees and the efforts of paid lobbyists. In the opinion of most Washington analysts, the Commission has deteriorated in its mandated role of protecting the spectrum and regulating RF usage. This is precisely the kind of issue where if the full weight of the professional audio community were thrown into the fray, the likelihood of this RF nightmare transpiring might be greatly reduced.

Unfortunately, that is very much unlikely to happen. The professional and trade societies within the audio industry have shied away from this as with other controversial issues, preferring to do nothing rather than take a risk of being on one side or the other. This is not to fault them totally since their tax-exempt status makes them wary of any interface with the federal government. Perhaps there can be a general alarm mounted and letters written to legislators indicating a need to keep the RF spectrum unsullied.

It is interesting to note that a case of toxic waste pollution can be cleaned up at some considerable cost by digging up the offensive material. When we deal with RF noise pollution from millions and millions of consumer products, it will be virtually impossible to take back that which we may live to regret.□

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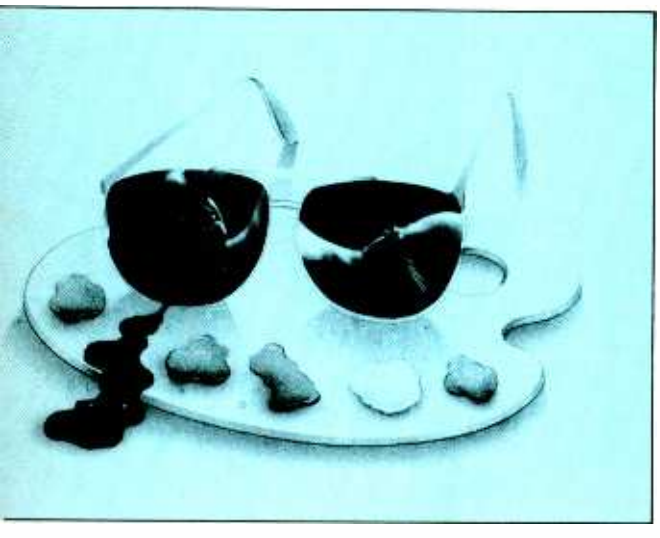

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WHICH AMPLIFIER TECHNOLOGY

PART THREE

This month, Ben Duncan outlines the techniques behind modern, high efficiency power amplifiers, using Classes G and D

Beyond A-B, the alphabetical scheme for Classifying audio power amplifiers continues but becomes progressively disorganised—and in most sound engineers' minds, a little foggy. Classes C to H are all concerned with increasing efficiency, though Class F remains frankly, a bit of a mystery.*

Right now, we can dispense with Class C, which is restricted to RF, or at least to circuits operating over a narrow bandwidth with a resonant load. Also, we'll come round to Class D later, for reasons that will become apparent.

Audio power: a new understanding

In 1972 Robert Carver, then President of Phase Linear Inc, published a paper[1] outlining Phase Linear's research into sonic differences between power amplifiers. Its aim: to explain why Phase Linear had launched a model producing 700 W, then a fairly outrageous power. In it, Carver cites a series of measurements which drive home a fact that was (and still remains) less well-known than it should be: that the 'loudness' capability of a power amplifier depends principally on the supply rail's regulation and voltage. In other words, for a given loudspeaker, the peak sound intensity (whether experienced or measured[2]) doesn't necessarily correlate, as might be expected, with the amplifier's rated power.

Carver noted that this was particularly true if the amplifier's power supply was fairly 'soft' ie one exhibiting significant voltage sag on continuous drive thanks to an undersized transformer or reservoir capacitors. For example, an amplifier rated for a continuous 100 W (into 8 Ω) with a badly soggy supply dropping from ±65 V to ±45 V on load, could sound louder on music passages, than a 200 W amplifier (again into 8 Ω), with tightly regulated rails of ±57 V. Although Bob Carver wasn't the first person to stumble across the effect, judging by what he subsequently implemented, he clearly glimpsed consequences that others didn't. Today, the effect is recognised as 'dynamic headroom'.

For domestic hi-fi in the US, the IHF defined dynamic headroom over a decade ago. It's the maximum average (or short term RMS) power available for just 20 ms every 500 ms, beyond the rated continuous power. Sometimes it's called 'burst power'. Today, there's documentary evidence[3] of something amplifier designers and discriminating listeners have long suspected. Music's peak SPL requirements can extend in bursts to 300 ms and beyond, with a 20% duty cycle, ie lengthy transient bursts can recur every 1 to 2 seconds. It follows that IHF 'burst power' ratings are next to useless: They don't provide the data to distinguish good amplifiers from mediocre specimens. To be taken seriously, future amplifier designs will need to quote burst power over more realistic intervals.

Meanwhile, another august US body, the FTC, insist that an amplifier's advertised power rating is the average (RMS) power with a continuous sinewave, into a resistive load. No doubt, this ruling exists to prevent the public being misled by 'watts peak' (twice the average or RMS power) or 'Sinclair watts'. Until recently, all reputable pro-audio power amplifiers were routinely designed to meet this kind of standard, and have been reviewed accordingly. Given a driveable speaker, amplifiers of this calibre maintain their rated power on all kinds of signals: continuous or erratic, triangular, compressed, asymmetric or just plain random, for days on end. At the same time, amplifiers designed solely to meet the FTC's requirements tend to have dynamic headroom approaching 0 dB. Their stiff power supplies result in an output which very nearly doubles with every halving of load impedance, until the output protection cuts in.

A possible argument against the FTC specification is that it penalises legitimate designs which sacrifice high continuous power for effective burst power. As a result pro users have perhaps been paying for unnecessarily heavyweight amplifiers. And why? Is it solely to sustain the rated power under unrealistic conditions, namely with continuous high level waveforms, surely the stuff of industry? Or is there some other reason? Surely, granted that pro-audio amplifiers are restricted to music and speech, the only steady tones are slates, occasional violins, or *avante garde* synth players, none of them requiring anything like 0 dBVR from an amplifier that's adequately rated (torture chambers excepted)?

Class G

In 1977, Hitachi introduced a range of domestic amplifiers and receivers labelled *Dynaharmony*, which aimed to overcome the problems of clipping during loud passages, by radical and well considered means. Of course, the professional's curt reply would be to dig deeper and buy an amplifier with a high enough (continuous) power rating in the first place. Then again, Japanese accountants saw that the added cost, weight and size involved in attaining a 'proper' power headroom would detract from attaining a high sales volume in the domestic market.

Recognising that 50 to 70% of the power needed to avoid clipping on full-range signals with (note) wide dynamic range, is only called for 5 to 10% of the time, Hitachi produced an amplifier which could extend its headroom to accommodate loud passages. Looking at **Fig 1**, TR1-4 comprise a conventional 100 W into 8 Ω class A-B amplifier stage. Provided the instantaneous signal voltage is below 40 V, the remaining transistors (TR5-8) are cut off. But once the signal swing exceeds ±40 V, TR5, 6 or 7, 8 are brought into action. Being energised from a ±95 V rail, the amplifier's headroom is now raised accordingly, to around 500 W, for as long as it's required. At the same time, fast diodes D1, 2 switch or *commutate* the lower, ±40 V rails.

In domestic realms, *Dynaharmony* is just a distant memory. One leading UK reviewer didn't rate the *HMA 8300*'s sonic quality. However, the topology wasn't held directly responsible. In particular, Hitachi overcame the most immediate objection: they succeeded in attenuating switching spikes generated by the diodes during commutation. At the time, the argument was that Class G was a needless complication, since the "...ear is surprisingly insensitive to momentary and well behaved clipping, hence Hitachi have little guarantee their amplifier will sound better."[4]

The average domestic user must have feared the transient capabilities of Class G, imagining he had to own speakers rated at 500 W+, to be safe. Now although most drive units can handle 3 to 10 times their rated power handling for musically significant periods (ie 10 to 500 ms), most domestic HF drivers, being rated at 3 to 5 W RMS for continuous tones, are already making use of this safety factor. On this basis, the consumer's angst was justified. It seems clear that Class G was doomed in the domestic field owing to the absence of drive units, which had excursion and thermal capabilities commensurate with the transient power on offer. Without these, sonic quality was inevitably marred by thermal compression, cone and suspension break up, or sudden silence. Pro-audio users had no such qualms. But recognition and acceptance of Class G was slow to dawn.

Today's makers

In 1981, Bob Carver, having left Phase Linear to set up his own Carver Corporation, unveiled a domestic amplifier which confounded the establishment. Model *M400A* (better known as the 'Carver Cube') weighed under 10 lb and measured just 6.8 in³, yet claimed 500 W output. When driven with music signals, the claim was found to be true. Although relying most of all on a new and radical power supply for its exceptional power-to-weight ratio, the *Cube*'s designer hadn't forgotten what he'd learnt nine years earlier. The ▷

◁ *M400A*'s output stage contributed to economy of heatsinking, by employing (you guessed) a subtle variation on, and refinement of, Hitachi's Class G topology.

Anyone who's perused Carver's literature (**Fig 2**) should be forgiven for thinking otherwise, for "...Carver has a penchant for creating names for...circuits which don't always reflect exactly what the circuits actually do..."[5]. In this instance, the brochure gives the impression that a '15 W linear amplifier' achieves the headroom of a 500 W amplifier by being commutated between a series of ascending rail voltages[6]. Although dubbed 'Class H', the *M400A*'s output stage is no more than a cleverly disguised description of (or a 'new way of looking at') Class G, given that the commutated output devices are followers (ie with unity voltage gain). On reading this, Bob Carver exclaimed "If I invent it, I get to name it anything I want. Of course, it's only fair if my circuits actually do what I claim they do."

Since 1983, Carver's circuitry has been refined and repackaged for pro-audio users in the form of the *PM.175, 350* and *1.5*. Meanwhile, over on the US West Coast, a manufacturer called QSC had established a line of amplifiers called *Series I*. Their engineering blended some of the elegant ideas employed around the same time by Crown (eg a ground referenced output and mica-less output device mounting) to provide a vastly simplified circuit with workable protection and effective yet lightweight heat exchangers. In 1984, QSC introduced their *Series III*, which retained the ground referenced output, marrying this with an improved Class G output stage. More recently, the series type of scheme (**Fig 3**) has been spotted in Crest Audio's models *6001, 7001* and *8001*; and earlier, in Yamaha's mammoth, 5U high *5002M*, now obsolete. If anything, this shows how the Japanese tinker with amplifier technology, while US companies get stuck in.

Early in 1978, shortly after Hitachi's *Dynaharmony* was launched, Matsushita published a rival idea using a floating supply which 'wobbled' to make the total rail voltage available to signals of either polarity. In 1985, Rauch Precision's *DVT-500*s employed a similar technique to produce two channels of 1 kW into 8 Ω in a 3U enclosure. At the time of writing, BSS Audio in the UK has taken Class G still further. In their *EPC-780*, shunt-mode commutation involves progressive transfer between three supply rails, instead of hard switching. At the same time, the output stage is configured as an asymmetric bridge[7]. Altogether, Class G's direct effect on efficiency, size and weight have been augmented with the indirect, power saving benefits of 'bridged-bridge' outputs (Part 2, *Studio Sound*, January 1989). But rather than use the extra efficiency so gained, to squeeze yet more watts per channel into the smallest possible box, BSS have chosen to use commutation to reduce mean temperatures, and thereby prolong MTBF.

Competing circuits compared

There should be no illusions about free lunches. Even if you are lucky enough to stumble across a smart solution, you may still have to pay if nature outsmarts you. Class G type techniques certainly need careful thought. At the outset, Class G seems to save on heat exchanger capacity. If the high voltage tiers are energised only 5 to 10% of the time, the average waste heat must be reduced, almost in proportion. Why? Well, waste heat is directly proportional to power dissipation in the output devices. In turn, dissipation is proportional to the product of the voltage across the active output devices, and the current passing through them, ie P=VI. The latter depends on the speaker(s) connected, so it lies beyond the amplifier designer's control. Which leaves the voltage to be sustained, V_{SUS}. When a Class A-B amplifier is driven with programme, V_{SUS} typically averages 80 to 90% of the rail voltage. But with Class G, the output devices are only being asked to sustain the higher rail voltages (V_{SUS} 1+2 in **Fig 1**) that provide the desired headroom, for only 5 to 10% of the time...always provided the signal has the dispersive characteristics of music.

The occasions when the PMR of music programme becomes dangerously close to that of a continuous sinewave are threefold. Two are obvious: when the signal is clipped or highly compressed. The other, less obvious. When an active crossover is used to split the audio spectrum into two, three or even five bands, dispersion ends in chaos. With one or more *bifurcations*, the reduction in music's PMR is especially dramatic at low frequencies. It follows that to be satisfactory, a power amplifier driving bass (and sub-bass) in a PA rig mustn't rely on Class G overmuch for burst power. The bottom end of an active monitoring or PA system is one place where continuous welly still counts.

In the series mode scheme, developed by Hitachi (**Fig 1**) and refined by Carver (**Fig 3**), the transistor(s) between each tier handle a fraction of the total rail voltage. For example, TR3 in **Fig 3** sees no more than (124−76) = 48 V. Conversely, the series connection means each transistor potentially needs to handle the maximum rated current output. This is no bad thing, since the reactive load presented by real loudspeakers can demand maximum current at any output voltage. At the same time, for three tiers of rail voltage, three times as many output transistors are called for, compared to a comparably rated Class A-B output stage. Fortunately, as with bridging, the benign voltage rating facilitates the economic sourcing of transistors with high current and fat SOA ratings.

Although extra dissipation arises from the series connection, Carver points out that it's offset by the fact that music and speech programme average 10 to 30% of maximum output power, unless hard clipped. Carver's *PM* series amplifiers also use three supply rail tiers (and four in model *M 2.0*) to gain further, second-order improvements in efficiency. There remain two snags. First, the output devices have to be mutually insulated. This means the transistors either suffer higher average temperatures owing to the thermal resistance of mica washers, or else live on separate heatsinks. Carver adopts the former. But if the latter option were chosen, full-scale ▷

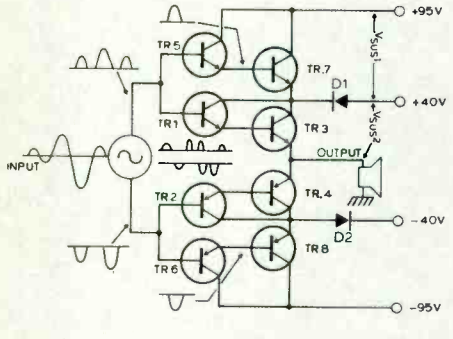

FIG 1 HITACHI HMA 8300 SIMPLIFIED SCHEMATIC

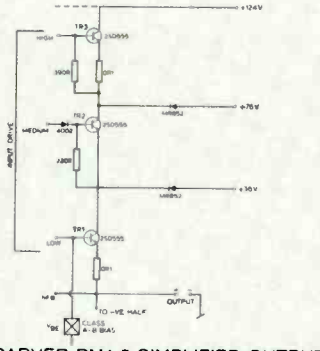

FIG 3 CARVER PM1.5 SIMPLIFIED OUTPUT STAGE

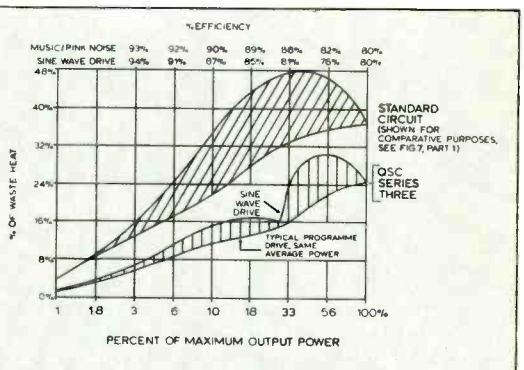

FIG 5 CLASS G EFFICIENCY BASED ON QSC SERIES III TOPOLOGY

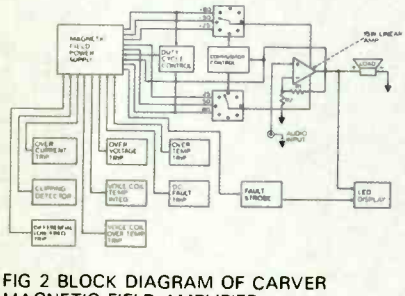

FIG 2 BLOCK DIAGRAM OF CARVER MAGNETIC FIELD AMPLIFIER

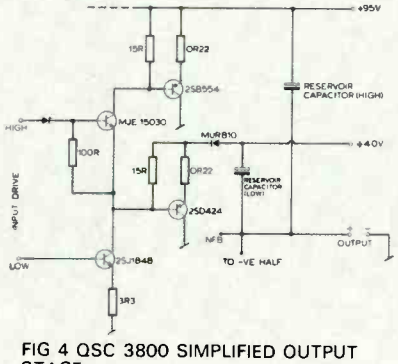

FIG 4 QSC 3800 SIMPLIFIED OUTPUT STAGE

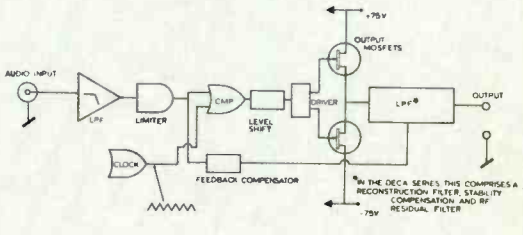

FIG 6 AUDIO PWM AMPLIFIER BLOCK SCHEMATIC (BASED ON PEAVEY DECA 1200)

heatsinks would be required for each tier, to be sure each could safely handle worst case dissipation, ie an unfortunate combination of capacitative loading *and* a signal with a small PMR. Second, the switching spike residual is finite, though the application of Carver's amplifiers in studio monitoring suggests it's not as audible as oscilloscope traces make it appear. In Carver's own heroic words "If they had been audible, I would have engineered the glitches away somehow".

In QSC's *Series III* output stage topology (**Fig 4**), there are just two tiers of output devices and these are shunt connected. In consequence, there are no large scale spikes in the output; the period of transition is more like Class A-B crossover. To support this, QSC quote a near worst case distortion contribution of >0.03% at 20 kHz at −6 dBVR. Though it's not immediately apparent, the upper tier of output devices normally sustain less than the full rail voltage, and with music programme, the transistors in each tier share the power dissipation almost equally between them.

As with the series scheme, for *n*-rails, *n* times as many output devices are required. But with the shunt connection, there's a soft-fail mode; the amplifier can continue working with reduced efficiency if one or more transistors expire. QSC's designer, Pat Quilter also points out that the shunt mode reduces saturation losses. It follows that a Class G amplifier operating in shunt mode will run cooler than one based on series topology, when handling actively-split programme, on musak (definition: PMR = <5 dB!), and whenever wilful abuse occurs, namely hard clip.

For a given amount of feedback, the shunt-mode goes on to exhibit a better (lower) open-loop output impedance under large signal conditions, which helps to keep interface intermodulation effects at bay—where it really matters. Finally, given QSC's clever topology, shunt connection allows all the transistors of common polarity between different tiers, to be directly mounted on a single, common heatsink. The upshot is that a given volume (not to mention weight) of aluminium alloy is kept 'filled with heat' most of the time, dispersion notwithstanding. Here lies another dimension of amplifier efficiency: the percentage utilisation of nett thermal capacity.

The efficiency of QSC's *Series III* amplifiers (seen in **Fig 5**, below the hatched curve for conventional Class A-B output stages) shows off the performance of pure Class G at its best. By contrast, the series scheme adopted by most other manufacturers of Class G amplifiers is progressively less efficient for signal levels averaging >−5 dBVR, ie above 30% of full power. If the signal is compressed, clipped or bassy enough for these kind of conditions to be prevalent, then the difference is a significant one. At 56% of full power (−2.7 dBVR), Carver quote 65.7% whereas QSC's curve (**Fig 5**) indicates 76% with sine waves, and 82% with music drive. But with substantially uncompressed music and speech, the difference recedes.

One question remains. Did the Japanese really invent Class G? The answer is no. Peter Baxandall kindly unearthed a reference[8] to a circuit described as a 'Quasi linear' amplifier. It appears in a 23-year-old American textbook, and anticipates **Fig 1** in every significant detail.

Beyond analogue: digilogue

In spite of their differences, all the amplifier types we've looked at so far are analogue: they are concerned with linear power conversion, where the output devices act as a modulated resistance. Take any ordinary power amplifier, drive it into hard clip with a decent squarewave, and it's likely to run cooler than when it's driven with music—for the same RMS power into a resistive test load. So what?

Let's recap: dissipation in all linear amplifiers varies according to the signal's instantaneous voltage (expressed as a % of the supply rail) and the time spent in regions of high or low dissipation. Thus practical efficiency varies with drive level, waveform shape and duty cycle. In Class A, standing current helps mask these effects, whereas for Classes A-B and G, dissipation reaches its minima when the signal voltage is close to its maximum capability, near either rail. At this point, dissipation in both halves of a Class B or G output stage is close to nil—always presuming the wiring and output transistors have low resistance, hence negligible I^2R losses.

For *any* split rail, push-pull amplifier (ie with conjugate pairs, running off ± supply rails), the 0 V (quiescent) point is the opposite minima, only here, dissipation is somewhat higher, depending on the standing current employed. During the waveform's transition to all other voltages (lying between +Vs and 0 V and 0 V to −Vs), dissipation increases to a lesser or greater degree. It's this area that both sinewaves and music waveforms spend most of their time traversing. Imagine though, that music were conveniently composed of perfectly neat and oversized squarewaves, meaning the output devices acted purely as switches. Then dissipation would shrink and even conventional output stages would closely approach 100% efficiency. Pursuing this line of thought eventually leads us to the principles of Class D or Pulse Width Modulation (PWM) amplification.

Introduction to Class D

While the origination and subsequent development of Class G owes much to US engineers, Class D has a thoroughly English pedigree. The distinguished expatriate engineer Norman Crowhurst is credited with the early development of Class D audio amplification[9], along with Sir Clive Sinclair. Sinclair's *X-10* amplifier was released in the autumn (fall) of 1964. It was temperamental, and when it did work, the output power was barely 2½ W. Sinclair's *Mk 2*, the *X-20* easily produced 20 W RMS, but suffered from the inconsistencies and limitations of the germanium transistors available at the time[10].

Twenty years have had to pass before Class D techniques received serious attention from power amplifier manufacturers. Rapid developments in MOSFETs in the early 1980s set the scene. Around the same time, a third Englishman, Brian Attwood wrote a paper[11] which set the ball rolling again. Five years later, his ideas are to be found embodied in a range of amplifiers made by a US company. Not before time, Class D has finally been dragged kicking and screaming into the closing frames of the 20th century.

Today, high power Class D amplifiers are being sold under a misleading title: 'digital'. It's an odd coincidence that the classification letter (originated 25 years ago, its position in the classificatory alphabet dates it) appears to stand for '*D*igital'. In fact, the Pulse Width Modulation (PWM) techniques employed under the lid are ▷

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◁ positively unrelated to CD and DAT's Pulse Code Modulation (PCM). Rather, the practical embodiment of this technology is more of a hybrid affair between a switching power supply and an FM radio transceiver. Today's designs rely on MOSFETs, switching at around 500 kHz.

Looking into **Fig 6**, the essential recipe begins with a triangle wave with a frequency that's much higher than audio, typically 500 kHz, and preferably shared between two channels, for mutual synchronisation. The incoming audio is filtered and limited. The difference between the two signals emerges from a fast comparator (CMP) as a square wave with a duty cycle that's proportional to amplitude, at a 'sample rate' that's much higher than audio. In turn the square wave switches a pair of output devices, hung as usual, between ±ve rails. Today's designs rely on MOSFETs because the switching speeds of comparably rugged bi-polar transistors is inadequate. A lowpass filter (LPF) reconstructs the original audio at the same time gobbling up (most of) the sampling hash. With the amplifier's output devices reduced to on-off switches, efficiency should approach 100%.

Scrutiny

At the time of writing, commercial realisations of Class D audio amplification are the first of a new generation. They need careful scrutiny. The calibre of engineering design needed to produce a PWM amplifier that's measurably and audibly on a par with equivalent 'analogue' amplifiers is truly formidable. For example, generous helpings of negative feedback can't be applied to 'kiss it better'. For analogue feedback, we naturally need to 'sample' the reconstructed output. So the feedback is derived after the output lowpass filter. The accompanying phase shift typically limits feedback to just 20 dB at high frequencies. It follows that open loop linearity has to be good to secure respectable THD and IMD figures at HF. Linearity depends in turn on the comparator's incisiveness, and the precise matching of each MOSFET's switching speed at high frequencies.

The makers of Class D amplifiers routinely claim efficiencies of 90% and over, irrespective of output level. Amplifier efficiencies of this order need careful definition, taking care for example, to exclude the power drawn by auxiliary parts, such as LEDs and relays. Equally, Class D efficiency figures should also be plotted across the audio bandwidth.

At the present state of development, comfortable operation up to 40 kHz is the 'leading edge'. But with first and second generation models, ascending frequency (or for music, increasing HF spectral content) caused switching losses to multiply rapidly. Steep lowpass input filtration above 20 kHz (already necessary to prevent aliasing) appears to be doubly desirable in some designs to protect the output stage from an HF fry-up. In a well-known, UK-made Class D amplifier, the HF response was found to roll-off as 0 dBVR was approached, presumably for protection. Meanwhile, in the US, a switching power supply manufacturer who has diversified into PWM amplification, is even offering pro-audio users an industrial PWM amplifier that's limited to 1 kHz, recommending it for bass amplification. The message is that while crude but efficient PWM amplifiers abound in industry, workable 'audio grade' PWM amplifiers are scarce, presently being limited to Peavey (US), HIT (UK) and Japan (Inc.).

With an RF squarewave let loose among sensitive circuitry, there's plenty of scope for harmonic radiation and modulation. Inside a PWM amplifier, the presence of RF on the comparator's inputs is particularly nasty. The thought of externally conducted and radiated RFI in a studio is even worse. The output reconstruction filter helps, but only so much, particularly without the benefit of a defined and matched load reactance. Loudspeakers are largely protected by the lowpass effect of their voice coil inductance, which leaves the speaker cables to radiate residual RF hash. In Peavey's *DECA* (Digital Energy Conversion Amplifier) series, representing the most refined Class D technology to date, Peavey quote conformance to FCC regulations for *'A Class B computing device, part 15(j)'*, with a pk-pk output ripple of <10 mV. The SNR of Class D amplifiers also needs careful assessment, particularly for studio monitoring.

Once the potential shortcomings have been overcome to everyone's satisfaction, the ultimate outcome *should* be that PWM amplification either sweeps the board, or provides a valued alternative to hi-tech variations of Class G—each having its trade-offs. At best, this will take time, because most of today's large scale users have already invested their 2 to 5 year capital budgets on analogue power amplifiers. Who will be first?

Glossary and abbreviations

Digilogue: circuits containing hybrid functional blocks which are in part both digital and analogue, eg comparators, clocks and modulators.
FTC: Federal Trade Commission (USA).
IHF: Institute of High Fidelity (USA).
MTBF: Mean Time Between Failure(s).
PMR: Peak to Mean Ratio (Crest factor).

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Further reading

Saburo Funada, 'A study of high efficiency audio power amplifiers using a voltage switching method', *JAES* Oct 1984
Tomlinson Holman, 'The amplifier-loudspeaker interface', *Hi-fi News & Record Review*, Dec 1980
*Can any readers enlighten us?

Which amplifier technology—correction: In part one, which appeared in the December issue, the artwork was transposed so the wrong diagrams were related to the captions. Here is the correct version.

FIG 1 VOLTAGE, CURRENT AND POWER RELATIONSHIPS IN CLASS A POWER AMPLIFIERS

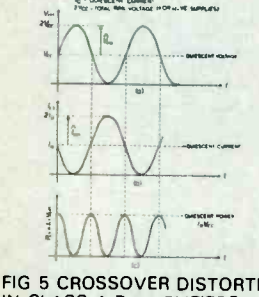


FIG 2 CLASS A OUTPUT STAGE WITH ACTIVE COLLECTOR LOAD

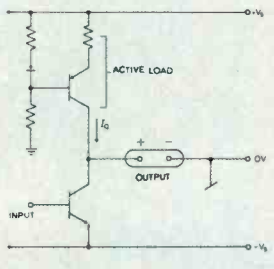


FIG 3 CLASS A OUTPUT STAGE PUSH-PULL CONFIGURATION

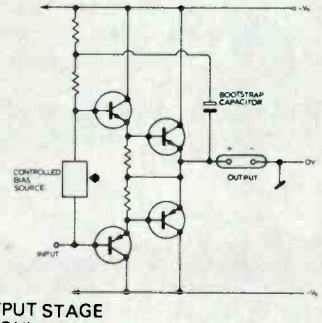


FIG 4 HILL DX SERIES SLIDING-BIAS OUTPUT SCHEME (SIMPLIFIED)

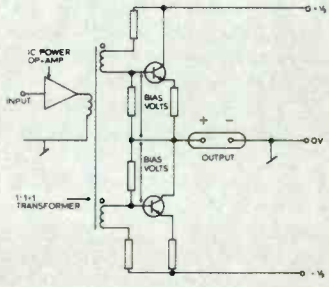


FIG 5 CROSSOVER DISTORTION IN CLASS A-B AMPLIFIERS

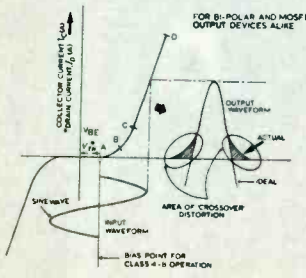


FIG 6 CLASS A-B OUTPUT STAGE (ELEMENTARY VERSION)

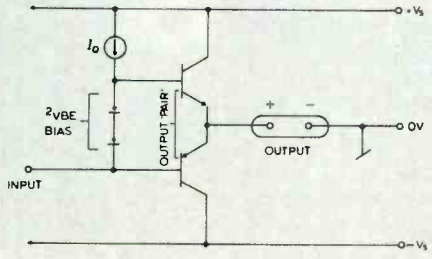
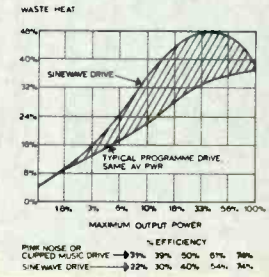


FIG 7 CLASS A-B EFFICIENCY



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AKG ADR 68K

Dave Foister evaluates a software-based digital reverb and effects processor

A common complaint about signal processors whose functions are defined within software is a lack of identity, and many feel that a software basis is too often used as an excuse for not getting it right first time. Problems are too easily swept aside with explanations like "Yours must be an early software revision—try this new EPROM" and after doing this three or four times you eventually end up with the product you thought you'd bought in the first place.

The other side of the coin is a product that keeps up with developing techniques and demands by means of prompt and comprehensive software rewrites, and a classic example of this is the *ADR 68K* digital reverb and effects processor from AKG. Originally developed by Ursa Major before the company was acquired by AKG some years ago, its exterior remains virtually unchanged while its functions and capabilities, being entirely software-based, have developed far enough for it to have been justifiably seen as a new product on more than one occasion. The current release is Revision *4.0* and its range of facilities must qualify it as one of the most versatile and controllable effects units available.

Revision *4.0*'s algorithms comprise six reverb algorithms, a dual DDL, chorus, sampling, stereo processors and a multi-effects algorithm, all well-represented in the 50 factory presets. All the presets may be used as starting points for user configurations, which may then be stored in 50 internal presets or on a plug-in cartridge. Because of the software nature of the unit, there are comparatively few dedicated controls; six faders and six associated buttons all have multiple functions defined in software. These vary not only according to which algorithm is in use but to which page of control parameters is currently active. Fortunately, the design avoids giving these controls any names at all—such as F1, Softkey1 or whatever—but directly names each control in the display window according to its current function in a similar way to the Lexicon *LARC* remote but with longer names. All controls (apart from mains power and the cartridge slot), the large LCD display and the metering (input levels and internal signal levels) are on the remote, which comes with a substantial length of reasonably manageable cable.

The reverb algorithms cover plates, rooms, halls, chambers, reverse effects and combinations of different reverbs and of reverb and other effects. Some algorithms differ slightly in the parameters available for adjustment but as a rule the degree of control is considerable. For instance, individual adjustment is possible of each early reflection's delay and amplitude, density of reverb at the beginning and end of its envelope independently, randomness of the reverb tail, a parameter called 'punch', which adjusts the proportion of early echoes within the reverb, and one called 'depth', which adjusts the apparent distance between the listener and the sound source in a way which quite clearly is a lot more complex than a simple wet/dry mix control. All the more familiar parameters are there of course, including room size, pre-delay, HF and LF decay factors and HF bandwidth.

If it seems curious that there is no algorithm for gated reverb, the reason is that virtually all the algorithms can be used as the basis for gated effects using the simple but powerful idea of two sets of reverb parameters, which AKG call Running Reverb and Stopped Reverb. While the input signal is above an adjustable threshold, the Running parameters are active; once the input falls below threshold and after a 'Stop Delay' time (also adjustable) the Stopped parameters take over. This makes all kinds of gated effects possible, from many variations in 'open' size and shut-off decay to weird effects where the 'idling' reverb is actually longer than that with signal present.

Most of the algorithms operate in true stereo, ideally requiring a stereo input. This obviously doesn't mean that inputs on the left only produce reverb on the left but it does clever things with the early reflections, which give a stereo picture in the reverb beyond the simple randomness of many effects. Listening to the reverb returns alone it is possible to locate approximately the original stereo positions of the input sources despite the full all-enveloping reverb. It is touches like these, along with its simple versatile controls, which make the sound of the *ADR 68K* so

pleasant to work with. As usual, I have been using the unit on a wide variety of musical material, from classical to rock to funk with a lot of jazz thrown in. Jazz enthusiasts (when they care at all about the sound) are notoriously hard to please when it comes to naturalness; I've had nothing but compliments about this reverb, whether I've been simulating a jazz club (using a variation on the factory 'Club' preset) or just adding space and warmth.

Small-scale classical music is also a tough test for a reverb, and the *ADR 68K* passes with flying colours, creating a variety of believable halls and recital rooms. For pop/rock/commercial projects the variety, power, programming simplicity and above all sounds are there for the job. It's an extremely versatile reverb, a versatility further enhanced by its Split algorithms, which allow the unit to be used as two independent stereo processors simultaneously, under full user control and with only a few of the adjustable parameters unavailable. For example, the Plate/Hall algorithm provides a stereo plate (which can be gated) and a stereo hall simultaneously and independently, with separate mono inputs and separate stereo outputs—the unit has two auxiliary outputs, the signal appearing on which varies from algorithm to algorithm with a good degree of user control.

Other Split algorithms divide the unit into a stereo reverb and either a chorus or a DDL, which again are slightly simplified versions of the full-blown effects available from their own algorithms. The DDLs provide two full-bandwidth delays, adjustable from 160s to 2s, with all the usual trimmings like variable feedback gain and modulation depth and speed, and the two can be configured in three formats, split (independent), parallel and chained (series). The Poly-Chorus algorithm provides up to six taps of modulated delay, again with all the expected controls and a couple more.

The Stereo Processor algorithms offer four different methods of synthesising stereo from a mono source, from familiar comb filter methods (it has two) to a Room synthesis and a Multitap system, which while very stable and clean can give problems on percussive material. I'm no great fan of fake stereo generators; I've not heard one yet that was really convincing, although these come as near as any. This section also features a Haas-effect panner.

The Multi-Effects algorithm offers a combination of most of the effects already described, simultaneously in one big set of control pages. The facilities offered here are, in order, a 2-channel DDL, 2-band EQ, Hall reverb with a multitap echo generator on its input, stereo chorus, another stereo multitap delay, two simple gates, a mixer for keeping it all in order and a selector for what should appear on the aux outputs. As with most of the other algorithms, a lot of control is provided as to what goes into the processor and what goes where when it comes out the other end, and one of the things which can be mixed into the inputs is the *ADR 68K*'s own Sampler section.

The Sampler operates in various modes, from a single sample (16.8 s stereo or 33.5 s mono) to multiple samples (up to 12 mono or six stereo) of variable or fixed (2.04 s) length, this last being the only mode portable into the other effects. It is clear that this bit of the unit is not intended to provide competition for, say, the Akai *S-1000*; only one of the program types can have its pitch shifted, there is no polyphony, editing is restricted to finding the beginning and end points and setting attack and decay times, and the only way of storing samples is to an external storage device via MIDI, either using SDS or AKG's faster and higher quality SysEx messages. What it does have however, is perfectly adequate for things like drum replacement (triggering from audio signals or MIDI notes or controllers is available) and can be used while the unit is doing all its other jobs at the same time. Sampling into it and editing is very easy, a nice touch being its editing technique, where as you move the fader to shift the edit point it continuously plays you the 20 ms slice around the current point. The sound quality is good, being 16-bit linear but perhaps suffers more than the other effects from the 15 kHz bandwidth of the unit.

The MIDI spec of the *ADR 68K* is probably the most sophisticated I have ever seen. Every possible incoming MIDI control message can be mapped by the user to any of a preset's functions, and each preset has its own independent map. This allows neat tricks like mapping the delay time of the DDLs to the MIDI clock rate, so that carefully-adjusted delay settings will stay in time if the tempo of the piece is changed. A single controller can do two things in different ranges of its travel, so that for instance the Bend wheel could decrease the reverb time when moved up and increase the HF bandwidth when down.

Further sophistication still is provided by Transmit and Receive modes, which allow full automation of the unit. Every possible control action on the *ADR 68K* will send out its own MIDI code—using standard General Purpose Controller codes, not SysEx—which can be recorded on any sequencer and played back to duplicate the sequence of changes. This includes not only changing programs and adjusting faders but changing control pages, modifying MIDI maps—anything that can be done from the panel.

I found the *ADR 68K* an extremely useful piece of equipment to have around. It provides a large battery of powerful controllable effects, a variety which could be bewildering if it were not for the intuitive method of operation, aided by context-sensitive Help screens. My only real reservation is that the unit I had had an alarming tendency to lock up for no apparent reason and with worrying regularity—it would still be working but nothing on the remote would function, even the metering was frozen—although I am prepared to accept that as a one-off fault on the review sample which I had no time to investigate. Assuming that to be the case, I would say the AKG *ADR 68K* is virtually everything you could currently want from a digital effects processor and more besides, and probably, because of its independence from its hardware, will become even more so in the future.

If the concept of a 'software product' taken to this extreme has a drawback it is that to the uninitiated the *ADR 68K* still looks like an old piece of equipment. Unless potential users are aware of what's gone on inside the box in the software department they may write it off as still being the old Ursa Major reverb, perhaps slightly souped up, and indeed if that were what it was it would obviously be becoming less rather than more relevant with the passage of time. Whatever people say to the contrary, a new designer case and lots of new lights and switches must help sell a new product, and the way the *ADR 68K* has developed it loses that impact. It is a sad reflection on the flavour-of-the-month oriented business in a way, since the AKG unit is offering virtual optimised signal processing and control without having to hike the price to pay for flash packaging and retooling, and yet its means of doing this may be its own worst enemy sales-wise. It deserves more intelligent appraisal.□

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Eventide Ultra-Harmonizer

Patrick Stapley tries out the latest digital signal processor from Eventide

Eventide have been making digital signal processing equipment for many years now, having started when digital was a mere twinkle in the eyes of most other manufacturers. In fact, the company began as a tiny night-time operation, making digital clocks for radio stations: hence the original name, Eventide Clock Works. This somewhat tenuous link between digital and audio led to the development of signal processors such as the *1745*, which was a delay line incorporating pitch shift. A great deal of interest was shown in this new effect and as a result the *910 Harmonizer* was introduced. Such was its success that the name *Harmonizer* soon became synonymous with pitch shifting, adding a new word to the studio dictionary. Since then the *Harmonizer* has developed and improved with the introduction of the extremely popular *949*, and the not so popular *969*. The *Ultra-Harmonizer* is the latest in this family, with five years gap between it and the *969*. The *H3000* is called 'Ultra' because it does a great deal more than the earlier models and there seems to be a degree of design influence from the *SP2016* effects processor.

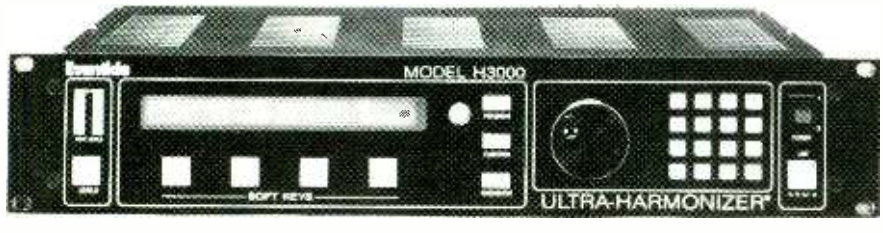
The dimensions 19×3½×13½ inches/ 483×89×343 mm (whd). The front panel is divided into four areas and has an uncluttered, straightforward appearance. Looking from left to right, the first area contains a pair of 10-segment bargraph input meters, going from green to yellow at segment 8, and from yellow to red (clipping) at segment 10. Situated below these is the Levels button, which switches the system into level adjust mode for both inputs and outputs. The next section houses a 6 inch/152 mm yellow display window, which has an adjustable contrast. Directly below this are four softkeys and, in a column to the right, are three other buttons labelled: Program, Function and Parameter. The third area contains a large continuously rotating knob and a 4×4 keypad. The last section has a system bypass button and the power switch.

At the back of the unit are the audio I/Os on balanced *XLR*s: MIDI In, Thru, and Out; mains, and three blanked off ports for future expansion.

Operation

The display consists of two lines. The top line gives information on the program number, its name and the parameter or function that is currently under control. The bottom line contains the menu, which is divided among the four softkeys, and depending on the current function, they will perform different tasks. The rotating knob is responsible for changing parameter values, moving through programs, running through MIDI patches, etc. To load a program the *H3000* must be switched to the correct mode using the Program button, which cycles through four operational modes. The display will show the name and number of the currently available program, and a Load message directly above Softkey 1. A program is then chosen using either the rotating knob, the keypad up and down arrows, or the keypad numbers. Once the correct program is displayed, it is loaded by pressing Softkey 1. The display will now change, showing a parameter above each softkey, so in the case of one of the pitch shift programs, the four softkeys will act as access buttons for Coarse, Fine, Delay and Feedback. As a parameter is accessed, the top line of the display will give a readout of its value, which can then be edited using the rotating knob.

Of course there are more than just four parameters per program and this is where the Parameter button comes into action. This button cycles through the available parameters including those belonging to Expert mode, which enables the user to modify programs in much greater detail. Once a program has been edited it can be stored under a new name and number. This mode of operation is another that is entered from the Program key. There is also a facility called Last Edit, which will reinstate the most recent program along with any edited parameters. Factory programs cannot be overwritten or erased and this makes them immediately distinguishable from user programs, which have a Remove option. This covers the basic operation, which is uncomplicated and reasonably fast.



Algorithms and programs

There are two versions available, one is designed for studio work and the other is intended for broadcast use. The broadcast version contains an extra three algorithms, which provide sound effects, vocal processing and the stereo time squeeze/stretch facility. This article shall concentrate on the studio version.

The *H3000* contains 999 program addresses and, at the moment, 68 of these are devoted to factory presets. Depending on the complexity of user modified programs, there will be room for storing approximately 400. The programs are based around 11 algorithms, which fall into pitch shift, delay, and reverb categories. When a program is first selected (prior to loading) it can be interrogated to discover which alogorithm it has been derived from, by hitting the Origin softkey.

Perhaps the most exciting and certainly the most talked about algorithm is the Diatonic Shift. This group of programs will intelligently pitch shift a mono input into separate left and right true harmony outputs. Unlike a conventional pitch shifter, which will merely change every note by a fixed amount, the Diatonic Shift will recognise the incoming note and change it to correspond with the key and harmonies that have been selected.

The Diatonic programs are organised into different harmonies, ie 3rds and 5ths, 4ths and 6ths, etc, and each output is adjustable in harmonic intervals between an octave down and an octave up. It is also possible to output just the tonic or dominant note of the key, either above or below the note being played. Before a signal can be processed correctly, the *H3000* must be tuned to the input by hitting the Tune softkey; a note is then played while pressing the Enter key on the keypad, the value of the note will appear on the display and the unit is tuned. It is now up to the user to set the harmonic interval required. The *H3000* also allows the key signature to be changed to one of 12 standard keys, producing major, relative minor, Dorian, Phrygian, Lydian, Mixolydian or Locrian modes. Some programs cater for 'just intonation' and will produce pure intervals that are mathematically correct without making concessions for temperament. For the expert, there is the facility to construct personalised scales and harmonies by individually adjusting the intervals on each of the 12 chromatic notes. There is also a Quantize parameter, which will tune the outputs to their nearest correct notes, and if the pitch is set to Unison, the input will automatically be pitch corrected.

The results achieved with the Diatonic Shift, seem to depend a great deal on the nature of input and the degree of shift being used. With greater intervals the effect becomes more obviously electronic, ie Mickey Mouse or a bass growl, and unless this is the intention, the ▷

outputs will require masking by the rest of the track. It's not, for example, an effect that is going to put backing singers out of business! Having said that, it does perform well on a lot of synth sounds and guitars. Other ways it proved useful were in experimenting with different harmonies when working out arrangements and to provide instant pitch references for artists laying down harmony tracks.

Apart from the pitch controls there is, up to 1 s of delay, which operates on both channels together, left and right feedback, and left and right wet/dry mix. There are three parameters that help get the best performances out of pitch changing: Low Note, High Note, and Source. Low and High Notes should be set to the extremes of the intended range, to give the least possible delay and smoothest shift. The Source parameter is adjusted according to whether the input is solo or polyphonic. The inherent delay when the unit is correctly set up is minimal and this is a great improvement on earlier models.

The next pitch shift algorithm is Layered Shift. This has the same mono in, stereo out configuration as Diatonic Shift but it has none of the intelligence. Instead the range of shift has been increased so that it goes from two octaves below to one above. The programs associated with this algorithm tend to set up some of the classic *Harmonizer* sounds, like sharpening and flattening the input by small amounts, and the use of octave and delay settings to produce effects. There is also the inclusion of a Sustain softkey that will loop one pitch period of the input round and round until the key is pressed again.

Dual Shift splits the *H3000* into two separate mono pitch shifters with a +1/−2 octave range. It has the same features as Layered Shift but the delay time is halved to 500 ms a side.

Stereo Shift provides a true pitch shifter, with the same range and delay as the Dual Shift programs. The parameters adjust equally for both channels and there is a Deglitch softkey that optimises the performance for stereo or paralleled mono inputs.

The last pitch shift algorithm is the 1 in/2 out Reverse Shift, which is designed to create effects programs. The input is reversed in chosen lengths of up to 1400 ms and can be pitch shifted twice, the outputs can then be independently fed back. This results in programs such as Aliens, which produces a low pitched robotic effect on vocals; Scary Movie, which has a quick upward and slow downward arpeggiation with a backwards characteristic; and Anti-Ambience, which produces slightly flattened and sharpened backwards delays, bouncing left to right in an ambient space.

The Swept Combs algorithm creates programs ranging from reverb to flanging. It contains six delay lines each having a maximum delay of 200 ms with adjustable modulation, levels, feedback and panning. The input can be switched between mono and stereo, and in stereo the delays are divided into three per side. Parameters for the six delay lines can be adjusted either collectively or individually, except for the levels, which only have individual control. For example, the feedback for all six delays can be altered in proportion to one another by selecting the Master Feedback softkey or alternatively each can be set individually by selecting the Feedbacks softkey, found in Expert mode. Modulation is essential in producing programs such as chorusing and flanging, and this is controlled by two parameters, Rate and Depth. Rate is responsible for setting the speed of the sweep, and Depth governs the maximum value of delay that a random number generator will output, so controlling the length of sweep. There is also a Glide parameter that produces a smooth transitional response when large changes are made to delay times. It can operate over a range of speeds between 0 (slow) and 100 (fast).

Swept Reverb has the same six modulating delays as Swept Combs but instead of feeding a panning network and then the output, they are fed into a reverb network and recirculated. The degree of recirculation is controlled by the Feedback parameter. This arrangement produces programs like, Shimmerish, which has a large room characteristic with lots of reflections; Drum Processor, which uses six very short delays giving body and presence to bass drum or snare; and ▷

Space Flange, which creates a thick, flanged repeat echo.

The preset programs derived from the Reverb Factory algorithm tend to offer more natural sounding reverbs, and there are some familiar names among them such as Small Room, Bright Room, Rich Plate and Warm Hall. The programs are mono in, stereo out and can include up to 500 ms of predelay. Again the six delay lines are in evidence but instead of their values being displayed as milliseconds, they are expressed as samples, with a maximum adjustable setting of 5000 samples (113 ms). This of course provides the user with an extremely fine control, dividing each millisecond into a further 44 segments. The delays, like the previous algorithm, are fed into the reverb network but before this they are put through adjustable high and/or low frequency attenuators. The decay time of the reverb at its shortest is 100 ms, it then lengthens in a linearly increasing fashion up to 800 s, after which it becomes Big and then Infinity.

Interestingly enough it doesn't stop here but has a further five settings of Infinity+values, which represent the capability of the reverberation to build up in intensity. An important feature of this algorithm, is the incorporation of a switching gate. This allows one program to produce two different reverb settings, dependent on the dynamic content of the input. For example, it could be used on a dynamic drum part to give a long, warm sounding reverb in the quiet passages, and a short bright sound in the loud sections. It works by switching between two sets of parameters at a given threshold. The parameters it changes are the EQ and decay time and each has separately adjustable settings for gate on and gate off. A number of interesting results can be achieved using this facility, including non linear and gated reverbs. The preset programs provide a good range of reverberant spaces, from a small metallic Locker Room to an enormous Canyon and their overall quality is excellent.

The Ultra Tap algorithm basically consists of a diffusor and 12 delay taps. The two can be used together or independently but the majority of preset programs combine them. The diffusor consists of four all-pass filters, which, depending on their delay settings (0 to 800 ms), will produce dense diffused sounds or discrete echoes. This can then be fed to the multitap delay, which has a combined delay value of 1450 ms, and each tap output has access to panning and level control. The parameters associated with the 12 taps are changed as before using either master or individual controls. However, there is now a new mode of operation called Quickset, which is split into three parameters: Spacing, Weights, and Pans. Spacing arranges the length of gap between each tap and provides six alternatives: Constant, Linear Increasing (gradually lengthens the gaps), Linear Decreasing, Exponential Increasing (rapidly lengthens the gaps), Exponential Decreasing and Random Spacing. Weights has the same six choices but applies them to levels rather than delays. Pans provides nine preset arrangements of panning and is useful in setting up quick stereo effects, such as the panning in the, Sweep Right program, where machine gun-like taps sweep from left to right in decaying bursts. Feedback is available but can only be selected from 1 of the 12 taps. The programs are a mixture of reverb and effects, with a good sounding Ambience program and an impressive preset called Circles, which gives the illusion of the sound rotating in an anticlockwise direction.

Long Digiplex is a single delay line with a 1400 ms capability, having Feedback, Repeat and Glide facilities. It has a mono input and two outputs.

Dual Digiplex provides two 700 ms delays with the same facilities as Long Digiplex. They can be used to provide independent left and right delays for a stereo signal, or as two separate delays for a single mono input. Each delay line has a separate output.

MIDI

The *H3000* has been throughly kitted out for MIDI and its uses fall into four basic categories: changing programs, dynamically controlling parameters, automation using a sequencer and dumping of user programs to a MIDI-equipped computer. The various MIDI menus are accessed via the Program and Function buttons.

MIDI program change numbers can either load the corresponding program, ie Program Change 10 loads Program 10, or they can be assigned to load a totally unrelated program number through the MIDI Map. This facility allows the user to organise program changes to suit his equipment, and the Map along with program data can be stored and loaded by a suitable computer.

Certain parameters on the *H3000* can be linked up to MIDI controllers, such as mod wheels, pitch benders, notes, etc, and there is a patch display that marries parameters to controllers. The range over which a parameter will adjust, and whether it changes in a positive or negative manner, can be set by the user.

Using the MIDI Out connector, information about program change, levels, parameters and the bypass switch can be sent to a sequencer. With the sequencer slaved to timecode, the *H3000* offers automation during mixdown.

Conclusion

The *H3000* is a very different animal when compared to previous *Harmonizers*; not only does it operate in a radically different way but it also provides a much wider range of effects. The Diatonic pitch change is, no doubt, going to be much in demand but some of the other programs, including the excellent sounding reverbs, should definitely be explored. The unit has a good noise floor suitable for digital recording and hopefully we will see a digital I/O port in the near future. The actual acoustic noise from the mains transformer, operating at *220* V, was more than I would have expected but if the unit is rackmounted this should not be much of a problem. The *H3000* brings the *Harmonizer* right up to date, and judging from current interest, this model should prove a big success.□

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