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contents

MARCH 1997

5 **Editorial** Trade show equipment launches and egos in the studio

NEWS

8 **Soundings** News form the pro-audio world highlighting new studio openings, audio equipment services, and the SPARS employment test

12 **International Columns** European and American business updates from **Studio Sound**'s exclusive international columnists

121 **World Events** **Studio Sound**'s regularly updated and comprehensive events listing will help you survive the 1997 show season

US live radio from London's Rock Garden demonstrates the convenience and flexibility of ISDN
Turn to page 105

FEATURES

66 **Super Bowl 97/Broadcast**
America's football showpiece demands a winning broadcast setup

76 **24-bit 96kHz/Recording**
The first 24-bit, 96kHz periphonic recording session is now history

82 **Music Annex/Facility**
Twenty years of San Francisco's music tradition is invested in just one studio

89 **Practical ISDN/ISDN**
Putting ISDN into practice can be trickier than the salesmen will tell you...

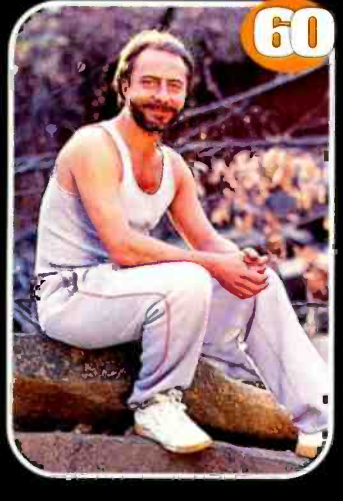
93 **Roundup/ISDN**
A rundown of the kit you'll need for ISDN

REVIEW SECTION

16 HARRISON MPC
US film console technology
23 LAWO MC82
German digital desk
31 AUDIO TOYS 8MX2
Mic amps for the MDM age

35 BAG END ELF
Low-down on the low end
40 LEXICON MPX1
Dedication in reverberation
42 AUDIO-TECHNICA AT4041
Small diaphragm; big performer
44 FOSTEX D15
Affordable postpro DAT
46 YAMAHA PROR3; REV500
New generation reverberation
48 TASCAM DA-P1
Affordable and portable DAT
50 DIGITECH VTP-1
Mic pre and A-D
53 NEW TECHNOLOGIES
What's pro in new audio

START PAGE 16



OFFORD INTERVIEW
Yes man Eddie Offord talks exclusively to **Studio Sound** about engineering and producing the supergroups of yesteryear

105 **London live/ISDN**
American ISDN broadcasting from London

107 **Masking/ISDN**
Listening tests for stereo masking systems

COMMENT

11 **John Watkinson**
The difference between 'numerically identical' compact discs is becoming a hot topic

102 **Broadcast**
Blue sky technology is more than a dark cloud on the horizon–it's a technological thunderstorm

172 **Open Mic**
The uneasy alliance enjoyed by music and business is beginning to break down. Philip Newell documents the increasing challenges to quality audio

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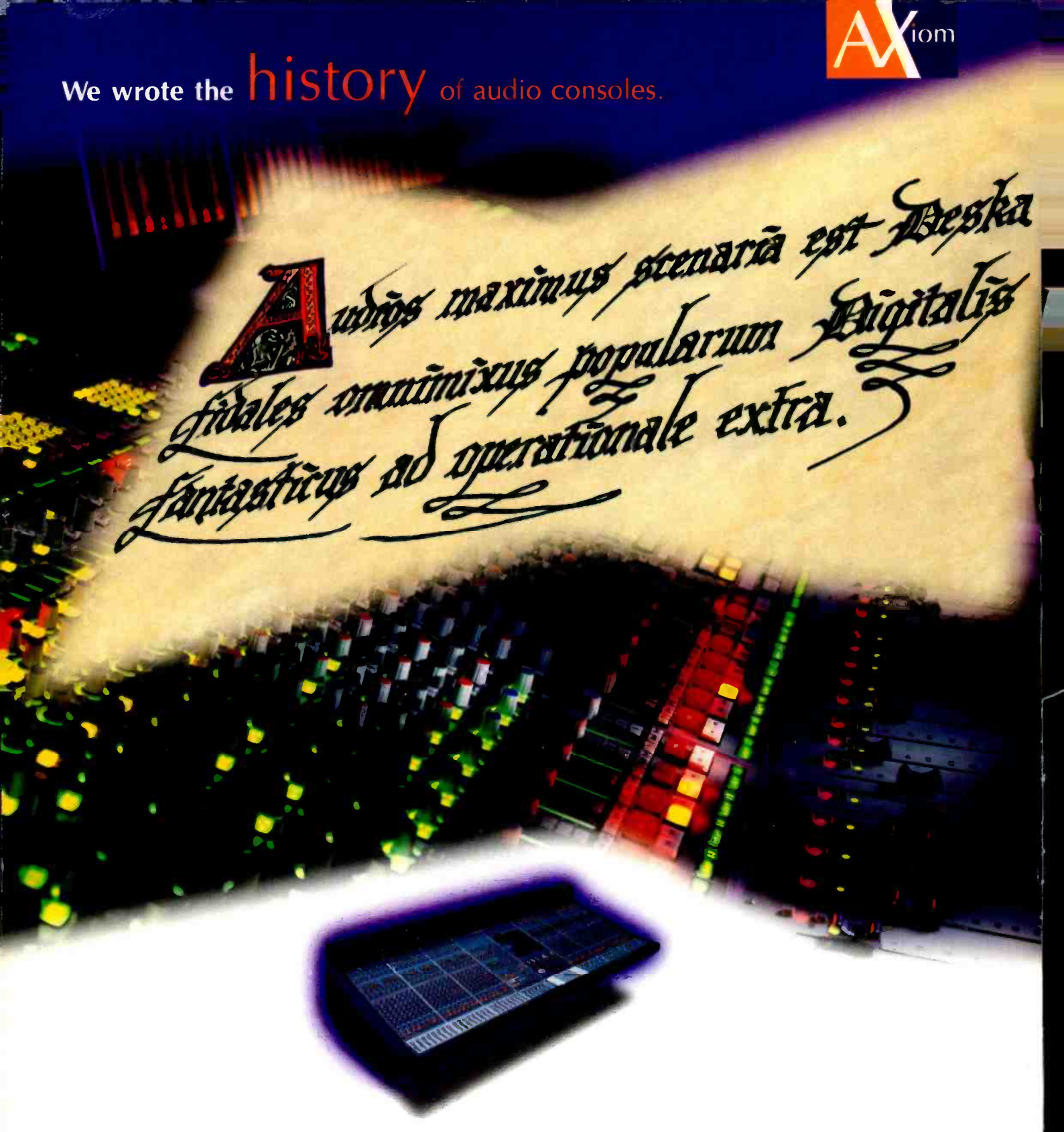

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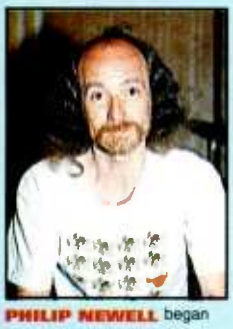

PHILIP NEWELL began his career as a live-sound engineer before moving into studio design and construction. He was heavily involved in Virgin Records' Manor Studio and Mobile before relocating to Portugal from where he has built over 100 studios in 31 countries including Russia.

GEORGE SHILLING is a freelance engineer-producer with extensive experience of dance, pop and rock recording. Recent credits include The Wannadies, Blur, Boy George, Eternal, and Marc Almond. He operates a programming-preproduction room at his home in the Cotswolds.

BILL FOSTER cofounded Tape One Studios, one of the pioneers in the field of CD premastering. He now edits One To One magazine. As a journalist Bill is also a long-standing regular contributor to ***Studio Sound*** and its sister titles

Buy now

DURING THE RUN UP to any major exhibition or convention my heart is simultaneously gladdened and saddened by the inevitability of product launches. Gladdened because without them it all gets a little bit staid and dull, and saddened because of the predictable throws of prepubescence that many of these new unwitting little cure-alls and must-haves will need to endure before they get to market. It frightens me that there are still so many instances of products released ahead of time in order to steal a march on the competition while also attracting attention to themselves as a purveyors of the latest and greatest.

This used to be a good game, we all played along because it was regarded as part of the painful but thoroughly worthwhile teething problems that accompanied the wave of software driven systems. Once you could even joke about it confidently, these days I'm not so sure. The mood has now swung so far away from those tolerant times yet many manufacturers seem not to have noticed. I would say that animosity towards a company that dares to mock-launch and camp up a product that is not nearly ready is at something of a high. I'd go so far as to say that anyone who reveals a product without a price tag and a drop dead delivery date is asking to have the shine scuffed off their credibility.

A statement of technological intent is one thing but a blatant marketing spoiler is now treated with the contempt that it deserves. The gag is a good one but an old one and it's not really very funny any more.

Publications are guilty of perpetuating these mythical products but are bound by the readers' right to know and ultimately it is the potential buyer's reluctance to postpone purchases on the promise of something better coming along that will discipline the remaining offenders.

Zenon Schoepe, **EXECUTIVE EDITOR**

Egomania

THE RECORDING STUDIO is a dangerous place to be. Primeval forces are at work here; things are created and destroyed in a moment of time.

While artists of all kinds are famed for their egos, the theatre of creation is an unequalled place to witness them at work. And the recording studio is arguably one of the best theatres of creation providing a defined space filled with all the tools and conditions necessary for the ego to thrive. Put one ego in such a space and it's relatively safe, able to indulge itself away from the competition or criticism of others. Put two or more into the space and the theatre of creation becomes that of potential conflict. Certainly, great works are born out of such conflicts but there are frequently casualties. Of course, the music business–like many others–loves its drama, it just has more opportunities than most to indulge in it.

But there are anomalies concealed in this apparently familiar situation. Contrast, for example, the rivalry neatly summed up by the request made of the monitor engineer on Deep Purple's Made in Japan album: 'We want everything louder than everything else' and the maturity with which jazzers trade solo spots. Why, when it is traditional for a rock band's drummer to have to be prevented from overplaying, have the drum parts on certain dance records assumed proportions beyond the wildest dreams of the demon rock drummer? How can it be so difficult to assemble five progressive rock players in the same studio when the credits at the close of a feature film run for the length of a single–and that's just the technicians?

Are jazzers fundamentally more highly evolved than rockers? Do keyboard players simply overplay on the drummer's behalf in the absence of the real thing? Are film producers all secretly trained in psychology before being shown a storyboard?

The competition between musicians working within the same group (not simply rock) can certainly be intense even when they are working toward the same goal–some of Eddie Offord's recollections of his days spent working with Yes illustrate this. Yet the same characters in slightly different situations can behave dramatically differently; while what you might reasonably assume to be comparable situations in other creative businesses appear relatively safe from this side of studio life.

Is there a side to recording studio design that has so far escaped us? Could there be some aspect of creating music in a particular kind of space that directly recalls the imperatives of cave dwelling? Are musicians a doomed evolutionary line seeking to play out (sic) its closing days surrounded by the luxuries of high technology and inspirational architecture?

Tim Goodyer, **EDITOR**

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CANADA: **Toronto's Ford Centre for the Performing Arts is currently playing host to the latest musical to open in Canada. The sound for Ragtime—which was scored by Stephen Flaherty and features sound design by Jonathan Deans—uses 46 Sennheiser 1046 radio mics and is centred on an 84-input Cadac J-type mixing desk. At the other end of the signal chin, a massive 184-speaker, Renkus-Heinz system addresses the audience. The delivery system also makes extensive use of surround and subwoofer channels.**

WEB NEWS

A roundup of the latest-breaking newcomers and upgraders of Web culture would include:
Allen & Heath www.allen-heath.com
Aphex Systems www.aphexsys.com
ARX, www.arx.com.au;
Russ Berger Design Group www.rbdg.com;
Canford Audio www.canford.co.uk/index.htm
Crystal Semiconductor www.crystal.com
Eela Audio www.eela.nl
Furman www.furmansound.com
HHB www.hhb.co.uk
Neumann www,neumann.com
Opcode Systems www.opcode.com
Orchid Electronics www.zynet/.co.uk/gold/orchid/
QSound Labs, www.qsound.ca
SSL www.solid-state-logic.com
Daniel Weiss www.weiss.ch
Wild-Media, www.wild-media.com

Notable is the fact that the Web is moving increasingly quickly from being a means of fashionable media posturing to being an alternative to the traditional interaction of phone calls and postal services for relaying public domain information.
EAW (www.eaw.com) reported in excess of 10,000 hits per day at the tail end of last year.

THX Club

SWITZERLAND: The month of March marks the opening of a significant new facility in Bern. SDS Studios in Ostermundigen was formerly part of Schwarzfilm that has now re-established itself under the direction of Ulrich Grimm and Hans Künzi. Back on line with a 64-input SSL Axiom in the main room, SDS is THX certified in both this, a smaller AV preproduction room and its home monitoring room which offers a Studer Dyaxis DAW. A central machine room is equipped with Studer D820-48 and A820-24 digital and analogue multitrack machines, Tascam DA-88 MDM, Sony PCM800 and Hi-8 machines among other recorders and dubbers.

Apart from its direct sphere of business, SDS is instrumental in forthcoming meetings between this and other European post facilities that have secured THX certification. The group will be known as the European THX club and have the aim of working towards a coordinated top class THX service capable of building business confidence in its members and the standard. SDS Studios, Switzerland. Tel: +41 31 939 1919.

UK: A new sound and vision hire facility has recently come on line —Gearbox. The London-based service offers a wealth of diverse equipment along the lines of 'desirable outboard from major manufacturers such as Focusrite', Sony Hi-8 MDM recorders, DAT machines including the HHB Portadat, VTRs, camcorders and tape and disk media. For those with esoteric tastes, there is even the classy Sony C-800G valve microphone.

With its declared emphasis on quality, Gearbox is targeting London's Soho film and video community. A 24-hour service, therefore, comes without question. Gearbox, UK. Tel: +44 181 449 6555.

US: The American SPARS body has announced a revised '1997 SPARS Test' to assist pro-audio employers in the selection of their employees. The Test takes the form of a number of modules which variously address the requirements of technical, administrative, music recording and audio postproduction requirements and is intended to offer a standardised 'benchmark' method of assessing potential candidates for established duties.

UK: **EMC testing gained its largest and most up-to-date facility with the recent opening of Panasonic's Welsh test facility. Two years in development with the assistance of test and measurement specialist Rhode & Schwarz and Hemford Communications, the facility is expected to dramatically reduce the company's EMC processing. Members of Panasonic and Rhode & Schwarz celebrate the opening**

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qs

The test is not entirely new, owing its origins to a scheme begun during the 1980s, but makes a timely contribution to the continuing questions surrounding industry education. 'The problem in interviewing has always been to accurately assess the level and depth of someone's knowledge and skill,' comments SPARS' President Tom Kobayashi. 'This series of tests seeks not to determine the scholastic achievement of a particular person taking the test but rather to provide an objective means of evaluating the level of an individual's competence in a number of skills areas.'

Tests are available from, and chargeable by, SPARS with grading done by SPARS' American national office itself. SPARS, US. Tel: +1 561 641 6648.

US: Following a troubled year that saw a number of strategies dubbed 'kinda stoopid' by President and CEO Paul Reilly, D-Vision was eager to paint a fresh picture for its future. Consequently, the company has abandoned its vision of achieving 'Avid for the PC' status in favour of a more realistic goal of setting the standard for PC-based nonlinear video editing systems for Windows NT.

Having brought the world's first PCI-based system for Windows NT to market, D-Vision has opted to concentrate its own efforts on software development rather than system assembly. The philosophy now is one of providing an 'open tool' built on its own expertise in collusion with technology from other companies and including the plug-in modularity seen in Pro Tools' TDM bus. The key element to this is seen as Microsoft's Windows NT.

Reilly identifies the convergence of technologies—audio, video, nonlinear editing, multimedia, Internet—as driving the next phase of the industry's evolution. 'The past five years has been about tools,' he said at a recent UK conference. 'The focus is now moving to distribution; DVD, cable modems, and the Internet and Intranet. This in turn will create the need for more powerful tools.'

The sentiment was endorsed by Marketing VP Mark Basler when he speculated that 'the last three years' growth in this market is nothing compared to what is to come over the next five'.

As such D-Vision's new OnLINE v2.0 for Windows NT is available now (in contrast to some of the company's old claims for its technology) and supports an impressive complement of video editing functions and effects as well as supporting 500 editable 16-bit 48kHz audio tracks with 24-track simultaneous playout and dynamic level and pan automation. The plug-in audio support presently extends only to Sound Forge but D-Vision are actively seeking partnership for high-end audio support.

TIM GOODYER

US: Spatializer Audio Laboratories has collaborated with Solana Technology Development Corporation to present a 'letter of intent' to all parties concerned with delivery of audio over the Internet. Anticipating that consumers will receive between 10% and 20% of their audio over the Net, Solana and Spatializer have undertaken to develop Electronic DNA (or E-DNA) to facilitiate secure tracing of copyright material. The companies have produced a study document which is available from Rick Loughery at Technology Solutions
Tel: +1 408 280 6000 ext. 201
or via e-mail at
rloughery@ca.tsipr.com

UK: Channel 4 television's excellent *Naked Classics* documentary on the development of classical music is currently being aired in the UK. Apart from Simon Rattle's incisive commentary, *Naked Classics* involves a considerable amount of music some of which is particularly demanding—one piece involves three full orchestras with their own conductors—was mixed at M2 Facilities and mastered to DAT. Auto-conforming was also performed at M2, to an SSL Scenaria

Contracts

◆ British postproduction studio Hullabaloo has claimed the world's first installation of the Amek DMS digital console. The 56-input, 52-output desk has 48 equalisers, 16 assignable dynamics units and two Amek crosspoint matrices for input-output configuration, and will work in conjunction with one of the facility's two Avid Audio-Vision systems. Located in the same corner of England as Amek, Hullabaloo handles major audio post projects.
Hullabaloo, UK.
Tel: +44 161 882 0007.
Amek, UK.
Tel: +44 161 834 6747.
Avid Europe.
Tel: +44 1753 655999.

◆ The Netherlands' Bullet Sound Studios has purchased a Sony PCM-3348 DASH multitrack machine. The 3348 will keep the company of a 3324S and Studer A800, and serve two SSL 4000-series consoles. The studio combines local television post services with sessions for a variety of established recording artists including Prince, James Taylor and Lenny Kravitz.
Bullet Sound Studios, The Netherlands.
Tel: +31 294 254027.
Sony Broadcast & Professional Europe. Tel: +44 1256 55011.

◆ China's Central China Television has just placed an order for TL Audio portable mixers and Micron radio equipment. Ten TL Audio 4:2 mixers accompanied 65 Micron TX-503 transmitters, 105 SR-520.1 receivers and an 8-way MCR-8 diversity system where they will be used for ENG purposes along with an HHB Portadat.

◆ China has also seen SADiE systems into the Beijing Film Studio and the Academy of Broadcast Science; the Academy system sale includes SADiE hardware controllers, CD-R, Exabyte and CEDAR De-Noise facilities.
Tony Larking Professional, UK.
Tel: +44 1462 490600.
Audio Engineering, UK.
Tel: +44 171 254 5475.
Studio Audio & Video, UK.
Tel: +44 1353 648888.

◆ New York recording and postpro facility, Acme Soundworks, is the latest US convert to DAR's SoundStation Sigma Plus workstation as part of its move into corporate and commercial video. The arrival of co-owner Fritz Lang marks Acme's targeting of the commercial sector for which the 16-channel Sigma Plus represents a key element.
DAR, UK. Tel: +44 1372 742848.

◆ London's Sarm West recording studio has installed a 56-input SSL 9000j mixing console in its recently reopened Studio 3. The new desk is the studio's second SSL 9000j, following last year's installation in Studio 1. Those of Sarm's clientele who have used Studio 1's console includes Bon Jovi, Seal and Depeche Mode.
A further European SSL9000j installation has taken place at the Parisian Plus XXX studio. The 72-channel desk occupies Studio 2 and has already served a Phil Ramone-Frank Filipetti project with Patricia Kaas.
Sarm West, UK.
Tel: +44 171 229 1229.
Plus XXX, France.
Tel: +33 1 42 02 21 02.
SSL, UK.
Tel: +44 1865 842300.

◆ Portugal's premier broadcaster has installed Orban Optimod-FM 2200 digital FM Processors at five national radio sites. Rádio Renascença is responsible for two national networks as well as a short-wave service serving Europe and quotes local radio growth for its expansion.
Rádio Renascença, Portugal.
Tel: +351 1 347 5270.
Orban, US.
Tel: +1 510 351 3500.

◆ Bangkok Jatulong Studio and Master Recording Studio has taken receipt of an unspecified number of 24-track Dolby SRP-series systems. The placement coincides with a number of two-channel systems taken by Singapore's Pyramid AV International postpro facility.
Dolby Labs, UK.
Tel: +44 1793 842100.
SSL, Asia. Tel: +65 285 9300.

◆ British independent broadcaster, London Weekend Television, has installed two American 360 Systems Instant Replay machines in its London premises. The systems supply spot effects and audience tracks for national TV productions including *London's Burning*.
360 Systems, US.
Tel: +1 818 991 0360.

◆ When Romania's Pro TV established the territory's top OB truck late last year, it was equipped with a 32-channel DDA QII console. The project has since resulted in a further order for a QII.
DDA, UK.
Tel: +44 1562 741515.

◆ Berlin-based Video & Sound Services has become the first facility to use the Otari Elite console. V&SS specialises in postproduction and film mixing and has installed a 48-frame Elite fitted with an additional 16 stereo modules and surround-sound M-pan facilities.
Otari, Japan.
Tel: +81 4 2481 8626.
Otari Corp, US.
Tel: +1 415 341 5900.

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Mr Kauko Lindfors - MD Kikeono Film Sound Oy.

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Colin Sheen - Jingles Studio.

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Pete Bellotte - Writer Producer.

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The analogue CD player

Differences in the audio derived from numerically identical CDs is becoming a hot topic. But is this a problem with the CDs or are the CDs trying to tell us something about our replication processes or our CD players?

Digital audio is hardly new, and although the Compact Disc wasn't the first digital audio product, it has still been around for about a decade and a half. Sad, then, that the way it works is still not widely known. Even sadder is the fact that the debate about CD quality drags on even though the way to build an ideal player is obvious after remarkably little research.

I read recently that tests have shown that CDs manufactured in different plants sound different even though they were made from the same data. How odd that this is possible when the CD is just a box full of whole numbers and doesn't even know those numbers represent a sound waveform. In common with all digital media, CD couldn't have a sound quality if it tried and never will. This doesn't mean that the listening panels who heard audible differences were wrong, far from it. I don't doubt that they did hear differences, because they are utterly predictable and of known origin. The origin is, however, not in the Compact Disc itself.

The sound quality of a well-engineered CD player is, like that of all digital audio replay, determined by three things: first, the quality of the D–A convertor; second, the quality of the D–A convertor and lastly, the quality of the D–A convertor. If it appears to depend on anything else, the player is deficient because it is not digital.

It is hard for an iconoclast such as myself to understand how the CD could be blamed. The only plausible explanation is that the audio industry used to make vinyl discs whose sound quality depended upon almost every parameter you could think of. If you knew that was true, but not why, you might believe that other types of audio disc could suffer from the same problem.

I have mentioned before the problems which attend a technological disjuncture when people who know the practice but not the theory inappropriately extend the specific to the general. I can appreciate how Frank Whittle felt when he rolled out the first jet plane to be told he'd forgotten the propeller!

BUT I DIGRESS. The data on a CD are numbers which determine what the output voltage should be at evenly spaced intervals. The tracks on a CD are pretty narrow so most CDs have an eccentricity of about six tracks. The flatness of the disc and the tolerances of the drive spindle go outside the depth of focus of the pickup. The pickup has a 2-dimensional servo to track follow and focus and this is constantly moving. If the servo amplifiers couple via the power rail to the audio, you have an analogue CD player.

The disc runout causes data rate variations. In addition because CD is a CLV disc the spindle motor is constantly hunting fast and slow to keep the average buffer content constant. If the RAM buffer doesn't completely remove the speed variations, of if the spindle motor servo couples to the audio power, you have an analogue CD player.

> More fun can be had by allowing ordure from the logic to pollute the sampling rate clock as this makes it jitter and makes the audio waveform other than a function of the data

In the decoding circuitry of a CD the phase locked loop locks to the off-disc channel bit rate. The control voltage varies to follow disk runout. The EFM decoder and the Reed-Solomon decoders do a lot of clever stuff with high frequency logic which is not exactly class-A and does introduce all kinds of guano into the power rail. Again if this power goes unfiltered to the audio, you've guessed what happens. Even more fun can be had by allowing ordure from the logic to pollute the sampling rate clock as this makes it jitter and makes the audio waveform other than a function of the data.

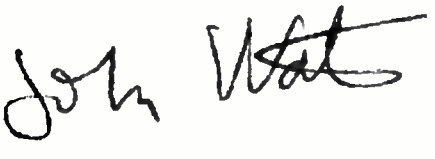
So the solution to the analogue CD player problem is just to make it digital by design and then to prove that it is digital by test. The sampling rate clock and the D–A convertor must be isolated from power coupled or radiated by the servo and digital processing. Isolation requires screening, a proper ground plane in the logic and the elimination of common impedances due to poor layout.

One accidental by-product of the elimination of common impedances and interference is that not only will the product sound better, it will also soar like an eagle through EMC testing. Isn't it odd that the high-end hi-fi brigade opposed EMC legislation so much because they claimed it would damage sound quality? Perhaps they were trying to tell us something about their design skills.

It's easy to tell if a well-engineered design has been achieved, simply by playing an all zeros disc and examining the analogue output, which should be a straight line, whether or not the disc is put in on an eccentric wedge to drive the servos harder. Testing for jitter is pretty straightforward and needs a disc with test tones and a spectrum analyser. The jitter on the disc can be increased artificially using any sticky refractive medium. I prefer marmalade because I can lick it off afterwards. The effective jitter can be increased by adding pink noise to the eye pattern signal from the pickup. In all cases if the spectrum analyser shows increasing HF noise compared to LF noise you have an analogue player.

The problem with objective tests of this kind is that it is difficult to know just how much impairment of the waveform is audible. You might over-engineer by accident so that servo noise was 200dB down on the audio. This would sound great, but a player which is a 1m cube might not sell well.

Consequently the best test I can think of is a subjective one. You have CDs made in as many different plants as possible from the same data, so they all have different amounts of runout and warpage and eye-pattern jitter. When they all sound the same, your player has been well engineered. If they sound different, by definition, it's not good enough.



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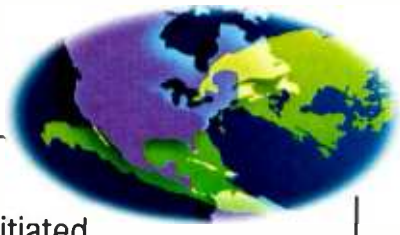
Palaces of democracy



Like the kind of art that demands an intimate understanding of its conception for appreciation, recording studios used to attract only the initiated. Now they're shaping up for architectural awards writes **DAN DALEY**

It's not my imagination. No, the opulence of recording studios in the States is rising to a level not seen before. Once it was a bit of Italian marble or slate here, or a filigree from France there, but for the most part, the American recording studio was a craftsmanlike affair. But, as you have seen chronicled in these very pages, the upper end of the business is moving past simple pulchritude and is approaching outright voluptuousness.

It began a few years back with Hit Factory's new digs in Manhattan. There, the Italian marble was laid on thick, and the sensuousness of the facility's rooms rivalled its technology. With the inclusion of space for housing production companies and a planned-for restaurant in the structure, Hit Factory was less the mothership than a pro-audio version of Harrod's. As wonderful as the former Power Station had been, its charm was its sound, not its aesthetics. Once Hit Factory opened its doors, the bar had been raised considerably in terms of what constituted an amazing facility.

To me, the real attraction of Eddie Germano's pleasure palace by the Hudson was that there wasn't another American studio that had allied form so closely to function. A few palaces had recently come on-line in places like Italy and South Africa, but Americans will tell you that we prefer our palaces in Europe.

But opulence is back in fashion, as much in evidence in recording studios as on the decidedly non-*pret-a-porter* runways of Milan and Paris. Two recent entries in Nashville illustrate the point and lead the pack. Starstruck Studios is owned by country singer Reba McEntire. It opened in late 1996 with a one-two punch that featured not one but two SSL 9000j boards and a design by UK designer Neil Grant which included the combined aesthetics of a red terracotta floor and a slate-tiled diffractal ceiling, a visually dramatic high-dive-like balcony, richly stained cherry wood trim in one of the iso booths, photo-electric windows, mood-reflective lighting system, colour-coordinated glass and ceramic diffusers, and sculpted horses that frolic in the running brook in front of the facility. Rock & roll meets Architectural Digest.

Then there is the new Ocean Way/Nashville, a joint venture opened early this year by Allen Sides and Gary Belz (two veteran studio owners with copious amounts of experience, vision, ego) and Dead Presidents who collaborated to turn a grand old church into an even grander new recording complex. The restoration of many of the 145-year-old building's architectural finer points, like its charming stained glass windows and a working fireplace in the third studio, almost distract one from noticing the first Sony Oxford digital console installed in the US, or the world's largest vintage Neve desk.

Cut across to San Francisco, where the Russian Hill Recording satellite facility, Crescendo!, opened its doors a few months ago as a recreation of a bucolic Tuscan village, replete with running fountains, country kitchen and bistro-like lounge whose windows offer a vista that looks out on the Bay Bridge to Oakland, the only thing to remind you that you're in San Francisco. With its emphasis on postproduction and the sorts of anonymous, black-box technology that that generally entails, the aesthetics of Crescendo! truly do overwhelm any overt indications of its mission. Sure, Crescendo! is a post house where the clientele expects a somewhat enhanced environment and premium bagels. But Crescendo! exceeds the expectations of the ad agency crowd: it is as much a theme park as it is a recording facility.

WHERE IS THE IMPETUS for this growth of opulence coming from? For starters, it is the homogenous black-box nature of technology that forces this hand by demanding that studios differentiate themselves. The change in equipment aesthetics is illustrated graphically at Ocean Way/Nashville: when you walk into Studio A, you realise immediately that the room is viscerally dominated by the massive pair of vintage Neve 8078 desks; in Studio B, on the other hand, the sleek, small, modern Oxford looks like it could easily be a snazzy interface for a Bose home stereo system and must thus compete with the rest of the room visually. 'How good you look is often what gets you the gig,' Crescendo! studio manager Cindy McSherry observes.

A second and more complex reason is that the personal recording explosion has brought both many more small studios on-line while reducing the overall demand for studio time of any type. At the same time, the cost of leading-edge equipment has skyrocketed. Those few studios that pursue that type of equipment are now finding that technology alone isn't enough to keep your edge, and aesthetics have become a major component of how a studio markets itself. For instance, the mediaeval castle motif of the new Chung King Studios complex in Manhattan appeals to the upscale Gen-X crowd of video-game-bred rappers and rockers the studio has targeted.

If you cannot be absolutely the first or absolutely the best at anything, you will always have an unlimited opportunity to at the very least be the biggest. The entire state of Texas is predicated upon this notion

Finally, it is simply so American to go to excess in anything. Understatement is not a crime; it's just not part of our lexicon. It is one of those quintessentially American inventions that so broadens the concept of democracy: the notion that if you cannot be absolutely the first or absolutely the best at anything, you will always have an unlimited opportunity to at the very least be the biggest. The entire state of Texas is predicated upon this notion.

So look to America to take the idea of the studio palace to its next evolutionary plateau. I don't know exactly what form it will take, but if I were to guess, I would start by wondering what it would be like to have a large, gaudy club in my town where pin-headed bouncers scrutinised me for my hipness quotient before letting me in and where I could buy overpriced beer and hamburgers and even more expensive logoed tee-shirts and baseball jackets and, in between courses, overdub a guitar part or two. We could call it the Hard Rockin' Planet Cafe of Pro Audio, or something. I'll get the boys in marketing on it immediately.

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Akai digital is the answer, what was the question?

There is now, the Akai DD8. A self contained 8 track disk-based random access digital recorder which can replace existing tape or mag machines in any film-dubbing or television production environment. It uses an uncompressed 16-bit linear format and records to a user choice of Magneto Optical or removable Hard Disks.

Akai introduced the World's first audio editor using M/O storage in 1990 with the DD1000, and the mighty DD1500 16 track Digital Audio Workstation is probably the world's fastest system available, with zero loss editing via fast dedicated buttons, digital mixing and EQ and a beatifully clear on-screen display. Now shipping with two years worth of software development including the unique EDL package which allows conforming of EDLs from tape or even from Akai project disks; with this amazing feature the DD1500 can conform entire programs in an instant from studio recordings or rushes on disk. Since 1994, the entire product range has been gradually expanded to provide a family of compatible products, tried and tested. A worldwide digital standard.

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The DD8 TDIF I/O option along with the analogue i/o (balanced on a DSUB connector) allows direct replacement of existing digital MTRs; and being disk based, the DD8 provides freedom from slow, inflexible operating methods and high maintenance costs. The DD8 in fact offers the ultimate flexibility of disk interchange without restriction, giving the freedom to take a disk from a recording stage to a sound editing suite, and from a sound editing suite to a dubbing theatre, at any stage loading into any compatible Akai unit. No time consuming transfer of audio from one media format to another, thus cutting hours from the work schedule. For those prefering to edit using computer based systems, Akai has worked with Grey Matter Response™ to provide DD8/DD1500 support in Mezzo Interchange for Macintosh™ allowing bi-directional conversion capability between Akai and any OMF-compatible DAW. Any conversion between the two formats will also incorporate all new edits in an updated file.

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Troubled times

There's trouble in the European airwaves as manufacturers squabble over their use, and there's trouble in European households as their inebriated occupants plug loudspeakers into the mains writes **BARRY FOX**

Europe is now supposedly a united federation of states. Sometimes it is; sometimes it isn't. European manufacturers, including Sennheiser, Vivanco and Philips have, for the last two years, been lobbying the British government to bring the UK into line with the rest of Europe and legalise the use of radio headphones, and speakers, at 433MHz. But the government's Radiocommunications Agency still says no.

On the face of things, this sounds like stubborn obstruction, with far-reaching implications. Anyone who uses a pair of European wireless headphones in Britain, immediately becomes a criminal. They risk having their equipment confiscated, with unlimited fines, and two years in jail. But there is another side to the argument. The frequencies used in Europe can cause serious interference.

In all the major Western European countries except the UK, Norway, Finland and Denmark, radio headphones can work legally on a wide band of frequencies around 433MHz. So far they use analogue FM transmission, but in the future will be digital. There is enough space in the band for neighbouring offices or studios to choose between at least six different frequency channels and so avoid interfering with each other. Most major manufacturers are now getting ready to launch wireless loudspeakers. The manufacturers want the 433MHz band released for audio in Britain, so that all European countries can share the same technology. But the frequencies are already shared by amateur radio hams, the Ministry of Defence, home security systems and central locking controls and alarms for cars. If people use headphones on this band they can cause interference to these other systems. Anyone who suffers can then complain to the Radiocommunications Agency. The RA then uses a detector van to track down the offender and prosecute under the Wireless Telegraphy Acts.

'We have now given up on 433MHz for the UK' says Steve Holmes, Vivanco's product manager. 'So we have concentrated on getting the best quality out of a band of radio frequencies which is legal but less efficient'.

British radio regulation MPT1336 allows cordless audio at 36.61–36.79MHz and 37.01–37.19MHz, with 10μW of power. So range is too short for practical use. The same regulation also allows low power radio devices, including audio links, at 49.82–49.98MHz with 10mW.

Although the band is used mainly for radio-controlled equipment and walkie-talkies, Vivanco uses 49MHz to carry an FM stereo signal. Sound quality cannot be as good as at 433MHz, and there is only room for one stereo signal. So neighbours must share the same frequencies and risk interfering with each other. Philips and Sennheiser refuse to use the 49MHz band.

The RA says it still fears that low power devices will suffer interference from the MOD and hams who transmit at higher power. The RA reluctantly agreed to harmonise with Europe and let radio keys (which remotely unlock a car door) work at 433MHz, so that drivers could take their cars across the English Channel. MPT1340 covers vehicle radio keys at 433.72–434.12MHz at 10mW. But, says the RA, the 'many complaints' received about ham transmissions locking drivers out of their cars, 'realises our fears'. The audio manufacturers argue that although car keys may suffer interference from high power hams, there have been no complaints about interference from headphone listeners on the Continent.

The greater risk, the lobbyists warn, is legal. Anyone can legitimately buy 433MHz headphones from Continental shops. British shops can legitimately import 433MHz headphones direct from the Continent and tell customers they are better than native British versions.

Britain's Wireless Telegraphy Acts do not prohibit the sale of equipment that works on unauthorised frequencies, only its use. Although the RA can prosecute for 'incitement', salesmen can get round this by displaying a copout notice which warns that goods are sold for 'export only' or 'not approved by the Radiocommunications Agency'.

The RA says it is working with CEPT (the European Conference of Postal and Telecommunications Administrations) and 'actively pursuing' the search for a frequency band that is free across the whole of Europe and is wide enough to carry surround sound, while giving a choice of up to six channels so that neighbouring users can avoid mutual interference.

Almost certainly the only real solution is a digital system working in a band above 1GHz.

Jim Norton, the RA's chief executive, thinks that the 49MHz band is 'not acceptable' for hi-fi headphones; neither are the other legal bands at 36.7–37.1MHz. Norton says there have already been cases in the UK of illegally used 433MHz headphones immobilising cars and the RA has 'had no alternative but to take appropriate action'.

The RA says it has tested the Sennheiser system; it had a range of 100m and continued to radiate even when sitting idle on the charger base.

RECENTLY AMENDED EUROPEAN safety standard BS/EN 60065 (1994) effectively bans the 4mm 'banana' plugs which have until now been used to connect an audio amplifier to loudspeakers. The male banana plug, a springy metal pin which is a push fit into a female cylindrical socket, is small enough to fit into the 5.5mm openings of a European mains socket. So users can accidentally plug speaker leads into the mains. Audio industry folklore says the plug ruling stems from a letter of complaint written by a drunken Swede who rolled home from a heavy night out and, instead of going to bed, tried to rewire his hi-fi. He pushed one end of his loudspeaker wires into the mains and then held the other end, with predictable results.

But he lived to write to Brussels.

A&R Cambridge, maker of Arcam hi-fi equipment, worked with the British Federation of Audio to design a plug and socket that complies with North American, as well as European, safety standards. The BFA Connector reverses roles. The plug is female. A 6mm metal cylinder sleeved in insulating plastics is secured on the end of a cable. The sockets are male. Speakers and amplifiers are fitted with plastic cylinders which shroud a central metal pin.

There are no bare metal parts and the plug is too big to push into a mains socket but when the female plug is pushed into the male socket, the metal parts mate firmly to make an audio connection.

Because the BFA plugs are sheathed they do not short the amp if touched. The BFA hopes to win EU-wide, and then worldwide, acceptance by giving away the design on a licence-free basis. Manufacturers just pay £100 for plans. Leading suppliers, Westside Supplies, Deltron and TechLink, are already starting to produce plugs and sockets.

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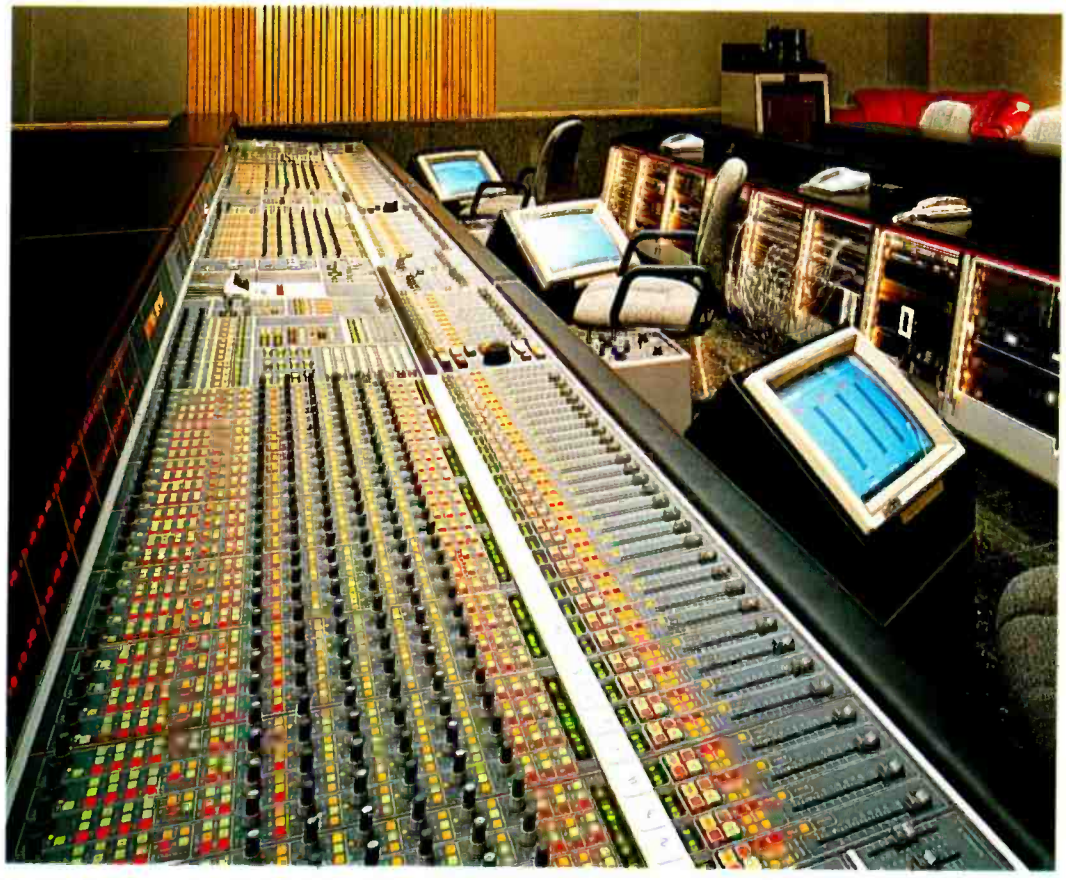
Harrison MPC

The facilities and architecture found in a film console readily distinguishes the 'real thing' from an inappropriately placed postproduction desk. ROB JAMES discovers real talent in the Harrison Motion Picture Console



WHILE SELLING multichannel recorders for Jeep Harned of MCI in Nashville, Dave Harrison was asked to design a companion desk for MCI to manufacture. This inauspicious start marked the birth of in-line console design as we know it today. The architectural precedents Harrison set in 1971 have become almost universal in multitrack consoles today.

Harrison's first dedicated film console was the PP-1. Delivered to Walt Disney Studios in 1979, this involved many of the ideas which have come to fruition in the MPC. After this came the fully-automated Series 10 which, after some teething problems, made it clear the company knew a great deal about the user interface required to make a fully dynamically automated console useable by mortals. The Series 10B was the dedicated film version, and it was from this heritage and considerable time spent talking to the leading practitioners in the industry, that the MPC was developed. The first unit was delivered to Sony Pictures on Valentine's Day 1992.

The scope of a mixing desk such as this is huge. To appreciate the philosophy behind the architecture it's helpful to describe its use. Film mixing is, in large measure, about leaving your options open. It is far from unusual to end up with more tracks than you start with—for example, consider the fact that the majority of location dialogue recording is in mono not to mention ADR recordings or post sync and effects but these may be premixed onto a three or four tracks to provide a Left, Centre, Right, Surround pre-dub not forgetting LCRS reverb. In this way, one mono source effect could arrive at the final mix as an 8-track pre-dub for a Dolby Stereo track. If the movie is to be mixed in an 8-channel format, the possibilities increase—include alternative dialogue takes plus effects, backgrounds, Foleys and music and you begin to get a feel for the scale of the undertaking.

In short, a large number of sources need to be processed, mixed, monitored and recorded onto a large number of tracks. The large number of resultant pre-dub tracks then need to be mixed and reduced to the relevant release format(s).

The convention in film mixing consoles is for large machines with a huge number of inputs, almost always configured for operation by two or three dubbing mixers. One will handle effects, another dialogue and the third, music—although these divisions are seldom fixed. The amount of information which has to be digested quickly and accurately by the mixers is formidable and the acreage occupied by one-knob-per-function designs is enormous.

THE HARRISON MPC addresses the specific requirements of this sophisticated and mature market. At first glance it appears to be a fairly conventional console, albeit with full dynamic automation. This is deceptive since the MPC also offers many ways of exploiting its digitally-controlled analogue (DCA) architecture including a degree of assignability and layering. It is possible to use the console in a conventional way, but the real power comes from exploiting the DCA features. Here Harrison does not use VCAs but relies on digitally-controlled attenuators of its own design

If the movie is to be mixed in an 8-channel format, the possibilities increase—include alternative dialogue takes plus effects, backgrounds, Foleys and music and you begin to get a feel for the scale of the undertaking

Physically, the desk consists of racks of audio processing, routing and control cards, the control surface and one or more interactive touchscreen interfaces (ITIs) connected to NuBus cards in a Macintosh host computer. The desk is organised such that there is a router controlled from the ITIs which may be up to 1024 x 1024 (1,048,576) crosspoints and can be considered as a computer-controlled patchbay. Setups for a variety of specific uses can be stored and recalled at will. Note, however, that this is a a router not a summing matrix, thus multiple destinations from one source are allowed but not multiple sources to one destination. Input signals are routed to input

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channels or to pre-dub inputs which are used to further control and mix existing premixes. After processing, signals can be routed to any or all of up to 48 main output buses or any or all of 24 re-assign busses which can be thought of as subgroup buses. Output signals go via the router to the recording medium. Monitoring is set up via the ITI which controls the relevant part of the router and a 32 x 8 summing matrix and also sets up record control logic. Mic amps are remote controlled and patchable to input channels. High-speed (10Mbit) serial links communicate between the various parts of the complete system.

All buttons illuminate or flash to indicate states and functions. Simple LEDs, arranged in segments, indicate whether rotary controls are off their centre positions and, of course, there are moving faders

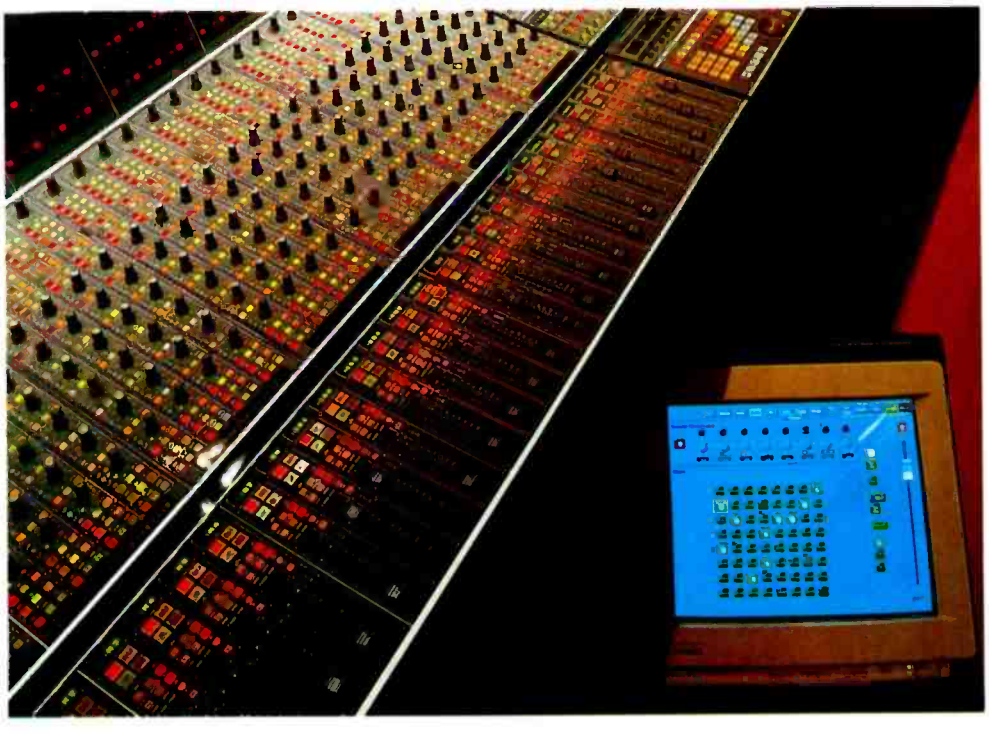
Since there is a good deal of distributed processing the system has a degree of fault tolerance. If one channel card fails, the local processor in the Cage can be turned off and the self configuring card hot swapped without needing to take the whole desk down.

Input channels come in blocks of four strips with a common alphanumeric annunciator panel at the bottom. The order in which the bits are assembled may seem unusual to users of more conventional desks but reflects the different priorities found in film mixing.

The strips are made up in the following way; on the upstand there is a pair of LED matrices which indicates which main and or reassign bus(es) to which the channel is assigned. At the top of the strip is the Aux section; a dual rotary-shaft-encoder controls send level and, for stereo destinations, pan. There are eight sends which can be used individually for mono or paired odd and even for stereo. This is an example of where assignability has been used to good effect since the one dual encoder is used to control all eight sends selected via buttons.

Next in line is the Dynamics section which can insert a compressor and gate into the signal path. The setup controls for the dynamics parameters are located in a central, shared, panel or they can be set from an ITI. This is another example of intelligent use of assignable controls to keep the clutter down. The input strip dynamics controls are reduced to four pushbuttons and an LED gain reduction meter. Similarly the Input section which is next consists of five pushbuttons. You can select A or B inputs, phase reverse, insert pan and trim the input level (+10dB to -20dB) using the fader. Immediately below is the Pan section with one dual-concentric shaft encoder. The inner is used to control LCR panning and the outer, surround. The inner control is used in conjunction with a button to control divergence. At the bottom of the strip is the equaliser and filter section. There are four bands of EQ with a high-pass and low-pass filter. Each equaliser band has a dual-concentric shaft encoder and three buttons. The inner controls boost and cut, the outer, centre frequency. Pressing a button converts the inner control to bandwidth (Q). If the bandwidth control is rotated fully clockwise the equaliser becomes shelving. If an ATT (attention) button is pressed or a rotary control is moved the numeric values for the equaliser appear in the channel display—boost and cut of 15dB are available at 800Hz–16kHz, 400Hz–8kHz (for high and low mid), and 40Hz–800Hz. Each band can be inserted and automated independently, or the whole equaliser can be inserted or automated.

Remotely located processing racks



MPC showing touchscreen, see sidebar on page 18

The automation can be as simple or complex as you wish. Every control surface function can be dynamically automated and it's possible to work with the whole desk in Write and then Read

The HP-LP filter consists of another dual control and three buttons. Here low-pass covers 800Hz–16kHz, high-pass 40Hz–800Hz

At the bottom are buttons to control two patch insert points, pre or post fader. These also switch between the two possible layers if the console is so equipped. ☞

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TWICKENHAM STUDIO 2

THE CONSOLE I examined for this article was recently installed at Twickenham Film Studios Studio 2 in West London. On the day I of my visit, the Theatre was completing a major film, Donnie Brasco, for Tri-Star Columbia. The film is a thriller, directed by Mike Newell who made Four Weddings and a Funeral and starring Al Pacino and Johnny Depp. This is a good example of the multi-format world of film. In the US it will be released in SDDS. In the UK, SRD with, of course, a conventional Dolby Stereo track in addition.

I talked to Dean Humphries, lead mixer on the film, about the MPC. 'It's a 72 mono input board with 8 pre-dub inputs which are each 8 so there are a total of 136. There are 48 main buses with 24 reassign buses which can be used to get signals straight onto the mains or as subgroups.

'One of the problems is, if you take a piece of audio on a mono fader, a spaceship or something, and fly it around the room with a joystick you can end up with an eight channel premix coming back at you on the final. I think we should invent a new term for what we do, it's not mixing, its more like "maxing".

Asked what had interested them in the MPC, Humphries' answer is surprising: 'Initially nothing,' he says. 'We wanted to buy a UK-made desk for all the usual reasons especially, support. We also wanted a fully automated desk, including the various pan formats and routing. But when we started to look around and talk to people they eulogised the Harrison and it was becoming almost a standard in some places. Plus it is built as a film console from the ground up.

'But we still had this problem that they are five thousand miles away in America. Everyone we talked to managed to convince us this really wasn't going to be a problem and now we are unequivocal in praise not only of the desk but of the support we have had. Although they are umpteen thousand miles away it is every bit as good as if they were four miles away.

'The fact they only make mixing desks means you have their undivided attention.'

Dean is not particularly worried about digital competition.

'We will have the option to add digital processing later on and, practically, we will probably do it in stages. There is a danger if we don't jump into digital that in four or five years time a director will be saying, "You don't have a digital desk like so and so". They really don't know what the ramifications are but if you buy a digital desk now, there is a likelihood of standards changing to 96kHz sampling and 24-bit, or whatever, and you could end up with a big problem.

'The real advantage to us in having some digital processing is in the things you can do with digital that you can't do cleanly with analogue like deep narrow notches. The automation already allows us to do things like keeping a library of EQ settings for future use.'

Dean regards the 'mini assignability' as 'a positive sign'.

'The word intuitive comes to mind. All the things you need in film dubbing that you want immediately and quickly are on one level. Slightly fewer used functions are down a level, but not so as it slows mixing up. It's all been very well thought out, things you need to grab quickly are one button for one function.'

This desk and its sibling the Series Twelve show clearly just what can be achieved in refining a control system for a specific purpose. It offers power without complexity and adheres to the KISS principle (Keep It Simple, Stupid). In my opinion, Harrison has reached a new peak in console design.

Disregarding the audio quality (which is excellent) the major achievement is in making a machine to control the mind bogglingly complex process of film mixing which is not only simple but highly enjoyable to use.

☜ The faders also come in blocks of four to a panel and apart from the motorised P&G fader and a small alphanumeric panel there are MUTE, SOLO and AUTOMATION control buttons together with a 4-segment Signal Presence meter. To avoid repetition I have omitted to mention many of the the automation specific controls.

The other building blocks which make up the user interface are panels containing Pre-dub Inputs, Remote, Re-assign Masters, Softkey-Reassign Matrix, Dynamics controls, Monitoring, Bias-Tape, Automation Control, Filters and optional Graphic EQ. The Pre-dub panel provides a means of controlling and routing a premix of up to eight tracks. There may be one physical set of controls per pre-dub or one set of controls can be used to control several pre-dubs

THE KEY to the success of a console in this market lies in the way it is controlled, automated and how it presents the vast amount of information available. To take the last first; If you are visually scanning a large number of control parameters it is unhelpful to have a lot of information presented alphanumerically; something more graphical is required. Equally, if you are attending to fine adjustments on an individual channel, more detailed information is required.

Harrison has dealt with these conflicting requirements in a most elegant way. All buttons illuminate or flash to indicate states and functions. Simple LEDs, arranged in segments, indicate whether rotary controls are off their centre positions and, of course, there are moving faders. If detailed information is required, this is available by touching ☞

AUDIX

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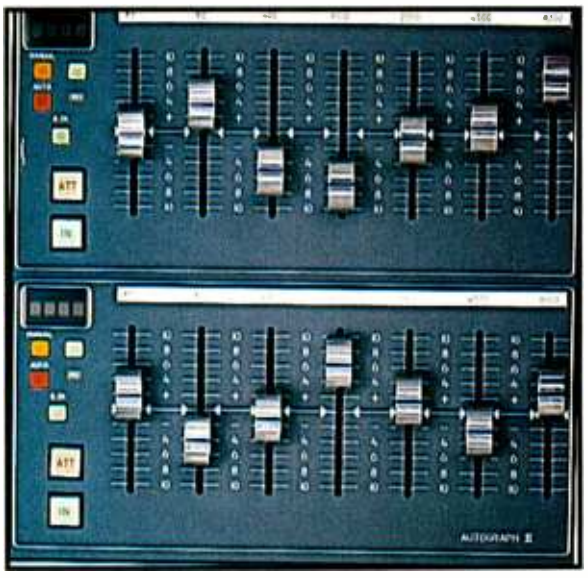
HARRISON

controls on the channel strip which then puts parameters into the alphanumeric display associated with each block of four channels. All this information and more can be displayed on the ITI screen.

Each channel fader can also be a control master with other faders grouped to it. In addition, remote faders and other shared controllers such as joysticks can control individual channels or groups of channels, re-assign buses or pre-dub inputs. The shared devices can be attached to input channels or whatever using the attention buttons. These are also used for routing and other functions.



Autograph II Panel

The automation can be as simple or complex as you wish. Every control surface function can be dynamically automated and it's possible to work with the whole desk in Write and then Read. Updating can be on a single control basis or in a variety of more sophisticated ways. Operators usually start using the simple approach and gradually explore the extended options. For example, there are now around 32 modes or combinations of modes available which dictate how the console will react when updating a mix.

But this has been achieved in a simple, logical manner without resorting to a forest of buttons on the surface. All bus routing and re-assign routing can be dynamically automated. In fact, the only functions not currently dynamically automated are the router patches. These are currently stored as snapshots but if enough owners request it dynamic automation may appear later.

The Automation Control panel works in conjunction with the ITI to make automation decisions and changes which globally affect the console. For the more adventurous specifier, the console is available with two layers—this allows one set of input strips to control twice the number of execution cards. Strips can be switched between layers individually, globally or in user-defined groups.

Given the variety of output formats and the number of record tracks involved, one of the more important aspects of film console design is monitoring and machine control. This is further complicated by having two or three simultaneous users with differing requirements.

The quaintly named PEC/DIRECT paddle switches on the Bias-Tape panel switch between track sends and returns. There are 32 logical switches any or all of which can be controlled by any physical switch. PEC stands for Photo Electric Cell, an archaism from the days when film sound was recorded with an optical camera directly onto negative film. In practice, the Direct side of a logical key will be an output bus and the PEC side a replay return from a physical recorder track. A Dolby Stereo or other encode-decode matrix may be inserted to enable its effect on the mix to be heard. The outputs of the logical switches feed the 32 inputs of the monitor matrix controlled from the ITI or the Softkey-Reassign Matrix panel.

There are ten preset buttons for fast access to various permutations. The LED bar graph meters can be routed to follow the logical keys. The physical controls are available in blocks of eight with Master controls in addition. An annunciator shows which bus is attached to the physical switch. There are also Bias buttons associated with the paddles for individual machine tracks or groups of tracks. This cleverly follows the track assignment selection. Finally, and telling both of the function of a film console and the MPC's ability to deliver, each of the desks operators can have their own set of these physical controls while leaving one position in overall control of the session.

For the more adventurous specifier, the console is available with two layers–this allows one set of input strips to control twice the number of execution cards

If you're thinking of moving into film work, you will need to consider all of the above. And if you're thinking of reassigning an existing console, you will need to think about it twice.

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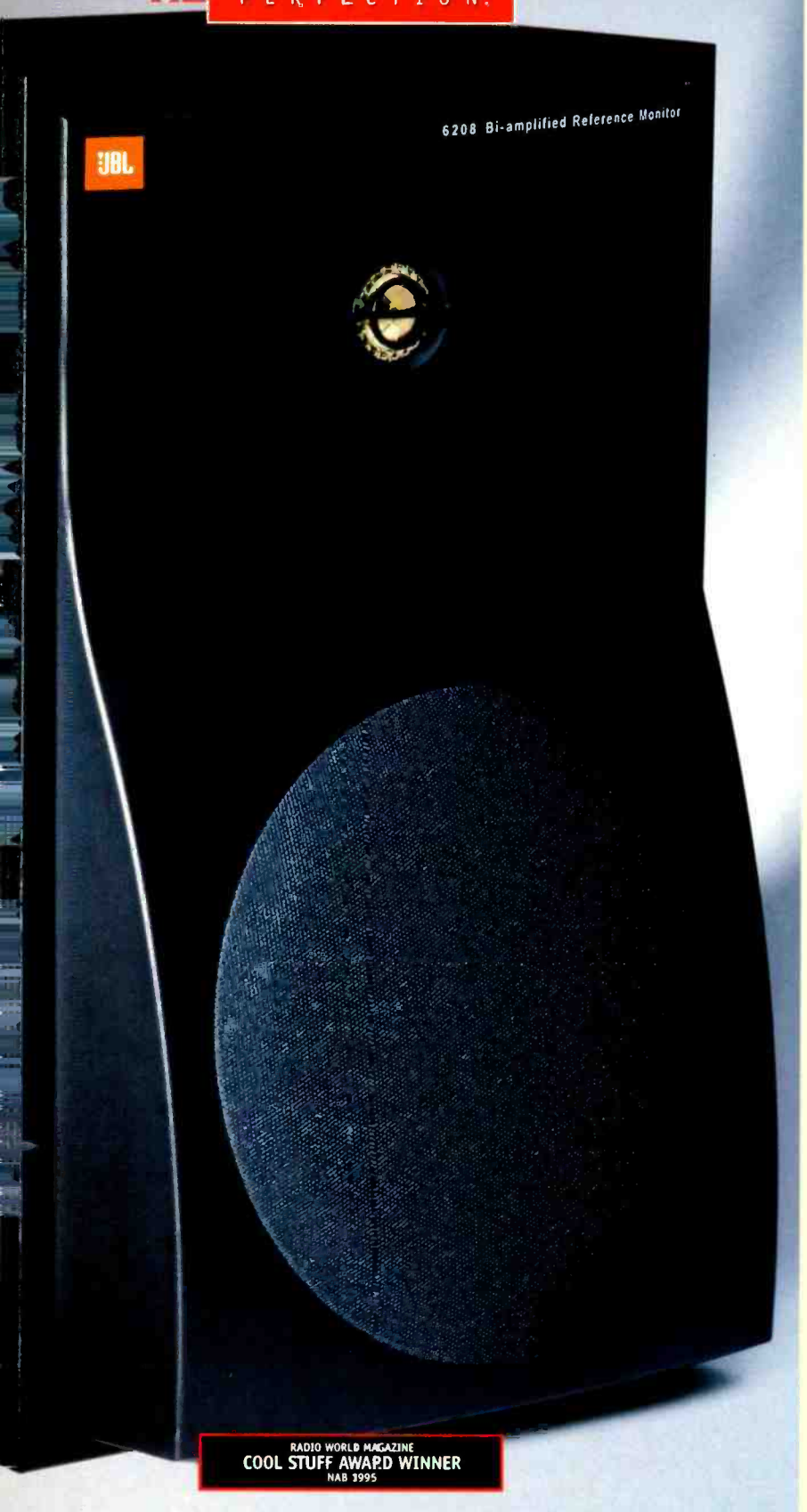

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Lawo MC82

The launch of digital consoles is not limited to the low end. **ZENON SCHOEPE** previews the latest digital desk from an established although not internationally known German manufacturer and deems it a contender

MC80 at ZDF Mainz

TO LOOK AT GERMAN console manufacturer Lawo is to discover a company that has quietly been getting on with it while the more high profile players have been hogging the digital desk limelight. Why many may not have heard of the broadcast specialist company is because its activities have been largely restricted to Germany—only four of some 30 digital desks have been placed outside of the country's borders. A little predictable perhaps, but a state of affairs that does Lawo's reputation no harm given the high regard that the country's broadcasters enjoy. Indeed there are many other countries where this situation would relegate a predominantly home-market based desk manufacturer to 'passing interest' status to the rest of the world. But Germany is different because as a market, and particularly as a consumer of digital desks, it is arguably the most sophisticated on the planet with all those high–profile players also enjoying the pickings. Why the German market is so plugged in to digital desks is a historical thing that hinges on the importance and investment placed in its varied and advanced broadcast set-up.

Lawo is no small company, it employs around 100 employees at its headquarters in Rastatt near Karlsruhe in all aspects of its manufacture and R&D of its boards. Its history is interesting with its founder, Peter Lawo, having a background in radio and navigation systems engineering before his development of a sound processing system for SWF and the creation of the company in 1970. This progressed in to tentative desk development of first analogue and then digitally–controlled analogue with the PTR model which benefited from the country's broadcasters adoption of a standard sized 'desk cassette' module which permitted custom configuration boards to be constructed. The PTR DCA technology is still current although what drew most observers' attention to the company was the rather surprising revelation of a fully–digital broadcast desk at the 1994 European AES. To its credit the company admits that originally it had intended to keep the work

> To its credit the company admits that originally it had intended to keep the work surface and simply switch over from the analogue to a digital remote rack but found this to be more complicated than it at first thought

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MC50 at SWF Mainz

surface and simply switch over from the analogue to a digital remote rack but found this to be more complicated than it at first thought and now is sure that this is not the way to cross this particular divide. A rethink was required.

Two models evolved, the smaller MC50 targeted at on-air use, itself a surprising qualification of just how willing the German broadcasters have been to go digital in radio while most other countries, and most other manufacturers for that matter, have largely avoided this particular area, and the altogether larger and more immediately identifiable MC80 production desk for music and drama recording, post and OBs.

Both consoles share similar processing innards but differ in configuration according to application and in their presentation of controller surface. The MC82, which will be shown for the first time at the Munich AES Convention this month, is a further development in controller surface, operating the same processing power in what has to be regarded as the strongest and most pertinent statement from the company since the revelation of all digital know how.

It employs what the company terms 'active spare parts' that effectively share processing tasks and permit one to take over processing should the other fail

An in-depth look at the capabilities of the MC– series desks is beyond the scope of this article, particularly as the focus has to be the new MC82 arrival, but those that are intrigued ought to investigate further for themselves. However, a brief outline is essential.

What we have here is 32-bit floating point processing that incorporates a large–greater than 500 x 500–matrix that is tied into console set–ups and reconfigurations working on multichannel audio links. The desk is modular from a DSP scaling point of view and through its control surface which incorporates cassette panel modularity. It employs what the company terms 'active spare parts' that effectively share processing tasks and permit one to take over processing should the other fail although the company stresses that this has been more of a psychological selling tool to reliability-nervous

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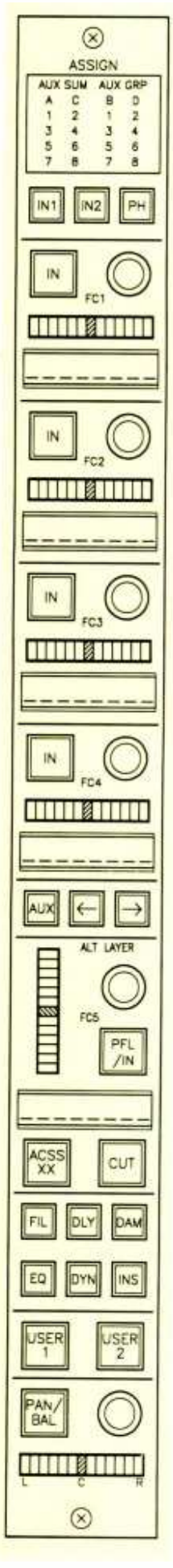

broadcasters than a practical necessity.

Lawo also makes much of its desks' ready to go out-of-the-box nature with no laborious boot routines. Custom configured for every client, the board switches on in much the same way as any analogue one does.

Features wise the boards have adjustable digital headroom, mic–line amps with split outputs, optional mic–line preselectors with 2 or 4 inputs per channel, AES3 IOs, proprietary sample rate convertors, clock regeneration and a stage box connected via fibre optic. The desk can also have a 'remote' control worksurface specified for instances where a control room and, say, a studio floor mixer both need to have access to the same electronics rack.

On a per channel basis there are four fully parametric bands of EQ sweeping from 20Hz to 20kHz supplemented by high and low sweepable filters and dynamics with a limiter, compressor, expander and gate all individually activated. Processing order can be altered by the user. The number of auxes depends on the configuration but can stretch to 32.

The limit of the DSP is 140 channels but the matrix, by virtue of handling far greater numbers of input and output interfaces, can be reconfigured at the touch of a button to access more sources and destinations and can patch across itself without going near a channel. A relatively new introduction is a multichannel panning option which can work either with a joystick or can be controlled via channel rotary controls. A total of 16 outputs can be created by the system.

Dynamic automation is available of all parameters aided by snapshots that can be recalled from the desk surface or from a trackerball driven screen-based approach. Signals can be isolated from the Snapshots which also isolates from the matrix. The automation is refreshingly uncomplicated employing the touch sensitivity of all the controllers and Lawo is currently developing a Trim mode for the EQ and off-line editing of automation data is also in the pipeline.

Operation of the board is via now well accepted principles of a central super channel strip which is assigned a channel on an Access switch supported by a few local channel rotary controllers (Free Controllers) that can be assigned functions and control by touch aided by assignable local switches. Channels have A and B layers to access two different types of signal path.

The centre section of the control surface has to be among the most heavily switch laden of any digital desk as the company appreciates that its customers are turned on by them and used to them in analogue equivalents. These can be programmed and assigned according to customer practices to, for example, preselect talkback destinations, speaker dimming and reverse talkback sources. On first encounter it's not the most instinctive arrangement but then each desk is designed and configured for a particular user. Once the arrangement is explained it becomes surprisingly easy to grasp. I would hesitate to describe the system as similar to any existing large-scale digital desk but there are enough similarities in general operating principles to make it seem familiar. It's actually quite obvious in very workmanlike way but still different. Not a bad thing.

Once the arrangement is explained it becomes surprisingly easy to grasp. I would hesitate to describe the system as similar to any existing large-scale digital desk but there are enough similarities in general operating principles to make it seem familiar

Where the MC82 differs from previous variants is in the arrangement of its channel strips which are about twice as long as those employed in the MC80 using different and more elements arranged in a different manner. It's certainly more trad looking to that on the MC80 but then it has come about because of requests for precisely this. The most significant departure is the inclusion of a dedicated control section on the strip to handle the channel's B layer permitting the desk to be used in an in-line fashion without resorting to switching layers.

More controls than MC80

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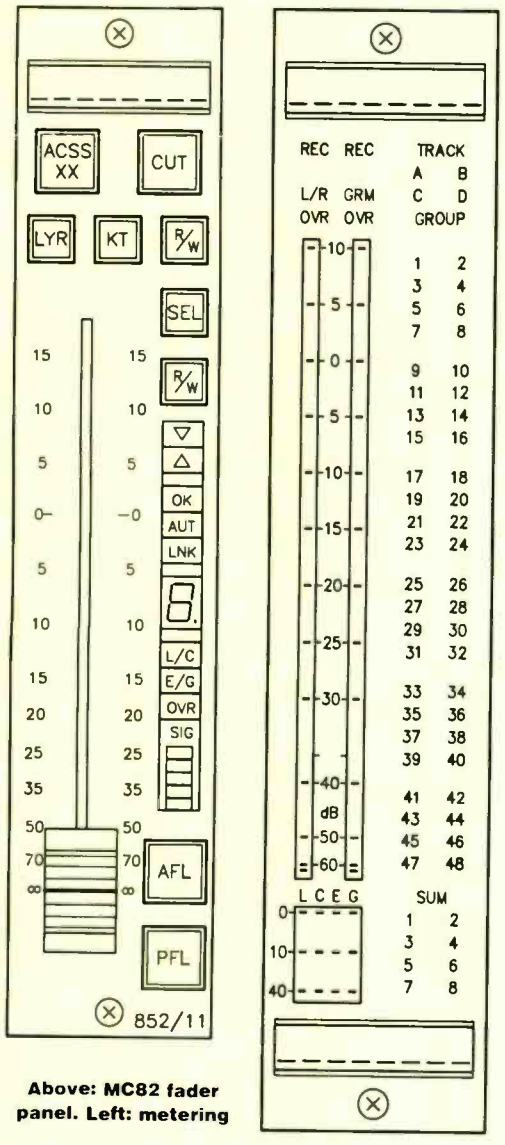

Above: MC82 fader panel. Left: metering

The arrangement also benefits from four more comfortably spaced Free Controls complete with larger identifying character displays and bar-graph value displays which adds up to significantly more local control. You also get individual switching of insert, delay, the digital amplifier,EQ, filters and the dynamics plus two assignable switches. The new module fader has dedicated function keys for cut, automation cut, Access, layer switching, fader automation, AFL and PFL plus indicators for automation status, parameter linking, VCA master status, overload, compressor-limiter activity, expander–gate activity and signal indicator LEDs.

As with the MC80 and MC50, MC82 and MC80 panels can be combined on the same desk to produce a type of hybrid control surface. Basically you can plan your control surface to suit the eventuality or likely requirement.

It doesn't take an enormous amount of imagination to realise that Lawo is clearly into the business of adapting control surfaces and while the company will not confirm it, I would not be surprised if it didn't take this process still further in order to spread the attraction of its products beyond the realms of its core broadcast user business.

The important thing to remember about Lawo's digital technology is that it's not pipe dream stuff and it's not just being used in C rooms and experimental suites. These desks are *in situ* and are being used around the clock for broadcasting duties. I've seen working stations on-air and loaded with these consoles.

The sheer number of them in Germany would suggest to even the most cynical that these broadcasters would not commit to technology that doesn't deliver. While the brand may not be that well known outside of northern Europe, it is already unquestionably an established and leading supplier of broadcast digital desks.

Perhaps the biggest question is whether Lawo can break out of its mostly home market and transplant its consoles into other territories. This will undoubtedly require modifications of the systems to fit in with the working practices of other broadcasting organisations but Lawo has built its reputation and prides itself on offering what equates to analogue desk style custom configurations for specific applications and requirements so this shouldn't pose it too many problems.

The release of the MC82 is a step towards broadening the appeal of the company's products and a significant advance in internationalising its business. It has something a little different to offer that amounts to all the trappings of a new global player. We should be paying attention. You read it here first.

It doesn't take an enormous amount of imagination to realise that Lawo is clearly into the business of adapting control surfaces and I would not be surprised if it didn't take this process still further

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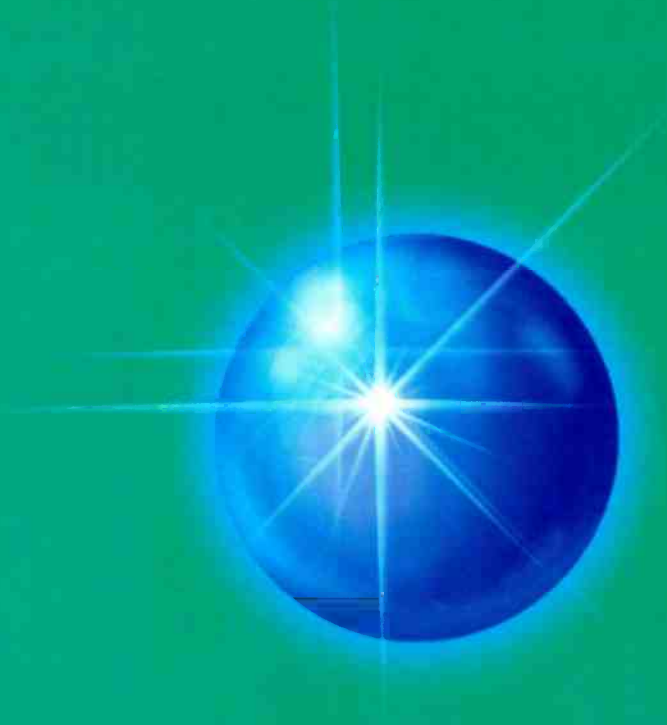

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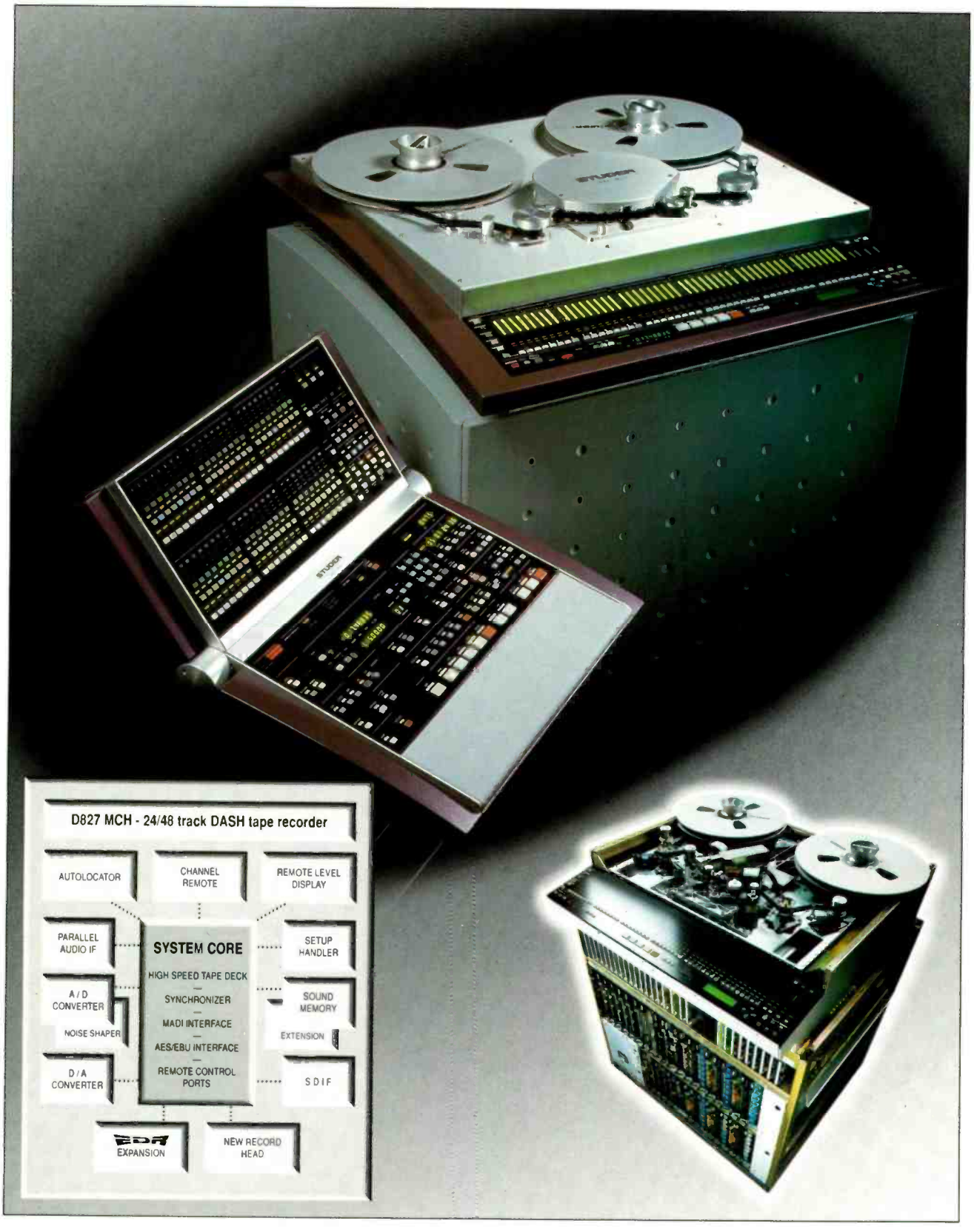

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Audio Toys 8MX2

The flexibility and portability offered by modular digital multitracks is only the start of the story of convenience.

DAVE FOISTER discovers an unassuming mixer that could dramatically change your way of working

LITTLE RACKMOUNT MIXERS are ten a penny. With dodgy line level input and output jacks, tiny awkward knobs and rudimentary facilities, they are only really at home as part of a keyboard rig, and have no place in a professional studio. This kind of line-level combiner is only a step up from a passive box full of pots—only just warranting the use of the word mixer in its most basic sense.

The 8MX2 from American company Audio Toys is radically different. It looks deceptively similar, but it soon becomes apparent that there's far more going on inside this 1U-high box than you'd have a right to expect. Essentially it's an 8:2 mixer, as the model number suggests, but there the similarity to the overblown Y-cords ends.

> The channel signals can feed not only a stereo bus but individual direct outputs as well. This is the completely unexpected ace up the 8MX2's sleeve its eight outputs appear on a 25-pin D-connector wired in the same way as the Tascam DA-88

For a start, it has proper balanced microphone preamps on all eight channels, complete with individually switchable 48V phantom power. ATI (Audio Toys Inc) is proud of its preamps, which also feature in its Paragon sound reinforcement consoles and the Pro6 processing channel. On the 8MX2 the preamps can handle levels up to +24dBu, removing the need for separate line inputs. Unusually, a useful ground lift switch is fitted to each input, although for obvious reasons this cannot be used when the 8MX2 is supplying phantom power.

The next surprise is that the channel signals can feed not only a stereo bus but individual direct outputs as well. This is the completely unexpected ace up the 8MX2's sleeve and gives away the primary market for the mixer, as its eight outputs appear on a 25-pin D-connector wired in the same way as the Tascam DA-88 balanced input connector. This allows it to deliver balanced pro level line signals to a suitable multitrack as well as giving an independent mix for monitoring or a stereo safety or reference recording. It goes further still, in having corresponding multitrack returns, again on a 25-pin D, for confidence monitoring or simple mixing. These too are balanced at +4, and although the obvious direct link is to a Tascam MDM—the DA-88, the new DA-38 or the Sony versions of the format—Audio Toys can supply ready made cables for a variety of other applications, including ADAT EDAC snakes and flails terminating in XLRs or TRS jacks. This copes with Sony PCM-800s and the Roland DM-800 and many more besides, and for those who need something different the full wiring spec is of course in the manual. It is also printed on the unit's top panel, along with other useful information.

Multitrack returns are individually selectable on the front panel for each channel, the chosen signal—source or tape return—feeding the stereo bus. A dual-concentric control handles level and pan, with a clearly marked unity gain calibration and a centre detent for the pan pot. A button marked MIX enables or cuts the feed, effectively acting as a mute although leaving the direct multitrack output intact.

The 8MX2: a light hidden under the Audio Toys' bushel

Each channel also incorporates a simple limiter, perhaps not the first extra facility you might think of adding but it's the only one that can be worked with one knob. This is the outer of the dual-concentric pair with the preamp gain as the inner, and as this would suggest it sits permanently in the preamp signal path, not available to the multitrack return. Time constants are fixed and fast with a claimed brick wall ratio, and the control sets the limiter threshold as low as +4 at one extreme while leaving it effectively off at the other.

A mixer must have a master section, and the one on the 8MX2 once again squeezes more than might be anticipated on to its 3-inch panel space. Here a dual-concentric deals with main output level and left-right balance, while the unit's only single control handles monitor level. This in itself is a surprise, as the mixer has a monitor output separate from the main mix feeds, available both on headphones—with plenty of level—and balanced, line-level TRS jacks. One of the advantages of this is that it allows a Solo facility to be fitted, a most unexpected luxury.

Each channel has its own CUE button whose function is determined by selectors on the Master section. One of these decides whether the signal is heard before or after the limiter VCA, while the other selects the multitrack return for solo purposes regardless of which signal is actually being sent to the mix bus. Solo is always mono.

The master section carries a pair of LED bar graph meters whose function is not just straightforward stereo level ☞

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monitoring. In fact, the stereo output can't be metered as such; under normal circumstances the green right-hand meter shows a sum of the two channels, reduced by 6dB. If a channel is soloed, however, the same meter shows the level of the chosen signal while the right hand one—marked Atten—shows operation of the channel's limiter circuit as a yellow bar graph falling from the top. Multiple channels can be soloed simultaneously and their combined levels and limiter attenuations are shown on the meters. By the very nature of the front panel it is not always easy to tell at a glance whether some of the buttons are pressed, so a valuable addition is an LED to show that Cue is active somewhere. For what it's worth, the Cue system places no clicks or other nasties on the main outputs, which although it may seem obvious is more than some much grander mixers can manage.

The final facility is a 2-track tape return, selected for monitoring with a single button, but yet again all is not as simple as it appears. The 8MX2's only internal jumper option decides the role of the return input connectors, allowing them to be hooked to the mix bus directly rather than just used as a monitor return. This means they can be used for effects inputs or other line level sources whose level does not need adjustment at the mixer.

A digital 8-track makes an ideal small-scale live classical recording medium given a suitable set of mic preamps and a convenient monitoring system, and this fills the bill perfectly, with the added bonus of a decent stereo mix just in case it's right first time

SO FAR SO GOOD: a small innocuous box turns out to be a complete 8:8:2 mixing package with all the facilities and flexibility needed for basic 8-track tracklaying and monitor mixing. But there's more still. Another pair of D-connectors on the rear panel—9-pins this time—allows multiple 8MX2s to be linked together to form a bigger system still. Not only are the stereo mix buses linked but so are the logic and signal lines for the solo system. This means that three of these mixers constitutes one integrated 24-track package, with 24 direct channel outputs, full 24-track monitor returns and stereo mixing of everything. The final stereo output is taken from one master 8MX2, and the same unit will then deliver full monitoring of the whole system, including all the solo functions from any of the slaves.

Part of the achievement of the 8MX2 is the fact that once you realise just how much it's got to offer it is remarkably easy to use, with all its facilities readily to hand. There's not much real estate available on the front panel to provide finger space between the controls, but they have been squeezed on just about as effectively as they could have been. I particularly liked the dual concentrics, often a real pain; these ones operate properly, with none of the common disastrous tendency for one half to move with the other. All the controls except the pan pots are detented all the way round to feel a bit like rotary switches but remain smooth and positive in operation.

The 8MX2 even manages to look distinctive; what you can see of the front panel through the forest of controls and the labelling is finished in a bright metallic red reminiscent of another manufacturer whose name escapes me for the moment, and the knobs are colour coded in brutal black and titivating turquoise. If it has a negative point it is the slight noise of its fan.

Audio Toys begins its introduction to the 8MX2 by extolling the virtues of its microphone preamps, not its ability to shoe-horn twice as much mixer into 1U as you'd have thought possible. Consequently one would hope that the audio quality would be as much of a design priority as the facilities, not just a secondary consideration, and here again one would not be disappointed. The microphone preamps are quiet and clean, with an extended HF response that bears out the published graphs. These show ruler flat lines in the conventional audio spectrum with only 1dB or so roll off by 50kHz. The limiters too are virtually inaudible in operation; I used them on a pair of drum overheads for safety and a bit of squashing and never once heard them obtrude, so evidently the time constants work well. Every element of all the signal paths, including the Cue system, sounds good, right down to the quality of the headphone output.

So there's no EQ, no auxes; it's easy to find things the 8MX2 hasn't got compared with conventional mixers, and none of the omissions is a surprise given the scale of the thing. The real surprise is just how much it has got, and the multitude of possibilities it presents.

ATI has a companion brochure to the manual showing suggested applications, which include use as a submixer to an existing console (a use which the enterprising could make even more viable given its logic interfacing capabilities), simple 8-track location recording and full-blown 24-track work. The more I looked at it, the more uses I saw for it and the more enthusiastic I became. A digital 8-track makes an ideal small-scale live classical recording medium given a suitable set of mic preamps and a convenient monitoring system, and this fills the bill perfectly, with the added bonus of a decent stereo mix just in case it's right first time.

As it stands the 8MX2 is a light hidden under Audio Toys' bushel; it deserves a higher profile, as there are any number of applications it can help with. I enjoyed it, and so will you.

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Bag End ELF SYSTEM

With increasing attention being focussed on the bottom end of the frequency spectrum, the search for an optimum subwoofer system is on. TIM GOODYER traces the development of one that has caught the attention of the US post market

BEFORE LOOKING at the Bag End ELF—or Extended Low Frequency— speaker system, it is necessary to examine the conventions in LF speaker design. There are two basic types of systems used for producing extended bass response—one acoustic, the other electronic. Acoustic systems can be divided into Assisted Resonance Systems that rely on wavelength dependent parameters, which require larger dimensions, and Mass Loaded Systems which are less efficient.

Assisted Resonance Systems (ARS) include ported, passive radiator, tuned chamber and transmission line or labyrinth systems while Mass Loaded Systems (MLS) are generally closed box, stiffness controlled systems. The distinction between the two is blurred if both wavelength dependent parameters and mass loading are combined in one system. Electronically Assisted Systems (EAS) include servo-controlled and bass boost types which are complicated and costly because of their loudspeaker and driver design requirements.

The ELF System

For a given diaphragm size, the maximum acoustical output level is limited by the maximum excursion capability of the loudspeaker driver. This is greatest at the lowest reproduced frequency—for every halving of the frequency, the excursion is four times as great. For example, to produce the same acoustical output at 32Hz as it does at 64Hz with a 1/8-inch peak-to-peak motion, the excursion of the bass driver diaphragm would be 1/2-inch peak-to-peak. Any driver operating in a closed box, is constrained by this law of physics.

In ARS, the acoustical output is increased beyond the normal limit of the driver excursion through ported, or bass reflex, systems. Ported systems have enjoyed popularity for a number of reasons. Through the work of Novak, Thiele, Small, Keele and others, this design generally gives a system that behaves as predicted. Consequently, ported systems have progressed from simple types to complex, multichamber systems—the latter designed with the loudspeaker drivers mounted inside the enclosure and the acoustical output radiated from single or multiple ports.

For a given diaphragm size, the maximum acoustical output level is limited by the maximum excursion capability of the loudspeaker driver

Another type of assisted resonance system is the transmission line, which in its folded form is called an acoustical labyrinth. These systems rely on the output from the rear of the loudspeaker driver to assist the output from the front. The transmission line systems are the largest of the ARS types.

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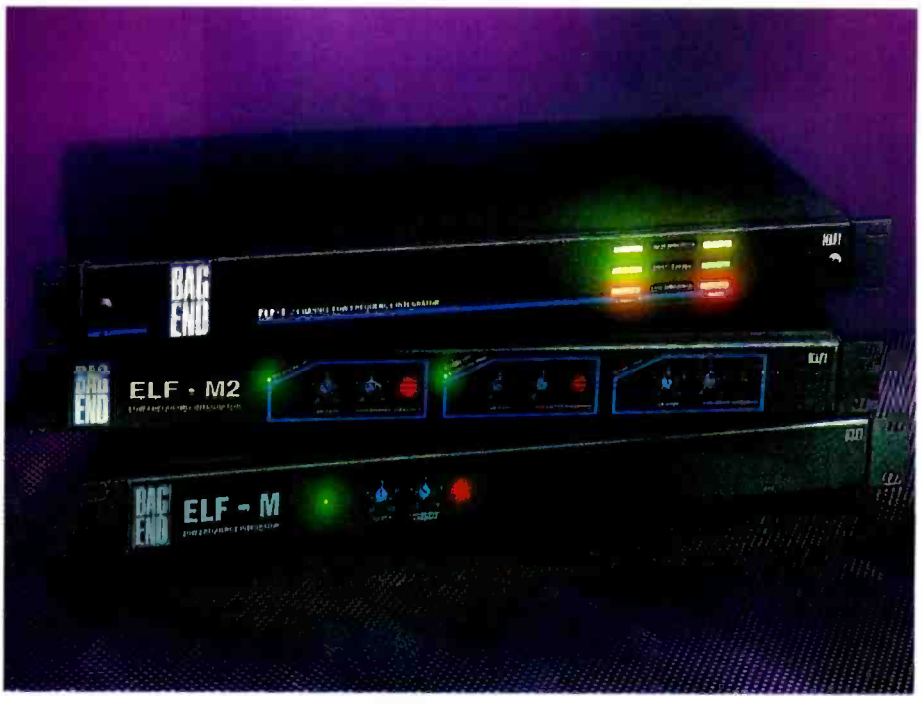
All LF ARS are large because they rely on acoustical stiffness of the air in the enclosure as well as the mass of the air in the port to tune them to a low frequency. This means that the size and weight of the enclosure is directly a function of the lowest frequency to be reproduced. In addition, the quality of sound is dependent on the internal impedance or damping provided by the driving amplifier. The

The ELF system was designed in the 1970s by Bag End's Ron Wickersham and Ed Long and is intended to provide a low distortion, extended bass response in a compact design

resistance of the connecting cables also can be a factor. Amplifiers work best when the impedance of the load is constant. The interaction of the amplifiers internal impedance and the varying impedance presented to it by the loudspeaker will affect the amount of power that the amplifier must deliver. It also affects the damping, or tightness of control, that the amplifier can exert on the loudspeaker system.

The upper range response of a subwoofer system also must be rolled off by a low-pass filter to blend with the main system. This introduces a time delay in the low frequency range because all low-pass filters have time delay. Also, because the rear of the loudspeaker driver diaphragms have no loading at the lowest frequencies, where the ports act merely as vents to the outside of the enclosure, a high-pass filter must be added to prevent the loudspeaker drivers from being driven beyond their capabilities and thus producing distortion.

The most complicated of all the different electronically assisted systems is the servo-controlled system. Servo systems are replete with complicated and interacting parameters which must be monitored and controlled in real time if the system is to work properly. Even the placement of the accelerometer used to monitor the diaphragm motion is not trivial.



ELF processors

Consistency in production is a major problem with these systems.

THE ELF SYSTEM was designed in the 1970s by Bag End's Ron Wickersham and Ed Long and is intended to provide a low distortion, extended bass response in a compact design. It began as a project to extend the low frequency range of a compact monitor loudspeaker system using a parametric equaliser. Long was able to adjust the frequency and Q controls to extend the compact system response one full octave below its normal cutoff. The sound was satisfying but the maximum output level was reduced. When the system was played at loud levels, vocals tended to lose clarity when the accompanying bass was heavy. They decided that a separate subwoofer system would be a better way to go.

The development grew up from the analysis of the way a driver behaves in a sealed and a ported enclosure, above and below resonance. They decided to try placing a simple dual integrator circuit in front of a power amplifier and connect it to a closed box system. The

The interaction of the amplifier's internal impedance and the varying impedance presented to it by the loudspeaker will affect the amount of power that the amplifier must deliver

resulting measurements revealed a flat response below resonance and a roll-off of 12dB/octave above resonance.

The next step was to determine the frequency above which the action of the dual

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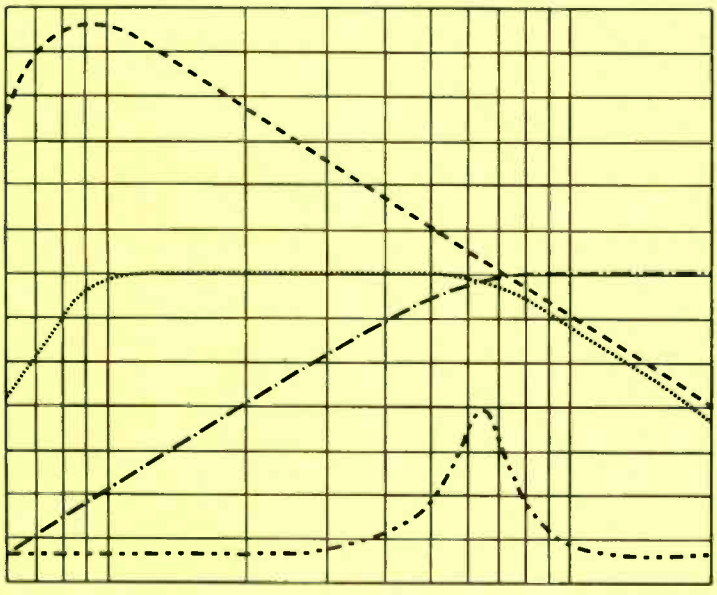

Electrical frequency response of the ELF dual integrator

Acoustical output of the ELF system

Acoustical frequency response of the ELF loudspeaker in a sealed box

Impedance amplitude of ELF loudspeaker in a sealed box

integrator was to cease and with this came the realisation that a smaller cabinet would allow operation to a higher frequency without changing the electronics.

Long and Wickersham filed for US and foreign patents and then constructed the first system using ELF with which they were able to demonstrate that ELF could be used with from 18-inch down to 2-inch driver systems.

Enhancements have been added since but the principle remains the same. Any subwoofer system design can operate the same ELF electronics without modification. The driver and and enclosure are tuned so that the system resonance is just below the desired low-pass crossover frequency. Below the system resonance (caused by the interaction of the driver mass and the stiffness of the air in the enclosure) the low frequency response of a closed box system rolls off at 12dB/octave. The rise in impedance occurs at the system resonance.

The development grew up from the analysis of the way a driver behaves in a sealed and a ported enclosure, above and below resonance

'The beauty of ELF is that is can provide both the desired low frequency response and the high frequency roll off simultaneously,' Wickersham says. 'With an optional low-frequency filter, the ultimate low frequency roll off will be at 24dB/octave, thus limiting low frequency driver excursion.'

If the input signal to the closed box system were caused to increase at 12dB/octave below system resonance, the response would be flat. Above the system resonance, where it is flat, if the signal were caused to roll off at 12dB/octave, it would result in the desired rolloff. ELF technology provides a response shape that has both of these drive signal characteristics simultaneously. The 12dB/octave response shape is provided by a dual integrator which results in the desired response. The final system response can easily extend to frequencies below 20Hz.

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REVIEW

Lexicon MPX1

The fashion in outboard is downward–whether it is for processors derived from expensive desks or 'affordable' outboard derived from more costly brethren. GEORGE SHILLING assesses Lexicon's latest foray into the middle market

HOT ON THE HEELS of Lexicon's mid-range multi-effects PCM80 came tc electronic's reply: the M2000. This incorporated many of the PCM80's innovative features, along with the much vaunted Wizard feature, and a price lower than the Lexicon. But before you can say EkoVerbSweep Lexicon has replied with the MPX1. When I took a look at the PCM80 for *Studio Sound*, I liked it immensely but was critical of the preset numbering, lack of XLR connectors (now rectified), and lack of distortion effects. The MPX1 addresses these criticisms, boasts many of the PCM80's features, adds some new M2000-inspired features such as morphing, and has an asking price lower than the tc.

The most obvious difference between the MPX1 and its big brother the PCM80 is the lack of a PCMCIA card slot on the MPX. However, the illuminating switches labelled: PITCH, CHORUS, EQ, MOD, DELAY and REVERB give an immediate visual guide to the effects in use for the current preset, and enable instant bypass and editing of each section in the chain. Each effect subdivides into different categories, some not normally associated with the main effect type. Similar to these buttons are those for Mix, Bypass, and Patch, which enables any control to adjust any parameter (up to five patches simultaneously). There is not only an input level pot, but usefully an output pot too.

One limitation is that you cannot overwrite the 200 supplied presets—but I used to think the nine programs on an AMS RMX16 were plenty. There are 50 Store locations for saving user edits, and of course you can do MIDI SysEx dumps. A huge LED display shows the preset number: 1–200 for presets, plus 201–250 for user memories. Adjacent is a less clear illuminated LCD screen for editing parameters and system information. This is poor compared to the PCM80's LED matrix, and it took me a while to find the contrast adjust parameter in the depths of the menu system. A database sort function enables you to categorise programs in many ways.

Physically, the MPX1 is several inches shallower than the PCM80 and includes both jack, XLR and SPDIF inputs and outputs. There are jack sockets for footswitch and foot controller, and the MIDI implementation even includes an arpeggiator function. The tone generator is accurate to a quarter of a cent and is useful for tuning and creating effects. Some of the MPX's inventive pitch-shift programs do not appear on the PCM80 until you obtain the new card, and also Overdrive effects, which have yet to make their PCM80 debut. However, the MPX1 does not share any of the surround-type effects of the PCM80. The signal path can be viewed on screen to assist navigation around the endless routing possibilities through and around the different effects blocks.

The A/B button switches between two variants of many of the presets. Any control can be patched to the A/B function, so all sorts of effects can be achieved, such as M2000-style morphing from, say, a reverb to a delay, triggered by the input level. Glide times can be set from instant to taking several minutes, but in typically perverse fashion, 0 is long and 100 is short. A display in seconds would be of more use. The effect is more a smooth crossfade than a true morphing effect.

By pressing VALUE you come to the Soft Row which contains the most important parameters for any given preset. This is like the PCM80's Go mode. For all of the finer tuning of obscure parameters, you press EDIT and then the relevant effect button to access all the settings, buried in layers of menus, where you can also change, for example, the reverb type. The menu system can at times be slightly confusing: I was expecting to find the Meter Assign setting in the System menu, not the Edit menu.

A TAP button sets up delay times, which can alternatively be MIDI clock controlled, and set globally or separately for each preset. However, not all the obvious possibilities have been utilised: In a few programs where, for example a pitch shifter modulates the input, the Tap tempo has not been patched to the LFO Speed. There is a way of setting this up, using the comprehensive patching facility, but I am surprised Lexicon missed this.

One potential area for confusion is that the rotary knob can be used either as a parameter selector or adjuster, depending on whether the VALUE button is lit—but it's useful when you've mastered it.

The MXP-1: worthy of investigation even if you already have a PCM80

There are some wonderful reverb programs—the Small, Medium and Large halls are not dissimilar from their 480L counterparts, with all the familiar parameters such as Spread and Shape. Programs such as Miked Cab EQ are not as good as the real thing, but useful if you don't have an amp-speaker setup to hand. There is a preset called Tape Echo, but sadly you do not get all the pitch changing madness as you change the delay time that you would with, say, an Echoplex. Included are rotor-cabinet, telephone and loudspeaker effects and a few new remix effects worth checking out.

Lexicon's reputation for high-end reverb processors needs no qualification here. The company's track record on budget units is good but it's a crowded market place and the competition is tough. One of the most significant elements in setting the MPX1 apart from this competition is the use of a separate dedicated chip to handle reverb processing—this alone should set the unit's reverb programs apart. Further attention to performance detail means that there is no discernible lack of sound quality compared to the PCM80. So even if you already have a PCM80 this unit is worthy of investigation.

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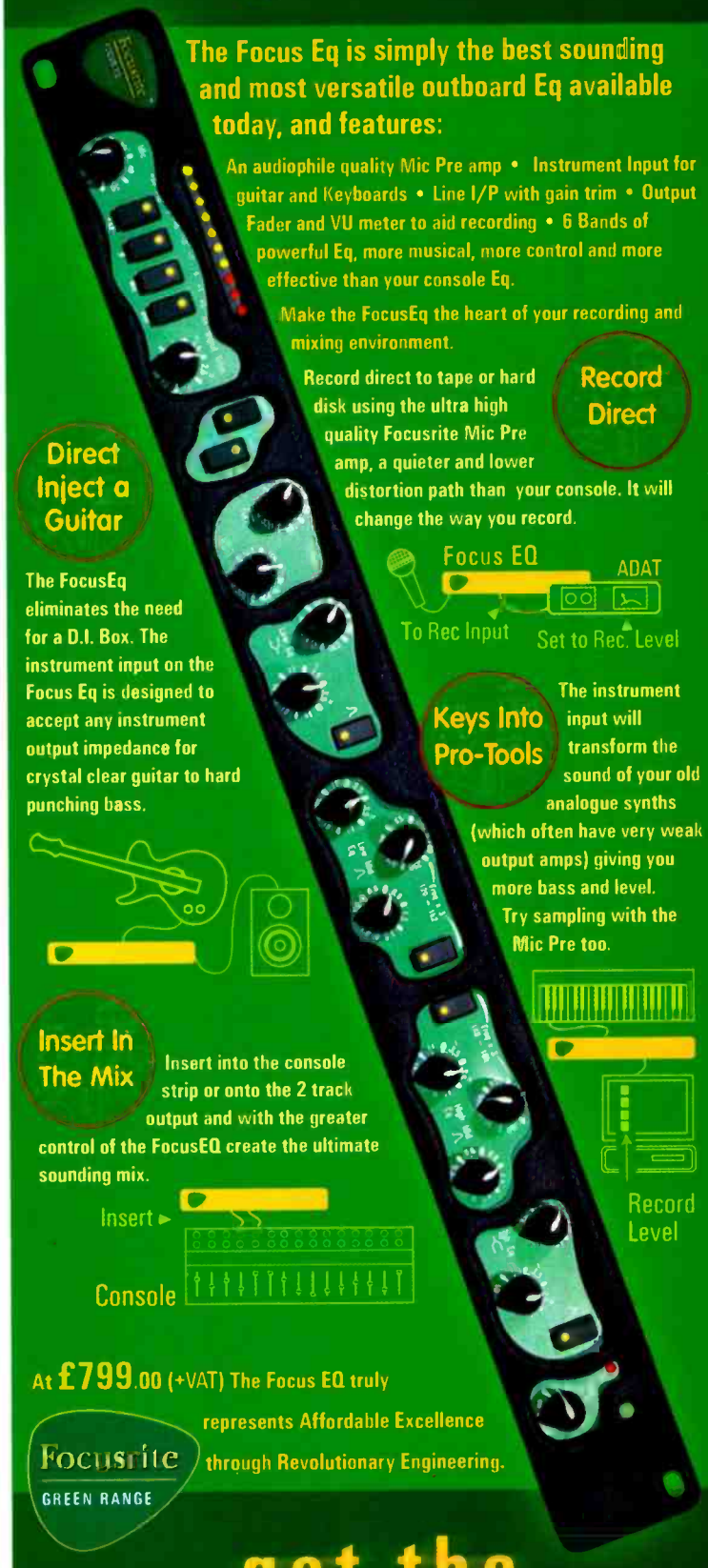

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Audio-Technica AT4041

The abundance of new, revived and improved large-diaphragm microphones currently appearing on the market either thrills you or bores you. DAVE FOISTER finds a welcome variation in AT's new small-diaphragm star

AUDIO-TECHNICA'S SUCCESS in moving its range of microphones up market is indisputable. It began with the AT4033, a large-diaphragm side-fire condenser which immediately drew favourable comparisons with established stars, lacking only the facility to vary its polar patterns to put it on a par with the very best. This omission was put right with the AT4050, endorsed by no less a personage than Alan Parsons, which achieved the unusual feat of becoming a familiar standard almost overnight.

An indication of their acceptance was the fact that both these microphones were used extensively for the broadcasts of last year's Atlanta Olympic Games. The new addition to the family, the AT4041 represents a departure from the established style, as it is a simple stick-type end fire microphone with a much smaller diaphragm. It is more than usually long but slender with it, forming an elegant contrast to its much chunkier stablemates.

> Vocals, perhaps the last thing you'd expect to choose a microphone of this shape for, are handled as effortlessly and convincingly

In fact, it's pretty much as straightforward a microphone as it is possible to be in terms of operation. Its polar pattern is cardioid pure and simple, as the slots in the body design would suggest, and its only control is a deeply recessed switch for bass cut, turning over at a subtle 80Hz with 12dB per octave filtering. With this out of circuit the microphone aims to be more or less flat, with a kink in the published curve betraying a 2dB or 3dB lift just above 10kHz. Otherwise it purports to be effectively a straight line from 30Hz to 20kHz, with an impressively gentle roll-off below.

It also claims a pretty uniform polar pattern with frequency, with a printed plot showing effective nulls at 180° at mid frequencies and only about 10dB more pickup at the extremes. This is borne out by a notably smooth off-axis performance with a naturalness to the spill pickup which as always makes such leakage less of a problem than it otherwise would be.

The heart of the microphone is its capsule, which adopts the Brüel & Kjær approach to condenser design. It uses a fixed-charge back plate, suitably aged to stabilise it and to avoid charge loss and consequent deterioration in performance. This also allows a reduction in the weight of the diaphragm, which helps transient response and HF extension as well as reducing handling and other mechanical noise.

The output is transformerless, helping to give a high SPL handling capability without the necessity for an onboard pad. The literature cites a comfortable response up to 145dB SPL before a THD of 1% becomes apparent.

ALL THESE PERFORMANCE claims are confirmed in actual use. The 4041 is a beautifully clean and open microphone, with a clear, natural and extended HF response and a bottom end warmth that belies its appearance. You could be forgiven for assuming that it might be a bit of a lightweight, but this is decidedly not the case. Handling it contradicts the impression in the same way, as the body is made of turned brass, painted black, and is consequently surprisingly heavy. The same is true of the stand mount, which looks plastic but has a solid metal base and is more than capable of supporting the microphone properly.

The AT4041: 'beautifully clean and open'

The sum of all these parts is a microphone that is nowhere near as anonymous as it looks. There are microphones resembling the 4041 that sit in the mic cupboard as fall-backs, reasonable workhorses that will handle the stuff that's left over when the best ones are all used up on the important things, but the 4041 is in a league above that. It's only trace of individual character is its HF bump, which is placed so as to be subtly useful without imparting a distinctive sonic fingerprint to the microphone. Otherwise it is a genuine all-rounder, without the jack-of-all-trades connotations that the expression usually carries. Vocals, perhaps the last thing you'd expect to choose a microphone of this shape for, are handled as effortlessly and convincingly as individual classical instrumental recordings, with a bottom end warmth that vindicates those who are adamant that you don't need a big capsule for decent bass. The smoothness of the off-axis performance lends it ideally to multi-microphone setups in an orchestra or jazz band.

Classical voice is always a stringent test, and one which the 4041 passed with ease. The spectrum is very extended and the levels can be surprisingly high, pushing the limits of lesser microphones, but the 4041 coped comfortably. There was no trace of strain or tonal restriction, and the gentle HF enhancement was more of a help than a hindrance.

In all the 4041 was full of pleasant surprises. There are jobs for which most people's first choice would be either a familiar large diaphragm standard or one of the more up market small diaphragm models from the likes of B&K or Schoeps. This little Audio-Technica defies first impressions and warrants consideration for such jobs. Its flexibility, its depth and its overall quality belie its size and price and can only further A-T's growing reputation as a manufacturer of seriously useable microphones.

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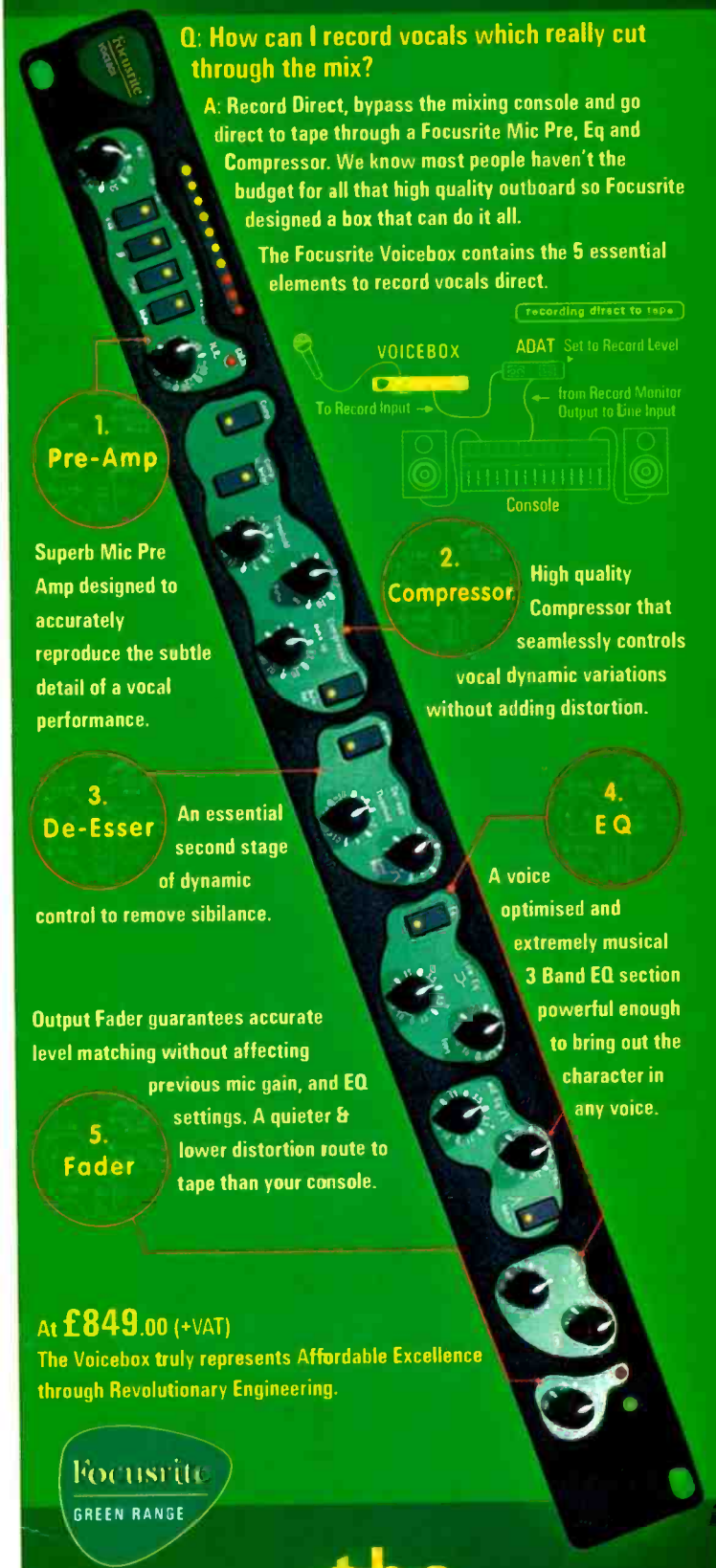

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Fostex D15

Fostex pursue their brief of presenting comprehensively specified professional DAT recorders at keen price points with the introduction of the D15. JIM BETTERIDGE files an exclusive first hands-on review

THE D15 IS the latest addition to the Fostex range of professional DAT recorders and replaces the popular D10. The Fostex DAT range now comprises two portable machines, the PD2 and PD4, the D5—a simple twin-head workhorse based on a Pioneer machine for £995; the D15, the D25—a 4-head time code-capable machine costing £4,845 and the D30—a D25 with a bigger display and a more sophisticated user interface for £6,695 (all UK prices). For those of you who know the range, the D15 can be seen roughly as a twin-head D25.

When it was launched a few years ago, the D10 was innovative in its use of onboard RAM to allow instant start, accurate cueing and, via its GPI (General Purpose Interface) ports, accurate editing between two machines. With the addition of an optional board, it was also the cheapest time code-capable DAT machine on the market. Though without any chase facility it could playback a time-coded DAT or record audio with time code; inserting time code alongside an existing audio recording (or audio alongside time code) was not possible.

The D15 retains all the RAM features of the D10 and goes considerably further as far as locking to external sources is concerned.

> Ingeniously, Fostex have used the onboard RAM of the D15 to simulate varispeed sufficiently long enough to achieve and maintain lock

The three main additions are that it will chase and lock to external time code, it has video sync in and it accepts word clock input—all very important for serious post applications. It also remains the cheapest time-code DAT on the market.

The rear panel of the D15 provides a good range of connectivity for pro and semi-pro environments. Digital in-out is on XLRs for AES-EBU or optical for SPDIF (connecting the XLRs to an unbalanced SPDIF source of target will, of course, work fine in terms of straight audio transfer). On the analogue front, +4dB in-out and time code in-out is provided on XLRs while -10dB unbalanced and time code appears on phonos. The GPI in and out are 5-pin DINs.

The front panel is similar to that of the D25. The tape draw has a window and a light lets you read the label on a loaded DAT. The transport buttons are a good size and illuminate when pressed; bigger would be better, though, and I prefer the old D20 style. Press a wind button once and the tape moves at 5x play speed; push it again and you whip up to 180x. I can't understand why certain other leading manufacturers don't provide this 2-step facility. Winding back a few seconds on some machines is a nightmare.

The latest 'D'—a neat addition to Fostex' range of DAT machines

AS WITH THE D25 and D30, the jog-shuttle wheel can be used to shuttle with audio from ½ to 15x speed or, in the RAM Scrub mode, to pinpoint a position within a single DAT frame. This pinpoint accuracy can be used for setting Start IDs, auto-record in-out points and edit points when editing between machines.

Though not available for another couple of months, there will be an RS422 card allowing integration into an edit suite or, for the sound studio, auto-conforming of audio. Though we obviously can't test in this report, although Fostex have been successful with the D25 and D30 9-pin ports and so with any luck this one will be fine too.

As mentioned, the D15 can be seen as a twin-head D25, so what do you get from the latter for paying almost twice as much? Well, there are a few major advantages. Firstly, the D25 is a 4-head machine so you can monitor off-tape whilst recording (confidence monitoring) and you can gaplessly punch in and out of record.

Secondly, the D25 has insert modes allowing you to record audio and time code independently. This, together with the punching capabilities, means you can drop-in and out halfway through the mix of a 1-hour programme to correct that one little error, avoiding the need to run the whole mix again. A twin-head machine doesn't allow gapless punching and the D15 records all or nothing. In fact, it isn't possible to lock to time code when in record. Lastly, the D25 has varispeed

Previously, a machine designed to chase-lock has needed varispeed in order to slew into lock with its reference time code. Having a variable speed capstan motor adds considerably to costs. Ingeniously, Fostex have used the onboard RAM of the D15 to simulate varispeed sufficiently long enough to achieve and maintain lock. Outside of this function, however, there is still no normal varispeed facility as found on the D25 and D30. In practice, the D15 locks up unusually quickly.

A 37-pin D-type connector has been provided for a simple transport remote, but this standard provides no time code or ABS information. Fostex no longer make a 9-pin remote (which would carry time data) although any of the new wave of reasonably priced third-party devices would no doubt do the trick if required.

The UK price of £2,495 (ex VAT) includes the time-code chase facilities but excludes the RS422 interface card which will be available for 'well under £200'. Worst case, then, we're looking at £2,695 which is at least £2,000 less than any other machine with similar facilities. The main drawback is not being able to punch in or out whilst in lock. However, for conforming, playing-in time-coded DATs and committing automated mixes to tape I can't help but think this is a real winner.

CONTACT

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Yamaha PROR3 & REV500

The first spin-offs from Yamaha's 0-series digital consoles takes the form of two dedicated reverberation processors.

DAVE FOISTER runs them up and discovers a complex virtual audio world that will have mass appeal

YAMAHA DOESN'T do things by halves. The new breed of digital desks is proliferating so fast as to make it hard to keep up, and has almost overshadowed the other manifestation of Yamaha's technological progress—new effects processors. A small but vital part of the appeal of the 02R and the 03D is the quality of the built-in effects, utilising the 32-bit architecture of the desks' DSP. It is therefore only to be expected that the same technology should be presented as a dedicated effects box, and in fact there are two.

The ProR3 appeared at around the same time as the 02R, which perhaps denied it the attention it deserved. Rather than set out to be the usual jack-of-all-effects, the unit is clearly labelled a digital reverberator, and while there are other strings to its bow reverb is its forte. A large range of basic types is available, together with independent early reflection types, and the depth to which the presets can be adjusted and reprogrammed goes well beyond the SPX arrangements.

The method of control is similar to that on Yamaha's previous units, but the user interface is a little less cumbersome than some of those were, and consequently quicker and easier to get round. The screen is big enough to carry a couple of parameters at a time, and in place of the strange old idea of having main parameters and 'internal' ones with no clear logic about what was to be found where, there are now Main and Fine parameters, along with separate menus for EQ, gate and balance functions. Besides this there is a 3-band swept EQ permanently available on the front panel to tweak the signal before it hits the main processor.

The range provided by the processor itself is huge. You'll search in vain for straightforward delay-type effects or such familiar Yamaha stalwarts as Freeze and Symphonic, but what you will find is every conceivable type of reverb, some of which have a touch of flanging, echo, pitch shift or panning available within the effect. As usual the factory presets show all this off to good advantage, with lots of very useful stuff straight out of the box and some off-the-wall things to prompt further experiment.

Range and ease of use are not the keys to the ProR3, however; this would sell with only half the number of presets and no controls simply on the strength of the quality of the reverb. This is probably as much of a breakthrough at the price as the mixers are, and the difference between what the ProR3 can do and what previous comparably-priced units were capable of can be summed up in one word: complexity. The ProR3's algorithms are startlingly convincing simply because there's so much going on within the reverb. There are no bland plastic tails, but real movement and sense of space. Like the most expensive reverbs, these genuinely sound like the spaces they are emulating and show up the lack of character of many run-of-the-mill processors quite embarrassingly. The audio quality also leaves them standing; 20-bit I-Os give ridiculously quiet performance with reverbs that decay to nothing instead of mush.

MORE ASTONISHINGLY, perhaps the same is true of the newer Rev500, apparently the smaller brother in terms of facilities as well as size, but again a reverb specialist with no concessions in terms of sound quality. Here the approach breaks completely with Yamaha tradition, with a front panel lending itself so well to fast intuitive adjustment that it's likely to win new friends on that score alone.

There are four rotary encoders for the four most significant elements of any reverb: reverberation time, pre delay, HF damping and the level of the early reflections. These are live all the time, and moving any of them calls up a graphic display on the large screen showing the effect of the adjustment as well as numeric read-outs of all four parameters. Each preset has a number of additional parameters which can be selected and adjusted quickly with two of the encoders rather than nudge buttons.

Rev 500–set to mass-market the ProR3 technology

Choosing a preset and editing it is made easier by the provision of internal samples of a snare and a rim shot which can be triggered from the front panel to try the settings out. This is an extraordinarily good idea; even when the intended use for a program has nothing to do with percussive sounds, these samples show an enormous amount about the reverb characteristics.

Preset organisation is logical and convenient, being divided into four banks comprising halls, rooms, plates and special effects. The last in particular includes programs with flanging, chorus, resonance and filtering, giving some interesting and bizarre possibilities.

These two boxes between them deserve to take the world by storm. The ProR3 has an extra appeal in its comprehensive editability and additional flexibility, but both offer ground-breaking reverb quality at the price. Not only are they destined to become as ubiquitous as the SPX series, but they are likely to find themselves being used for the jobs previously reserved for the big boys. S

ProR3–derived directly from 03D console processing

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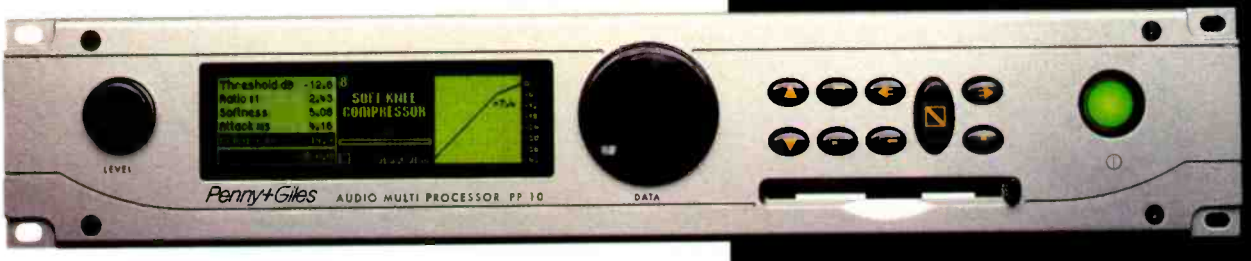

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Tascam DA-P1

The demand for a capable, cost effective, portable DAT recorder has never been greater—but the choice of suitable machines has never been smaller. ROB JAMES evaluates Tascam's latest contender

A FEW YEARS ago there was a considerable choice of semipro portable RDAT recorders. Some have fallen by the wayside while others have grown fatter and more expensive leaving a relative newcomer, Tascam's DA-P1 between Walkman-style machines and 'professional' devices. As the only game in town, the question here is less, 'How good is it?' and more 'Is it good enough?'

The machine comes as a neat package the size of a hard-back novel. It is large enough to allow the controls to be sensibly sized, but not so large as to make you wonder whether to bother taking it out with you. It weighs 1.44kg with its battery—contrast this with a Nagra or Uher 1/4-inch machine.

The only optional accessories available are a carrying case, which is almost mandatory for the likely uses of this machine, extra batteries and a battery charge box which allows batteries to be charged, using the supplied charger, without inserting them into the machine. This brings me to the first niggle, I would prefer to use dry batteries as well as rechargeables; I know economics dictate rechargeables make more sense but if you're recording in places away from the mains, the ability to use throw away batteries is a valuable one. A further problem with rechargeables is the NiCad 'memory' effect. If NiCads (and to a lesser extent NiMhs) are not fully discharged at each use you can loose capacity on subsequent recharges. As it is, if you want to use throw aways, you are obliged to make your own arrangements for a 7.2V supply external to the machine. On the other hand the supplied charger does a full re-charge in a commendably quick 2.5 hours. There is an auto power off function which turns the machine off after six minutes in Stop. This can be defeated by pressing STOP on power up.

The DA-P1 is a 2-head machine so there is no off tape monitoring.

Audio connections are suitably modest—two XLR mic-line inputs with switchable 48V phantom powering, unbalanced phonos for line in and out, SPDIF in and out plus a 1/4-inch stereo headphone jack. I would have liked this next to the headphone level control on the front but I soon became accustomed to this layout.

Controls have been kept to a minimum—level is taken care of by a dual-concentric input control which is easy and comfortable to operate either conventionally or as a thumb-wheel. This appears to track very well provided the controls are 'in sync'. If the channels are offset, as they might be in M-S recording, the tracking does not hold. For M-S recording you might be well advised to use an external level control. This is unlikely to be much of an inconvenience given the rest of the gubbins you need to monitor M-S sensibly. There is a switchable -20dB pad for the mic inputs. Examination of the circuit diagram reveals this varies the gain of the mic amp rather than padding the input—just the way it should be done. If more attenuation is required this can be inserted in the mic cables. There is an effective switchable limiter set at -3dB to -6dB below peak which prevents digital clipping. The limiter also works on both flavours of analogue line in. I would like to have seen a simple switchable low-pass filter but from past experience, where these are fitted, they seldom do what you need.

The DA-P1 uses separate A–D and D–A convertors for each channel unlike some earlier designs which employed multiplexed convertors resulting in horrible phase anomalies when tapes were played back on other machines. If you are recording from a digital source, the source sampling rate determines the record sampling rate and can be 48kHz, 44.1kHz or 32kHz. There is no SCMSor pre-emphasis to worry about. Pressing REC puts the machine into input monitor mode which enables levels to be set without recording or the machine to be used as a A–D/D–A convertor.

IDs can be manual or auto at selectable levels and can be edited. The Auto off option resolves the prospec of tapes full of spurious IDs just because it's quiet. In addition to the meters there is a latching indication of overshoot, re-set by a button, sampling rate, battery, dew warning, PGM number and counter. The counter has three modes, ABS time, PGM which is the elapsed time since the last start ID and Remain which, sadly, only works with tapes recorded with a TOC. There are autolocate functions which are come in very handy when you have just rewound to check a recording and then want to find the end to start recording again in a hurry. The transport controls all operate positively with a slight 'click' action.

WITH A COMPACT mic rig, the DA-P1 offers an easily portable package. Even in a biting wind the controls fall easily to hand and the ones you really need can be operated with gloves on although a little discipline is required when going into Record. Like any rotary head machine, when starting from cold, the head has to be spun up and stabilised before recording can begin—this takes around four seconds. If you need a quick start, you need the Rec Pause function but this is harder on the batteries. In any event, the DA-P1 drops back into Stop mode after five minutes if recording has not been started.

Tascam's DA-P1 represents the affordable edge of portable DAT machines

The mic amps are all I could wish for, being quiet and distortion free. These, if you use mics with low self noise, enable full use of the available dynamic range. The limiter is not objectionable unless pushed and is a boon in situations where rehearsals are impossible.

The DA-P1 delivers recordings as good as you'll get from DAT. To better the audio quality you would need a Nagra-D—a different league both in price and weight. The DA-P1 has many applications in field recording such as interviews for radio, sound effects and location recording for sound for picture. In addition it can be used as a high quality A–D/D–A convertor.

The controls quickly become instinctive in use. You can forget the machine and concentrate on the sound you are recording and not getting run over or drowned.

If you're looking for a location recorder but don't need time code or off-tape monitoring which come at a high price, this machine should be carefully investigated. Aa a powerful combination of simplicity and enough features for serious location recording, the DA-P1 is a highly desirable piece of kit.

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Digitech VTP-1

Early Chinese whispers of tubes 'softening the hard edge' of digital have given way to mystical boxes that promise the best of both worlds. DAVE FOISTER puts the theory to the test with a report on the VTP-1

CLEARLY DEMONSTRATED by *Studio Sound's* recent round-up of valve equipment is the range of applications that the tube has penetrated. While traditional vintage-style gear features strongly, there are also new ideas, the most unlikely of which is a valve processor with a digital output. Several companies now offer such a beast, and perhaps the most surprising is Digitech's VTP-1. It comprises a combination of valve microphone preamplifiers and analogue-to-digital convertors, with the added bonus of 4-band equalisation, all presented in a suitably retro package with the merit of simplicity.

The preamp section handles both phantom-powered microphone and line inputs, and since the signal path is a hybrid affair both pass through the valve stage. Initial microphone gain is provided by a solid-state section, complete with 20dB pad and optional transformer, and the final gain stage is a high-voltage class-A valve design; this is the only valve that appears in the unit. The gain structure and controls are such that fully adjustable use can be made of tube saturation on either input without overloading what follows.

> The final gain stage is a high-voltage class-A valve design; this is the only valve that appears in the unit

Next in line is the equaliser, switchable in or out as required, which has two swept mid bands with shelving high and low sections. It's only semi-parametric as the Q is fixed but the chosen Q is reasonably well selected, if perhaps a little on the narrow side, and the frequency ranges of the two swept bands are broad enough to overlap usefully but not so wide as to make adjustment fiddly. All four bands have gain ranges of ±15dB, and there is also a separately-switchable low-cut filter at 75Hz. It is important to recognise that the EQ itself is a solid-state circuit, not part of the valve design, but it does seem a commendably musical equaliser, tailoring its simplicity well to the likely application of overall sweetening. As the VTP-1 is likely to be used as a complete stereo signal path from microphones to digital recorder, it would have been useful to have the two EQ channels ganged for stereo when required, but the controls turn out to be remarkably well calibrated for reasonably precise visual matching, which is the next best thing.

The EQ output appears as analogue signals as well as the input to the onboard convertors, and it is at this point that it is metered on the quirky little round vu meters.

IT IS IMPORTANT to understand the VTP-1's gain arrangements to get the best out of it, the first point being that the output control, marked POST TRIM as it follows the valve stage, should by default be left at maximum for straightforward clean preamplification. The gain of the preamp is then set by the PRE GAIN control, and with professional line levels in and out this ends up at minimum for unity gain. If intuition is followed and these two controls are set at their marked centre positions, the result is very different, with the overdriven valve making an unmistakable contribution to the sound. All this happens before the signal reaches the equaliser, so that the EQ is always working at a reasonable nominal level regardless of what the valve is doing.

Because of the need to watch the levels reaching the convertors very carefully, there are no less than eight clip monitoring points throughout the signal path, and the single clip LED lights 3dB before digital full scale is reached. This is also 6dB before analogue overload.

The A–D convertor section is 18-bit, delivering either AES-EBU or SPDIF on a rear-panel XLR and phono. Both sockets carry an identical signal as set by a front-panel toggle switch, and another selects 44.1kHz or 48kHz. There is no facility for synchronising the convertors to other equipment.

The layout is very logical and straightforward once it is realised that this is American and therefore all the switches are up for on. The knobs are small but accessible and clearly arranged, and the multitude of little silver toggle switches sits well with the valve interior.

As does the performance. The whole signal chain from microphone to digital or analogue output is extremely clean and quiet when required, with the equaliser behaviour living up to the transparency of the rest of it. The fun lies in the ability to lose that cleanliness under complete control, as the two gain adjustments before and after the valve make it possible to introduce any amount of valve character up to and including the onset of gentle fuzz—this can go much further than most such preamps. It is also easy to be far more subtle, adding a delicate trace of valve thickness without it being obvious distortion.

> The two gain adjustments before and after the valve make it possible to introduce any amount of valve character up to and including the onset of gentle fuzz

The now-standard assumption that the behaviour of the valve perfectly mirrors the perceived shortcomings of digital recording in the way that a loudspeaker processor mirrors the known deviations of its associated cabinets still strikes me as odd, although the two technologies do seem to complement each other. Given that, the Digitech VTP-1 marries the two well, adding a useful degree of flexibility to a format that is rapidly gaining ground.

Odd bedfellows inside the VTP-1:valve preamps and A—D convertors

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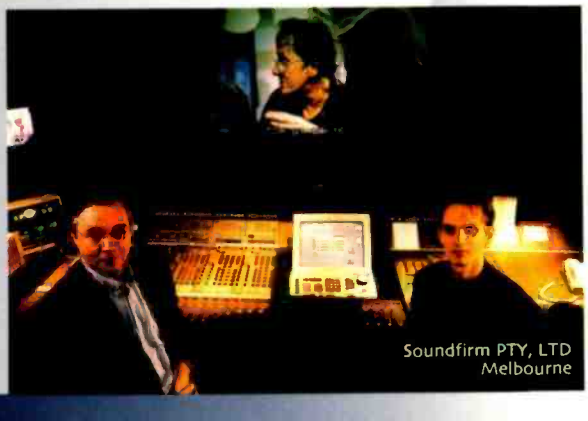

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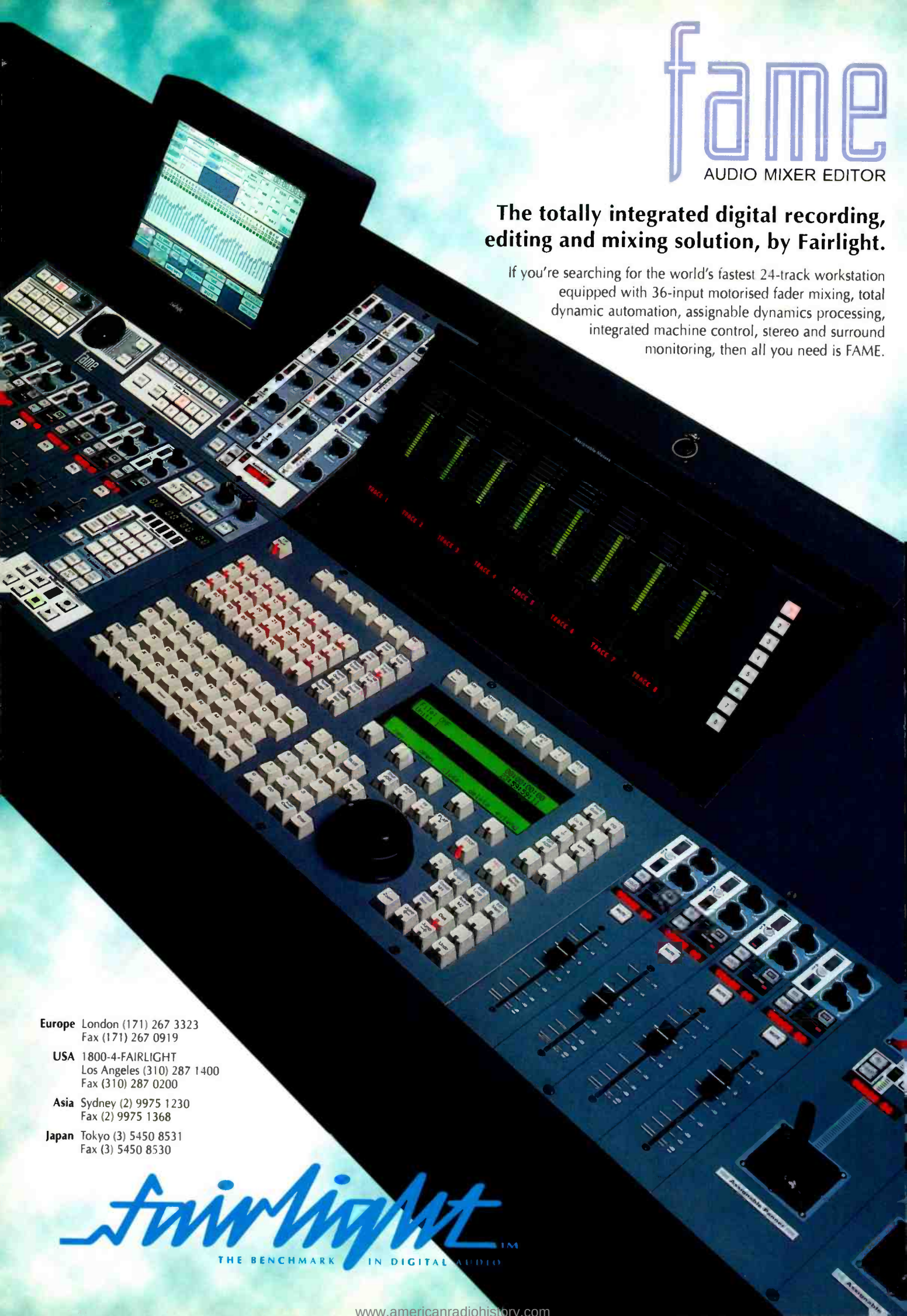

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New Technologies

The run up to a European AES Convention is traditionally associated with a good show of new products. **Dave Foister** uncovers a few spreads of news from the Frankfurt musikmesse

SCA2 and SPA2-150 from ATC

Leitch AES Glue

Three new products join Leitch's Digital Glue range, and their dedicated AES-EBU interfaces have given them the name AES Glue. New convertors comprise the ADC-6880, a 20-bit analogue-to-digital converter with up to four separate outputs, and its complement the DAC-6880. Both come in balanced and unbalanced versions and up to ten modules can be accommodated in Leitch's 2U-high 6800 and 7000 Series frames, together with any necessary digital video convertors.

Synchronisation of multiple AES-EBU devices is the job of the companion DAR 6880, an AES reference and tone generator module. This uses the Digital Audio Reference Signal (DARS) standard to provide synchronisation and other utilities, generating a DARS word clock, DARS Silence and DARS Tone. It can be used to reference a complete system or for test and alignment of digital equipment. *Leitch, UK. Tel: +44 1256 880088.*

ATC SPA2-150

ATC's SCA2 preamplifier, designed as a front end to the company's active loudspeaker and studio monitor systems, is now joined by a stand-alone complementary power amplifier, the SPA2-150. The same building blocks as are found in the amplifiers built in to the loudspeakers go to make up the new power amp, and as it uses the same discrete gain blocks as the SCA2 it claims the same transparency as the preamp. Its grounded source FET output stage delivers over 200W and quotes distortion components at more than 95dB down under any conditions.

The two channels are twin mono units complete with separate mains transformers. The output stage of each is monitored by microcomputer and a limiter prevents amplifier clipping and protects drive units. Limiter operation is indicated on the front panel, and over temperature and DC offset monitoring is also incorporated. *ATC, UK. Tel: +44 1285 760561.*

PreSonus Blue Max Smart Compression

Spectral AudioVault Transfer Agent

New software from Spectral allows digital audio to be transferred directly from a Spectral workstation to Broadcast Electronics' AudioVault on-air delivery system via standard network connections. AudioVault Transfer Agent allows work produced on AudioEngine or Prisma workstations to uploaded to a central AudioVault system for immediate airing. It ☞

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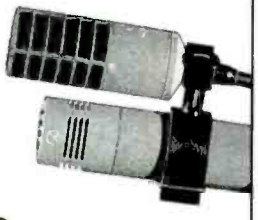

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works concurrently with Spectral's Express, Producer or StudioTracks XP interfaces under Windows (3.x or 95).

NetBEUI network protocol is used for the audio transfer, allowing simple configuration over a standard LAN. Linear uncompressed and MPEG-compressed audio are supported, and multiple Spectral workstations can run on a single network, or across networks in different physical locations using a LAN bridge.
Spectral, US. Tel: +1 206 487 2931.

Orban Optimod 9200

Orban's latest AM Optimod processor is the first to be implemented fully digitally. The 9200 is priced lower than comparable analogue units, but brings the advantages of digital operation to the familiar process that increases signal reach and impact.

Eight factory presets provide processing tailored to music formats from classical to hard rock, as well as to news/talk and sports programming. Parameter adjustment has been simplified by the introduction of a single 'less-more' control, and presets may be switched to synchronise with transmission times and special events. Remote operation is available either from a standard remote control or via modem, using the Windows-based PC software included with each unit. All-digital signal chains are catered for by an optional AES/EBU I-O module. While the 9200 is mono only, the companion 9100 is available for stations broadcasting C-QUAM stereo.
Orban, US. Tel: + 1 510 351 3500.

PreSonus dynamics processors

PreSonus' Blue Max compressor-limiter (described by the company as a dream toy) adopts a novel approach to the simplification of the compression process. It has full manual adjustment available when required, but also features 15 'smart' presets for various sources including vocal, percussion, fretted instruments and keyboards, as well as limiting presets and a special compression effect. Connections are provided for side chain access, stereo link to a second Blue Max, and a direct high-gain instrument input.

It is joined by the less colourfully named ACP-2, a 2-channel/stereo compressor, limiter and gate with full manual operation and an auto time constant override. High-cut filters are fitted to the gates for frequency-conscious action and gate key inputs are provided as well as compressor side chain access.
PreSonus, US. Tel: +1 504 344 7887.

In brief

Penny & Giles PP10 software

P&G's PP10 Audio Multiprocessor will appear at AES with a new software package. Following along the lines of the previous Pythagoras packages with their selected range of processes, and especially the Studio Suite aimed specifically at production applications, the Mastering Suite comprises a selection of 25 processes chosen to be particularly useful for mastering. To this end it includes a range of narrow band compressors/expanders as well as full-band soft knee, firm knee and kneeless compressors and expanders, five parametric EQs, a Warmth EQ, various types of filter, a soft clipper, micro delay, dither, link, Clone and noise shaping.
Penny & Giles, UK.
Tel: +44 1495 202024.

Harbeth DPM1

Harbeth's new Xpression range of studio monitors is joined by the DPM1, a close-midfield monitor with the emphasis on mid-range clarity. The cabinet is constructed from 46mm MDF, seamlessly welded to provide a rigid low-resonance platform for the two drivers. These comprise a unique 8-inch injection moulded polymer driver for low and mid, with a large diaphragm 28mm tweeter integrated through a computer optimised crossover. HF power monitoring and limiting is available, as is a matched subwoofer.
Harbeth, UK. Tel: +44 171 379 5148.

Aphex Model 2020 FM Pro

Aphex has introduced an FM audio processor with digital control, the Model 2020 FM Pro. Designed to tailor a station's on-air sound, it is fully programmable, remote controllable, and can be automated switch to different setups depending on the time of day.

The unit is modular and upgradeable, with analogue stereo inputs and outputs and Aphex' patented Frequency Discriminate Leveller, a multiband compressor, a bass processor and a peak limiter. Other Aphex proprietary features include Easyrider compression and Peak Accelerated Compression, and six patents are pending on additional new technology contained in the FM Pro.

beyerdynamic Blueprint

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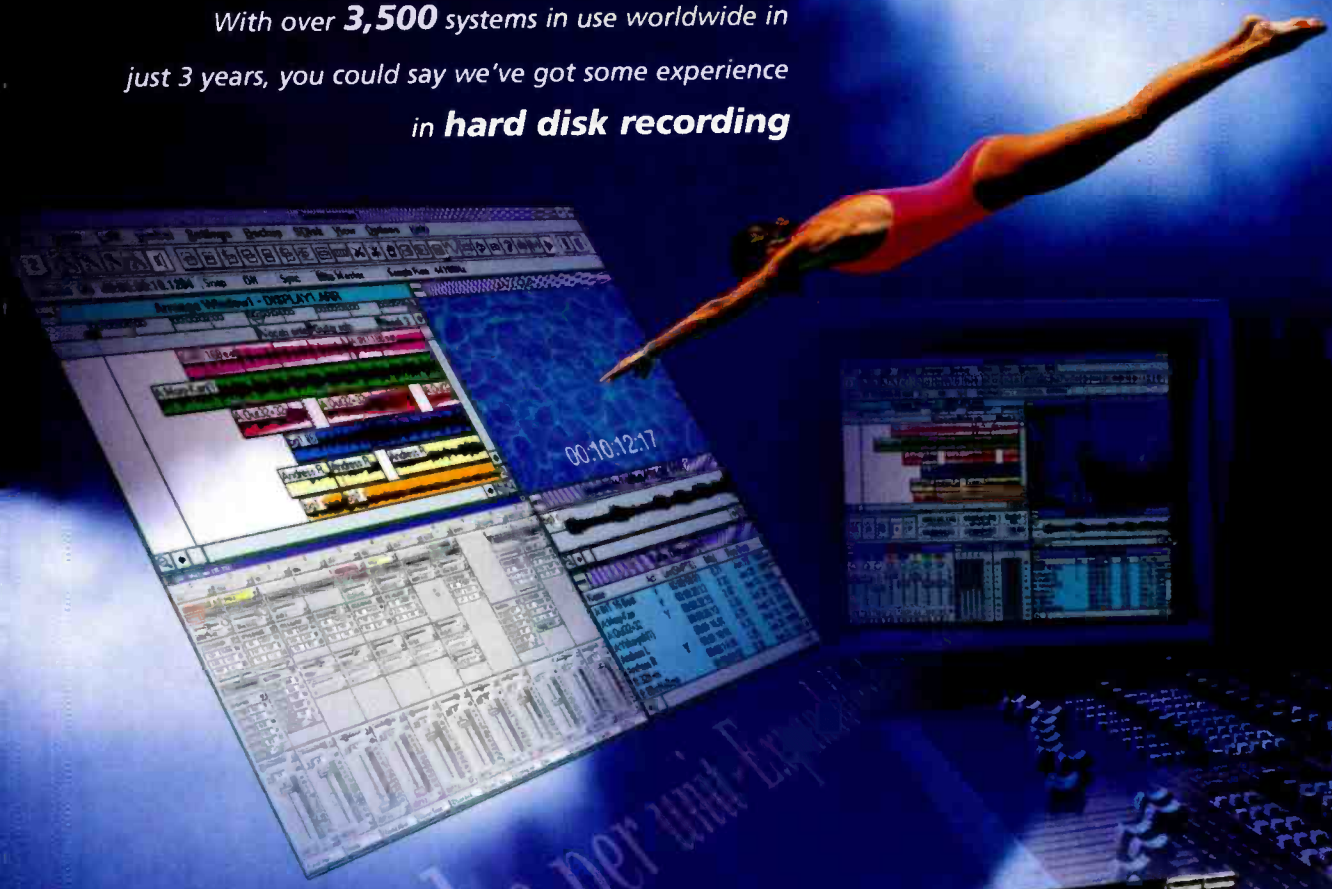

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Logic Audio Windows now supports Soundscape hardware

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Optional module add-ons, which are all field-installable, consist of a digital I-O module, a 50/75 microsecond pre-emphasis filter and a Digicoder stereo generator. Programmable and read-only presets are provided, and password-protected remote PC operation and monitoring is available.
Aphex, US. Tel: +1 616 683 4400.

beyerdynamic Blueprint

New from beyerdynamic is a 1U-high stereo power amplifier delivering 50W per channel and designed for studio monitoring and high quality sound contracting installations. The Blueprint uses convection cooling with a large heatsink, and employs a unique thermal integration of all the critical semiconductors to ensure optimum performance at all output levels. Inputs are both balanced and unbalanced, output is on Speakons and for the contractor a VCA option provides remote level control.
beyerdynamic, Germany.
Tel: +49 7131 6170.

ART processors

ART has introduced two sharply contrasting signal processors to its catalogue.

The first is the newest addition to the Vactrol Compressor line, the Pro VLA Vactrol/Tube Levelling Amplifier. It borrows from classic valve limiter technology in having electro-optical and tube electronics to deliver a 'vintage' sound without added noise. This is intended to provide the fast, punchy and transparent characteristics of the 'LA-' type levellers and has an auto setting which according to ART behaves more like vintage stereo Neve modules, providing what it describes as a smooth, loud and fat sound.

At the other end of the technological spectrum is the Quadra/FX Processor, a digital multi-effects unit capable of processing four individual channels with separate effects. It uses two of ART's proprietary VLSI ASICs to provide a wide range of algorithms including reverbs (some in true stereo), delays, chorus, flange, tremolo and panning effects and pitch shifting. An exclusive ART programming aid is a MORE feature, which enables the user to enhance any program with more of the same at the touch of a button.
ART, US. Tel: +1 716 436 2720.

Tannoy monitors

Among several new Tannoy items at Frankfurt were two additions to the range begun with the System 600 and System 800 dual concentric near-field monitors. The System 1000 is another near-field model using the latest 10-inch Tannoy dual concentric driver, while the System 1200 is a similar design with a 12-inch driver, making it more suitable as a mid-field monitor.

Besides these, new products for the sound reinforcement market include the i15, a replacement for the CPA15 featuring a new 15-inch dual concentric driver, and the T40, a sub-bass companion for T12, i12 and i15 systems using a 15-inch bass driver in a transportable cabinet with handles and pole mounts.
Tannoy, UK. Tel: +44 1236 420199.

Behringer new everything

Behringer excelled itself at Frankfurt by introducing no less than 15 new products. There are four new mixing systems, two in the Eurorack series and two in the Eurodesk range, the largest being the Eurodesk MX3282 split console for live and recording applications. This provides a total of 32 channels with eight subgroups and eight aux busses, while at the other end of the scale the Eurorack MX802 has four mic and four line inputs, 3-band EQ and stereo output.

The new Pro series of analogue processors, the first Behringer products to use surface mount technology, was launched with the Composer Pro MDX2200, an interactive expander-gate with compression and limiting, featuring status indication employing light-pipe technology.

A complete series of five valve processors appeared for the first time, comprising an 8-channel tube interface, a 4-channel stereo EQ, a tube version of the existing Composer, a precision mic preamp, and a tube version of the Ultrafex. All feature polished chrome front

In brief

Signal Transport Project Patch Studio Kits
Following the recent introduction of its Project Patch TRS patchbay system, with its connectorised rear panel for easy installation and configuration, Signal Transport has formulated a system of Studio Kits using the patchbays. The purchaser specifies the console and recorder to be used, and the appropriate patchbay system is then supplied ready to connect, using custom Belden cables and Switchcraft connectors. All the necessary wiring and patching is included, including provision for outboards, with the intention of eliminating problems due to improper grounding or phase reversal.
Signal Transport, US.
Tel: +1 510 528 6039.

LA Audio processors
Shown at NAMM were three new items from LA Audio: the EQX2 dual 3-band parametric equaliser, the MLX2 dual mic/line preamp and DI, and the MPX1 microphone processor. This last combines a mic pre with DI input, noise reduction, an auto compressor and an equaliser to form a complete front end audio path.
SCV, UK. Tel: +44 171 923 1892.

Philips MPEG brochure
Philips' support for MPEG is evident in its new brochure describing the details of both MPEG1 and MPEG2. "MPEG: The Only International Standard for Audio and Video Encoding" deals with MPEG's suitability for both audio and video applications, and discusses backward and future compatibility issues, the functions of constant and variable bit rates, and consumer benefits deriving from the adoption of MPEG technology.
Philips, Netherlands.
Tel: +31 40 2733455.
Philips, US. Tel: +1 408 453 7373.

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Zobel Active One monitors

panels and a Warmth control for deciding how much the valve will influence the sound.

Tube emulation is one of many primarily dynamics-based functions on the Ultra-Dyne DSP 9000, a digital processor using multi-band techniques to provide facilities for mastering applications. Also included is a multi-band exciter and a multi-band de-noiser for removal of noise, hum and crackles.

Another major addition is a new series of digital processors featuring 20-bit I-O and 24-bit internal processing. The Virtualizer DSP 1000 uses what Behringer calls Virtual Room technology to give reverb algorithms which it says automatically adapt to the applied program. Two parallel processors allow multi-effects use with a selection including delay, pitch shifting, vocoder effects and modulation. The Feedback Destroyer DSP 1100 uses automatic calibration of 24 parametric filters to identify and attenuate PA system feedback frequencies, either as a one-shot operation or continuously scanning, and its filters can also be used manually.
Behringer, Germany. Tel: +1 21 54 42 85 21.

APT codecs

APT will have two new apt-X based codec systems at AES. The BCF 256 Broadcast Communications Frame is designed to deliver full duplex FM quality stereo digital audio up to 15kHz over permanent links such as STLs and permanent studio networks. It incorporates an X.21 serial bitstream data interface and an integral terminal adaptor for fail-safe ISDN backup should the normal link fail. There is an optional digital I-O, and besides apt-X the unit supports Layer II and G.722 coding.

The NXL 256 Broadcast Network Transceiver is a 1U-high cost-effective codec also designed for fixed links. It uses apt-X exclusively, and has provision for connection to an external terminal adaptor for assured programme continuity.
APT, UK. Tel: +44 1232 371110.

Connectronics Clean-Act

Connectronics has now reached production with a multipurpose power supply unit designed to eliminate the outboard mains adaptors becoming common with some rackmount processors. The Clean-Act provides a range of power outlets including several individually-selectable regulated DC voltages of either polarity, low voltage AC and 240V mains, all with filtered mains input and protection against voltage surges. Both 1U and 2U versions are available, the larger having four unswitched and eight switched IEC mains outlets, eight 9V AC supplies and four independent DC sources switchable for 6V, 9V or 12V at 1A. Both models show DC status and fuse failures on LED front panel displays.
Connectronics, UK. Tel: +44 1279 506684.

Audix Broadcast routers

Audix Broadcast's ARM3000 series comprises audio routeing matrices and control systems, offering routeing capacities from 6x4 to 32x32 audio inputs and outputs. Central to the system is a simple user control interface that provides presenters with a comprehensive display of the routeings made and sources available on the system, removing the need for sticky labels and conversion charts. Each panel has a scrolling colour LCD screen showing details of all the sources available by means of a source number, a 40-character description and an 8-character abbreviated name. Selected sources are routed to outputs using four push buttons each with a display of its chosen source.

The controller panels are linked to the matrix units with unidirectional serial cables, allowing system resources to be distributed within a studio centre. The software uses a high level scripting language which allows the system to be custom configured using Easyroute Windows software to cater for modifications and expansion. An all digital routeing matrix is expected to join the system shortly.
Audix Broadcast, UK. Tel: +44 1799 542220.

Zobel Active One monitors

Intended partly for portable use, the Zobel Active One is a tri-amped active reference monitor designed for near-field listening. Its drivers comprise a hand-doped soft-dome tweeter and two low/mid units with ridged carbon-fibre cones. It includes active high-pass filtering for room tailoring, and the design is claimed to provide a unique 'directivity window' allowing little change to the sound quality off axis. Power and peak LEDs are fitted to the front panel, while rear-mounted carrying handles and optional padded carry bags aid portability.
Zobel, UK. Tel: +44 1747 820536.

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Use it

In the musical battlefield that was the 1970s rock scene, there were few recordings more ambitious than those undertaken by Yes and ELP.

RICHARD BUSKIN talks to Eddie Offord who managed the machines and massaged the egos

'THERE'S NOTHING WRONG with perfection but there can be this tendency to lose the soul,' says Eddie Offord. 'Doing too many overdubs, drowning out the essence of the song... Been there, done that.'

In a word, Yes. The band, that is, and one that basically gave new meaning to the concept of a rock 'n' roll circus. Leaderless, virtuoso musicians, alternately in harmony and conflict with one another, Yes conspired to indulge themselves in over-indulgence both musically and otherwise. Innovative, exciting, unpredictable, the man who stood in the middle trying to bring some cohesion to these often disparate forces was their engineer and coproducer, Eddie Offord.

Yet things were not always that complicated. Offord's introduction to the music world was as a guitarist in an amateur band. In 1967, looking for something to occupy his time in between completing A-levels and going to university, he landed a job as tape-op-cum-tea-boy at London's Advision Studios, but as soon as he had a taste of the business his temporary status within it proved to be only a temporary idea. 'The first time I heard musicians playing and heard the playback on those big studio speakers I was completely hooked,' he recalls.

After six months of assisting and acquainting himself with the equipment, Offord started to take on the kind of engineering work that nobody else wanted—the odd jingle, 'some real dodgy band' and a session with Brian Auger and Julie Driscoll that resulted in a hit version of Bob Dylan's 'This Wheel's On Fire'.

That was in 1968. Thereafter Offord's engineering career took off and he remained at Advision throughout the 1970s. The first half of that decade was a period when, in the wake of The Beatles' ground-breaking *Sgt Pepper* album and the experimental work of bands such as The Velvet Underground and Pink Floyd, progressive space-rock jumped to the fore and certain artists felt free to produce expansive opuses in which they indulged themselves to the limit (and often beyond), while redefining the previously established boundaries of Western popular music.

Which is where Yes enter this particular story. Jon Anderson on vocals, Steve Howe on guitar, Tony Kaye (and later Rick Wakeman) on keyboards, Chris Squire on bass and Bill Bruford on drums (later replaced by Alan White). Major talents, major egos, an object lesson in restraint.

'They came into Advision and I engineered *Close To The Edge* and *Time And A Word*, and those did absolutely nothing,' Offord recalls. 'Then they said to me, "Look, we really like working with you. We don't feel we need a producer, *per se*, so we can just do it all together. Would you like to coproduce with us?". Of course I said I'd love to. You see, at that time not a lot of engineers did produce. Anyway, we did *The Yes Album* and that was an immediate hit for them.

'The biggest part of my gig really was to try and keep all of the different, opposing factions in check. There was a tendency for ideas to conflict, for people to get upset—you know, "I want to do it this way", "No, I want to do it that way", and it was my job to say, "Look, I know you may be right, but we're going to try it his way and then, if you still don't like it, we'll try it your way". I was kind of a referee, almost.

> 'One day Bill stood up in the control room and said, "Why don't you stick echo on the whole record, put it in the background and be done with it?'

'Then there'd be the mix and obviously everyone wanted to hear their own instrument louder—except for Jon Anderson, who wanted to bury his vocals. So, after a while they pretty much said, "We'll leave it to

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or abuse it

Yes's Jon Anderson, Chris Squire and Steve Howe in the studio

Eddie". I mean, if they all started pushing everything up it got totally crazy!'

Offord recalls the band coming into the studio with the skeleton of an idea for a song, without any parts specifically mapped out, without even a taped demo, and then just start to rehearse.

'At that time most bands would come in, play the song and leave but Yes were extremely experimental,' says Offord. 'All of the material was developed right there in the studio and I guess they were one of the first bands to do that along with Floyd and all of the other progressive acts. They'd say, "Okay, let's do the intro", and we'd spend half a day on what would perhaps be a 30-second section. Then, once that was really perfect, they'd look around and say, "Well, that's the intro, now what do we do?". That's how it went, section by section, so the 24-track was just a series of splices every 20 or 30 seconds. As a result of all this, once they had finished the recording and wanted to go out and play it live, they would then have to go back and learn it from the tape.

'In fact, after the *Fragile* album, they asked me if I would consider going out on the road with them and help them recreate live what was on the record. That led me into a situation where I had two Revox machines with which I would cue in parts that they just couldn't quite play. So there'd be, like, a church organ section that I'd cue in or a vocal section—they did 90% of the playing and I'd just cue in the rest from the board.'

BACK IN THE STUDIO the six collaborators were always looking for new sounds —these were the days when innovation relied on inspiration and experimentation rather than the kind of effects processors that are now taken for granted. Offord smiles as he thinks back to some of the ideas that he himself came up with.

'For the guitar solo on a song called 'Siberian Khatru' I had two mics, one a regular close-up and the other on a 20-foot cord which I had the assistant swing in a circle around the studio,' he recalls. 'It was going close to Steve's amp on every cycle, and that gave it a real kind of Doppler effect as it went by.

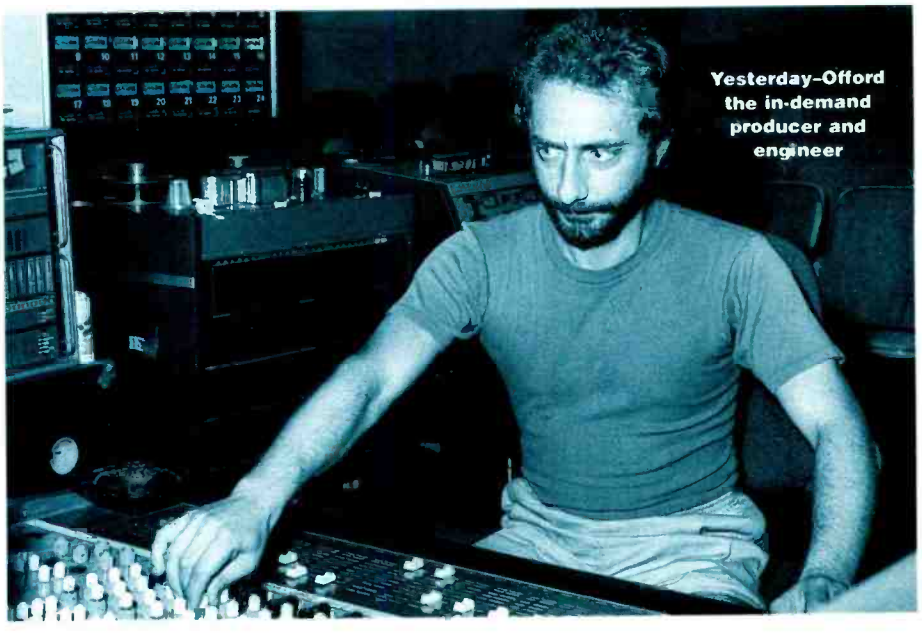
'I always loved the way that the band sounded live, and so on another occasion, after we'd just returned from a tour to do the next album, I built individual stages in the studio in order to get that wooden, acoustic kind of sound. Then there was the time when Jon said, "It sounds so great when I sing in my bathtub at home. What can I do?". So we built him a tiled room to do his vocals in and that made him happy because he felt like he was back in his bathroom.

'The sky was the limit. If you thought of something and could figure out a way of how to do it, then you were on your way. I can recall, on a song called 'America', Bill saying, "I want to put congas through a wah-wah". I said, "Fine", and we did it. After all, why not?

'The only danger at that time was the tendency to over-produce. Jon would say, "I hear bombs here," or whatever, and then he'd do it and everybody would sort of groan. So then he'd say, "It will be fine. We'll just stick some echo on it and put it in the background". This would go on and on; "We'll just stick some echo on it, put it in the background and it will be fine", and then one day Bill stood up in the control room and said, "Why don't you stick echo on the whole record, put it in the background and be done with it?

'My philosophy was: Never kill an idea before you've tried it. Even if you hate the thought of it, it might actually turn out to be something good. But then, out of that period [working with Yes] my philosophy evolved into: Unless you're specifically going for a background effect it has to work up front, ☞

Today–Offord the award-winning celebrity



Yesterday–Offord the in-demand producer and engineer

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and if in doubt leave it out. Experiment by all means, but at the end of the day be prepared to say, "Well, it didn't really add that much".

While most of the Yes albums were recorded at Advision sessions for the *Tales From Topographic Oceans* double set took place at the now-defunct Morgan Studios in North London, and those for Relayer reverted to the home of Chris Squire, with a setup assembled by Eddie Offord.

'I built a console to go on the road so that I could mix live sound better,' he says. 'It was like a 30-channel Neve rip-off and it was cut in three flight cases, and then I also had a 24-track cut into three pieces and put in flight cases. I could use that setup either on the road or in the studio, and so that's how we did *Relayer*.'

Nevertheless, as time progressed it became familiar work practice for each of the band members to come in and record their parts individually while none of the others were around, or, on occasion, for there to be two sessions taking place at the same time in different studios. Such was the growing discord within the group, and on the *Drama* album Offord even found himself running around with slave reels between a number of locations.

'The other guys in the band would get bored listening to Chris do a bass part hour after hour,' he explains. 'But then at other times, especially towards the end, I think it got very destructive because there wasn't that link between them. When it worked it was really good, but when it didn't it could get really weird.'

Sample those oft-recounted stories of Jon Anderson sitting alone and painting in his overdub booth, surrounded by the large rocks that he carried from studio to studio for the vibe that they produced.

'He was always a space cadet,' Offord confirms somewhat sardonically. 'He was the only guy in the band who really wasn't a musician. His guitar playing was terrible. The rest of the guys in the band used to tease him a lot about it and he had kind of a hard time getting any respect, but it may have worked to his advantage because he broke all of the rules when he was writing songs.'

Guitar excess–Yes' Steve Howe has one of the largest guitar collections in captivity

Keyboard excess–ELP's Keith Emerson and his legendary ranks of equipment

AFTER THE INTRICACIES of working with Yes, life must have seemed somewhat simpler for Offord when he went into the studio with Emerson, Lake & Palmer for their eponymous debut album, as well as for *Tarkus and Trilogy* (*Pictures At An Exhibition* was a live set captured on 8-track.) For one thing, three opinions were easier to handle than five, and this in turn enabled him to spend more of his time taking care of the engineering.

'When they entered the studio they were much more rehearsed than Yes,' Offord recounts. 'Keith [Emerson]'s keyboards basically consisted of Hammond B3 and synthesiser. The first big old Moog with all of the patch cords had only just been invented, and I was the one to actually program all of the synthesiser sounds. For the B3, however, he came in with, like, four Leslies and four or five Marshalls and it sounded incredible. I didn't know what to do with it–at first I was going to individually mic it, but in the end I wound up sticking him against one wall of the studio and placing a stereo pair six to eight feet back. That worked out really good.'

Offord recalls miking the rest of the band with 'a standard setup... just the same old crap', and while they did play together in the studio as a live unit there were, once again, a lot of overdubs.

'There were no polyphonic keyboards at that time,' Offord explains, 'and so for Keith to do a string section it took him maybe 10 or 12 tracks to accomplish that. There was a lot of bouncing down.

'Emerson's technical ability was just phenomenal. He could hold a conversation, drink a beer and use his left hand to play the most amazingly weird time signature, and he often did. He was unbelievable. He initially performed a song called 'Who Shot The Sheriff' on a grand piano, but we then decided that we wanted more of a honky-tonk-saloon-type feel and decided to varispeed the tape in order to get slightly detuned pianos on

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Apollo 13 sound edited at Hastings Sound and Wonder Dog Music. *Dead Man Walking* sound edited at Hastings Sound

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top of each other. Keith did four takes of piano one after the other and achieved complete perfection in terms of double-tracking. Unbelievable. It almost sounds like one piano.

'Carl Palmer, on the other hand, also had an incredible technique–he could play the greatest kind of complex rhythms–but his timing from one bar to the next wasn't the best in the world. I think that came out more when you heard him play in Asia and even on 'Lucky Man' he was a little bit up and down. He just can't play two bars in the same tempo. But then he comes up with all of this incredible stuff.'

And then there was Greg Lake, who threatened to take even the Yes penchant for excess to new heights by way of such idiosyncratic behaviour as standing on a Persian rug when performing on the concert stage.

'He was a really good guy, a great player, and he liked his material comforts,' says Offord. 'I had a lot of fun with those bands. It was really interesting. However, it turned out that there was a lot of jealousy between Yes and ELP, and so at one point I was forced to choose one or the other and I decided to go with Yes.'

OFFORD WAS clearly a man in demand. Even when he engineered several songs on John Lennon's 1971 *Imagine* album–'Jealous Guy', 'I Don't Want to Be A Soldier' and 'How Do You Sleep?' in addition to the title track –he found himself being called away from the project in order to satisfy the requirements of the Yes men. Still, the Imagine sessions did manage to serve some purpose for Yes –Alan White played drums on them and soon became Offord's London flatmate. Subsequently, when Bill Bruford quit the band their producer-engineer had a ready replacement.

However, having fully ingested all of the excitement and heady innovation of those progressive years, Offord would eventually become somewhat jaded with a rock scene that he viewed as becoming increasingly bland and formulaic. His other credits range from

'Keith did four takes of piano one after the other and achieved complete perfection in terms of double-tracking. Unbelievable. It almost sounds like one piano'

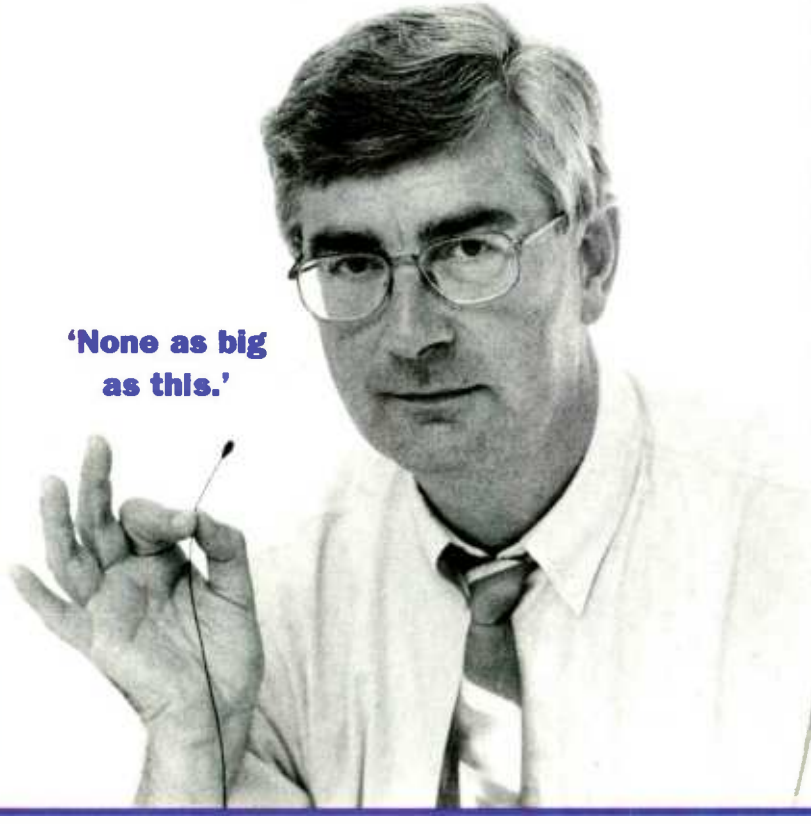
The Police and The Dregs to Platinum Blonde and the RCO All-Stars (featuring Levon Helm, Dr John, Booker T and Steve Cropper, among others), yet today, living in Los Angeles, he is very selective about the few projects on which he works and now spends a fair deal of his time pursuing other business interests.

'I found a band called 311 that I enjoyed working with quite a lot,' he says. 'They would break all of the rules and go from reggae to rock to jazz in the same song, and that was really, really interesting. I've also worked with a pretty grungy-type band called Medicine, and then recently I produced, engineered and mixed an all-star type album featuring an artist named Valerie Carter, along with guests such as Phoebe Snow, Lyle Lovett, Jackson Browne, James Taylor and Linda Ronstadt. That was done at Jackson Browne's studio in Santa Monica which has all of this vintage equipment–an old Neve board and amps and these great tube compressors–and it was a fun project. Overall, however, I am a little jaded and I have heard it all before.

'Still, for those projects which I do get involved in I have my own ADAT studio and that's a fairly straightforward affair. I'll tend to do the basic tracks in a decent, fairly live studio but I'll then use my own setup for all of the overdubs. After all, one of the hardest parts is dealing with the vocals. Like with Jon Anderson, the band would lay out this kind of symphony of music and it would grow and grow and grow, and then it would come time to do his vocals and he'd be shaking in his boots!

'Singing is a very lonely thing, and so I now find that setting up a little studio in somebody's living room or wherever helps eliminate that problem. The same for guitarists; "Here's the Record button, try as many times as you like. You've got two or three tracks to play with and when you've got one that you're happy with, call me". That works well for the artists, it works well for me, and so as far as I am concerned I think that the ADAT situation has helped out a lot with the making of records. After all, it's like any technology–you can use it or abuse it!' S

'In your time at Brüel & Kjær you created many breakthroughs.'



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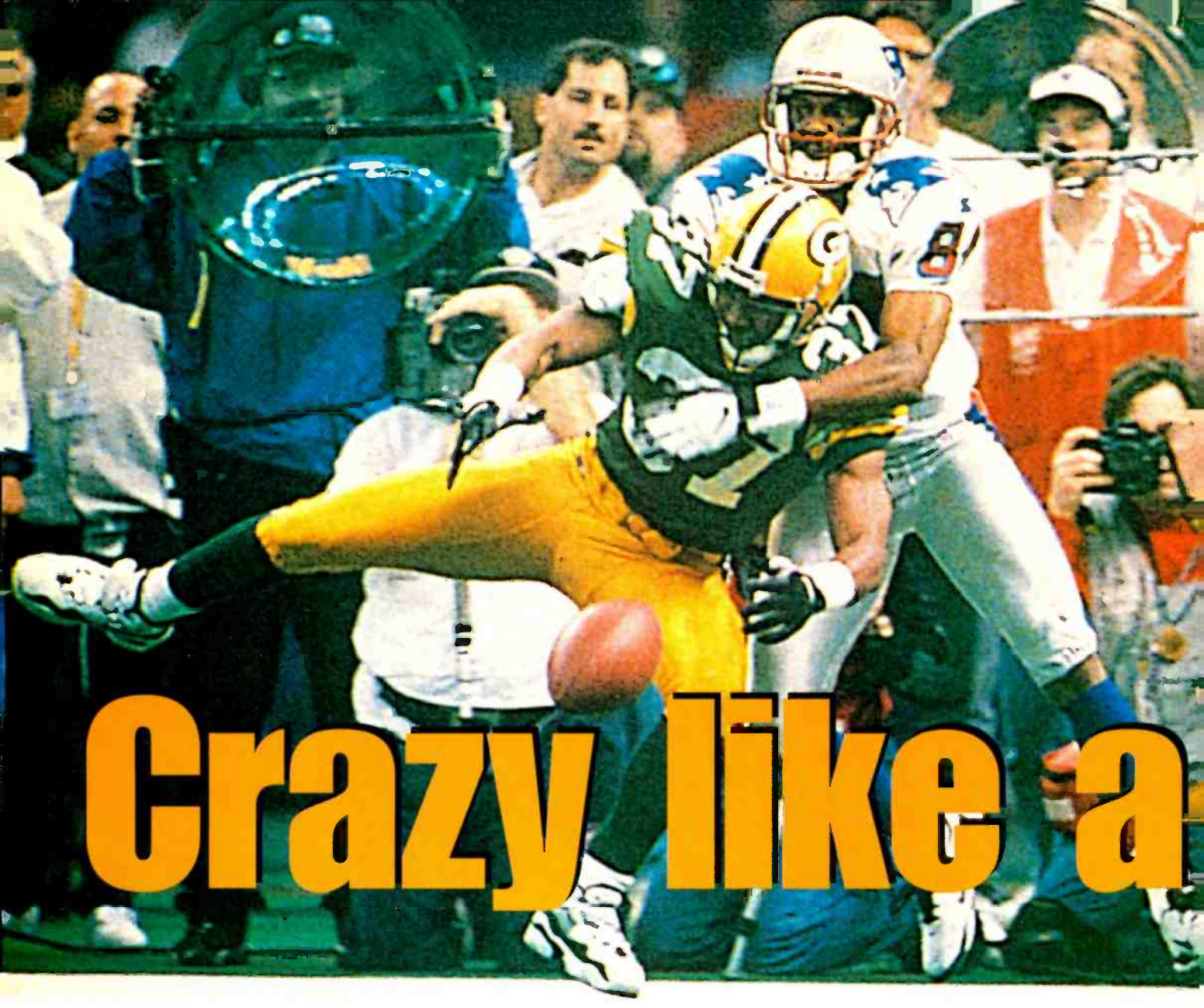

Crazy like a

American Football's Super Bowl final attracts a live audience of over 70 million, with hundreds of millions more fans tuning in their television sets across the globe. **RICHARD BUSKIN** gets the lowdown on the broadcast setup for this year's event

IT WAS THE FOURTH most watched broadcast in American television history. It was Fox TV's own slam-dunk winner in its ten years of existence. It was seen live by an estimated 128.9 million people in 42 million homes across the US. It was seen by millions of others in more than 100 countries. It was Super Bowl XXXI.

Some 72,300 rabid fans jammed into the Superdome in New Orleans to witness the great event, albeit that, during the 3 hours, 3 minutes and 46 seconds that the players were on the field, what with all of the huddles, commercials and standing around, the fans only got to see 16 minutes and 3s' worth of action. Still, a little under 9% of the total playing time was all that the Green Bay Packers evidently needed to defeat the New England Patriots 35-21 on Sunday, January 26, and while the day was swimming in statistics—did you know, for example, that Antonio Freeman's 81-yard touchdown pass from Brett Favre during the second quarter was the longest in Super Bowl history?—a good number of them actually concerned the techs working behind the scenes on the Fox Sports broadcast.

Another Super Bowl record was set with the use of 29 cameras positioned all around the stadium, as well as an overhead blimp; 25 videotape replay machines were used in addition to six videotape machines boasting super-slow motion capabilities; the Fox crews shared three mobile production units, three graphics trucks, one transmission unit, two edit suites and four 300kW electric generators; and there were in the region of 50 miles of assorted cable.

In spite of the fact that this was Fox's first-ever coverage of the big day, according to Senior Vice President of Field Operations and Engineering, Jerry Gepner, 'The only word for it was "flawless". There was virtually nothing that gave us any reason for even moderate concern.'

As finally assembled, the technical team led by Gepner comprised Chief Engineer, George Hoover, an employee of NEP, the OB vendor that Gepner selected to supply all of the game and pregame facilities; Bob Muller, Technical Producer for coverage of the game itself; Tim Abhold, who assisted Muller with the game coverage while also handling post-game 'points of interest' such as the trophy presentation and locker-room celebrations; Jeff Court, Director of Field Operations and Technical Producer for pregame and post-game coverage; Dave Hill (not to be confused with Fox Sports' President, David Hill), the Technical Manager responsible for transmission, including the coordination, timing, setup and execution of all of the in-coming and outbound feeds; and Craig Marlowe, who was responsible for all of the remote trucks—there

> 'One of the big considerations when you start mixing in stereo for sports events is what to do with the sound stage, and boy, I tell you, we had some knock-down, drag-out fights over that in the early days of Fox Sports'

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were eight separate pickups positioned around New Orleans for the pregame show alone.

Basically, the main difference between the Super Bowl broadcast and that of the regular NFL games was its scale. For, while the latter usually take up three to four hours of air time, with perhaps an on-site pregame show, the Super Bowl represented nine and a half hours all originating from the one site and altogether different requirements.

'We had multiple control rooms operating simultaneously for this event, whereas for a regular event we'd rarely have that,' explains Gepner.

While normally associated with the introduction of new technology to the sports that it covers, Fox opted for the safer shores of trusted reliability in its use of conventional analogue TV equipment for the Super Bowl. Not only was this a one-off event, it was also a make-or-break opportunity as far as the network was concerned. No chances would be taken.

'In the weeks leading up to the event people kept asking, "What's Fox going to introduce that's new?", recalls Gepner. 'My answer, very simply, was, "Absolutely nothing!". This was not the venue in which to debut new technology. It was the venue in which to demonstrate to the whole world what our quality standards are. We wanted to do the best job that we could, and I think that's what we achieved. We provided pictures and sound that backed up our belief that we are technologically the best when it comes to the broadcast of American football. We're not the best because we take huge risks, we're the best because we pay attention to the details.

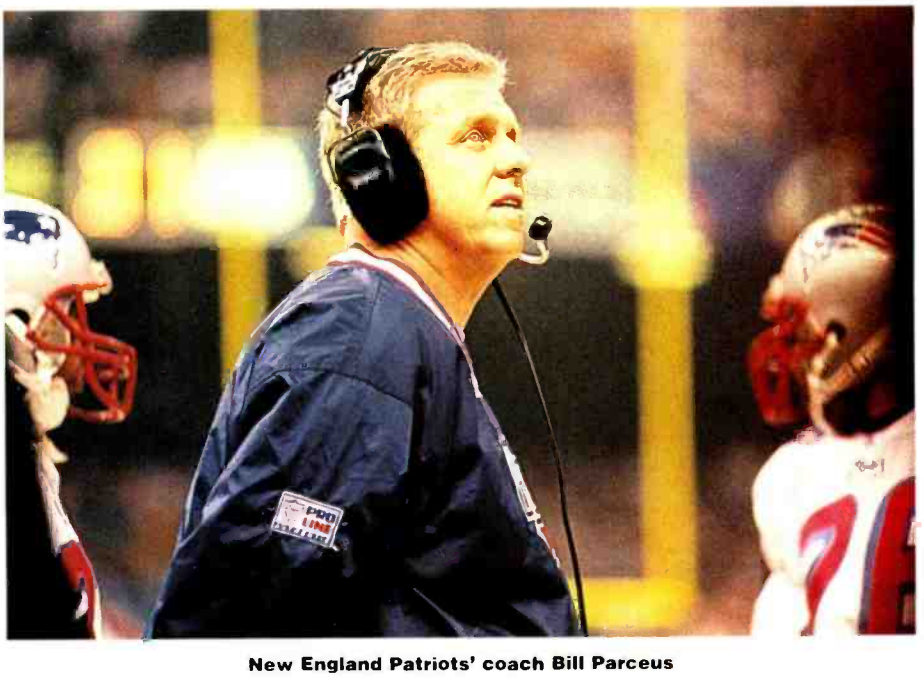
'All of the cameras that we used, save for two, were Sony—the studio-style ones were BVP375s and the hand-helds were BVP90s,

'We actually spent a full day just parking the mobile units, because of the jigsaw puzzle parking arrangement that we had to come up with in order to keep everybody squeezed into one box'

with lenses supplied by Canon. The two non-Sony cameras were Ikegami RF wireless cameras. Then, on the sound side, the tape machines were also all Sony; 25 BVW75 replay machines and six BVW9000 super-motion systems. Basically, this is the equipment that NEP use on their trucks, and one of the reasons that I selected them as the vendor is because they standardise their equipment between all of their mobile facilities. We had five of the same communications systems between all of the trucks, and we were able to use trunk masters to tie them all together. So, in effect, we had a 500 x 500 intercom matrix without having to build it.'

Sennheiser MKE102 mic and Connectronics Big Ears parabolic reflector on the touchline

Telex Audiocomm provided the intercom systems for said event. PH1 and PH2 headphones with mics were worn by the referees, and FMR-450 Referee Wireless microphone systems were used by the players along with SoundMate in-ear hearing systems, (many of which have been customised to fit under their ☞



New England Patriots' coach Bill Parceus

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grid-iron helmets). As for the matrixes that were used in four remote trucks, these included two Telex 80 x 80 RTS ADAM Advanced Digital Audio Matrix systems, one 64 x 64 ADAM CS system and one 50 x 50 CS9500 Series system. A fifth truck was used as support.

'We did use some new technology, but it's not as if we shook the world by doing so,' says Jerry Gepner. 'The routing system used on each of their trucks is the same model and manufacturer as the Pacer 5000 system –Is it the finest system available? Probably not. Is it very reliable and high quality? You bet, and it ties together real nicely.

'Obviously you can spend a lot more money on a routing system–if you weren't building an OB facility but one that required a 1000 x 1000 matrix, then you might want to look at something like the Grass Valley 7000 Series–but frankly the Pacer is very high quality, its cross-point is 100MHz bandwidth, and it uses internet-style data control, so for field use it's very nice. It's also very convenient in terms of the amount of cable that you have to run.'

And there was a lot of cable; about 250,000 feet of it if you put together all of that used for power, signal, cameras, telephones and data communications.

'The telecommunications end went in first, because we knew that everybody would want a telephone the moment they arrived, so we started doing the wiring for that on January 3rd. The office trailers went in on the sixth of the month, the trucks arrived on the 14th and then we were ready to go on the 22nd. We actually spent a full day just parking the mobile units, because of the jigsaw puzzle parking arrangement that we had to come up with in order to keep everybody squeezed into one box. So we essentially started work on the 15th and then had seven days to put the entire system together before we turned it over to production to begin work.'

Eric Shanks, remote graphics producer in the Fox graphics truck

Aside from the usual technical problems–such as a tape machine waking up and feeling funny about life–Gepner states that nothing out of the ordinary reared its ugly head. More to the point, teamwork was the order of the day.

'It will never be said that one person saved the Super Bowl,' he asserts. 'What will be said is that a certain department blew it! Well, I was absolutely determined not to have the latter of those two statements said. What we needed to do as a group–and what everybody did–was learn to check your egos at the door, work as part of a team, stick your finger in any gap that appeared, and, if all of your fingers and toes were busy, then call the guy next to you.

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'All of the updates to all of the files that we kept with concern to this project were done in a shared environment on the Internet, and that forced people to share what they knew. As a manager that was a huge objective of mine, because what often happens with large productions is that you find one person being the repository of a lot of answers, and when that person is busy, overloaded or just not around things grind to a halt. Either that or people go off in the wrong direction and you find yourself doing something twice to get it done right. Well, I wasn't about to have either of those happen.'

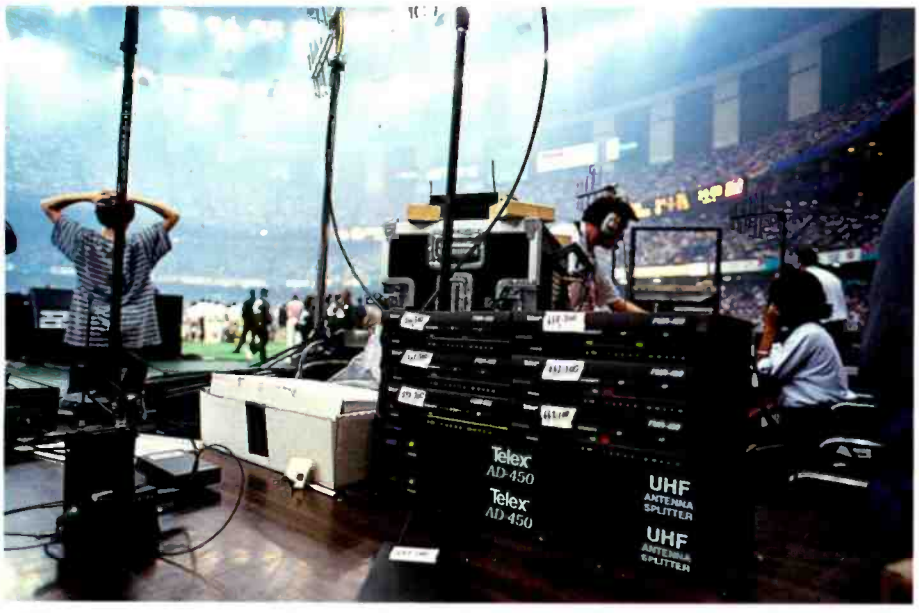
BROADCAST IN STEREO using Dolby Surround, the sounds of the Super Bowl were further enhanced by the use of six on-field parabolic microphones. Connectronics is the manufacturer, the model is called the Big Ears, and these 'parabs' are used by Fox Sports with Sennheiser MKE102 microphones tied to the Sennheiser EM1046 radio mic system.

'That provides us with very, very high quality sound on the field,' says Gepner. 'We're doing something [at Fox] with American football that is not at all unusual in Britain or the Continent, but was a huge shock to American TV audiences and broadcasters when we started doing it three years ago. It was introduced by David Hill and I remember that he had to beat me over the head about this...'

So what could Jerry Gepner be talking about? Non-censorship of swear words? Encouraging the crowd to break into a sing-song? Well, not quite. Actually it's just the sub-mixing of microphones on the field, revealing every little cuss, spit, shuffle and thud–and there's plenty of all in American pro football. Needless to say, David Hill's suggestion was taken on board and the result is that field audio now passes through an audio sub-mixer located in the stadium press box, before being integrated into the game broadcast in the production truck.

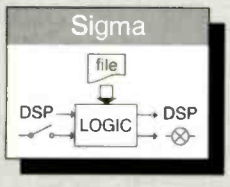
'That never happened here before in regular stadium-style sporting events,' Gepner stresses. 'Only in the very largest of events, such as golf, where you just can't have a desk that big. Either that or you'd need a motorised chair to get from one end of it to the other.

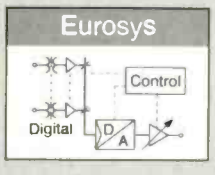
'Anyway, we started doing it for regular sports broadcasts, and we developed certain hardware and techniques on our own to make it work for us. In 1994 I selected a console,

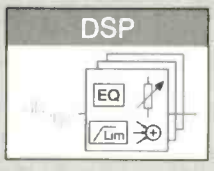


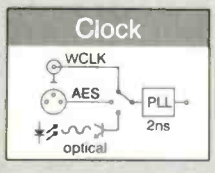
Telex telecomms rack at the pitch in New Orleans–match referees used PH1 and PH2 headphones, FMR450 and SoundMate systems were used by the players

Signal matrix == Flexibility









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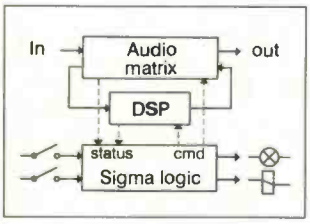
```
Faderstart;
OR    INPUT A01    INPUT   ==   „CD 1"
AND   INPUT A01    PEGEL_OPEN   == 1
TRUE    RELAIS     CD1   ON   == 1
FALSE   RELAIS     CD1   ON   == 0
Sigma_end
```

The signal matrix will manage anything you need in the studio – including the coffeemaker, if required...

The signal matrix is a programming language for mixing consoles which not only can handle control I/O like pushbuttons and relays but also directly has access to all the DSP settings and matrix setups. Therefore the system will easily give you all the **faderstart** and **signalling** features you may ever need. And there is more ...**16 stopwatches** ...automatic **talkback systems** ...**machine control** with parallel and serial interfaces ...**custom monitoring systems** for digital and analog audio ...**surround monitoring** systems ...you just have to drink the coffee yourself. If you are interested to learn about the world of „Sigma" – ask the experts at LAWO !



MC 50 - Digital On-air console

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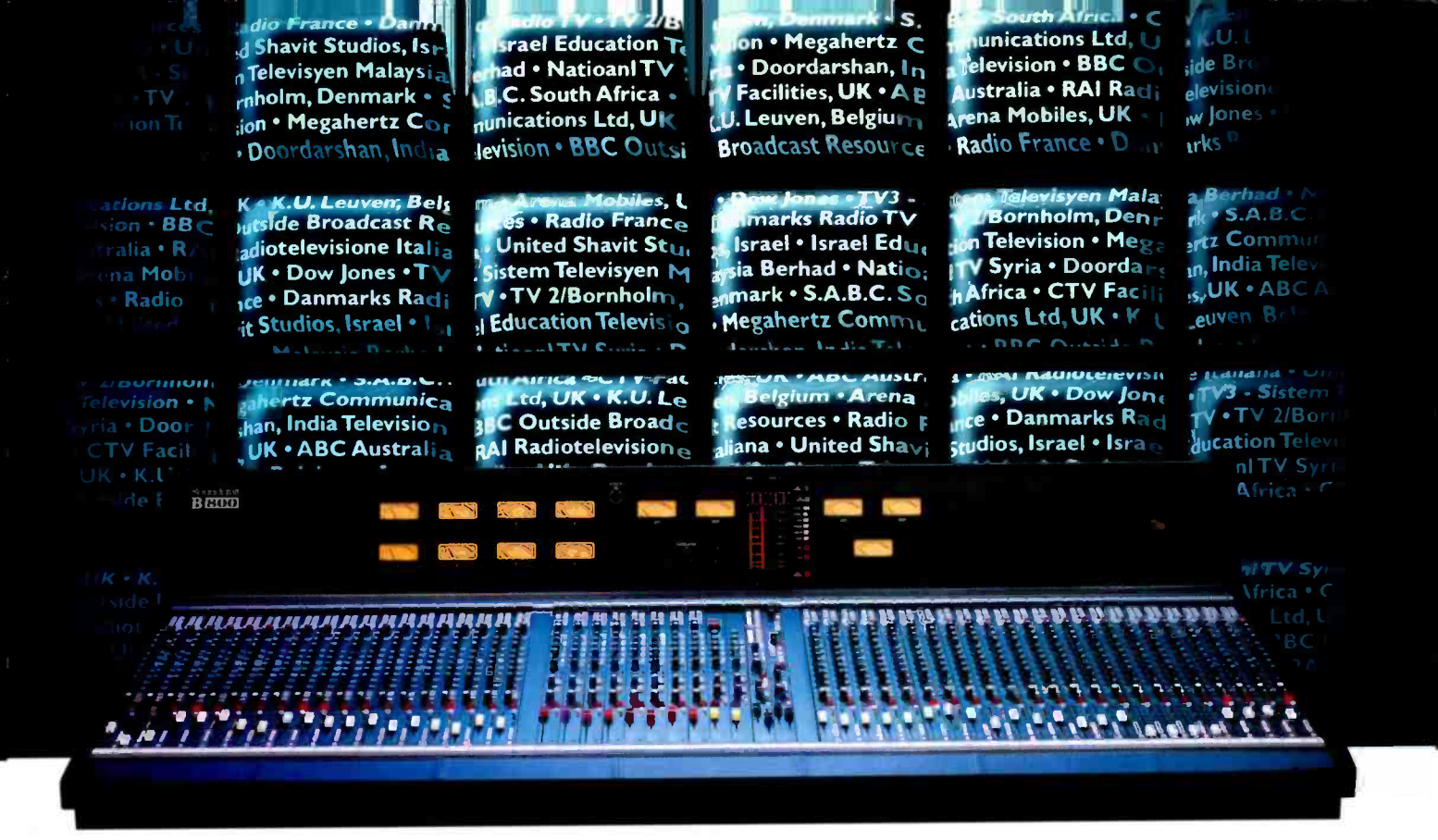

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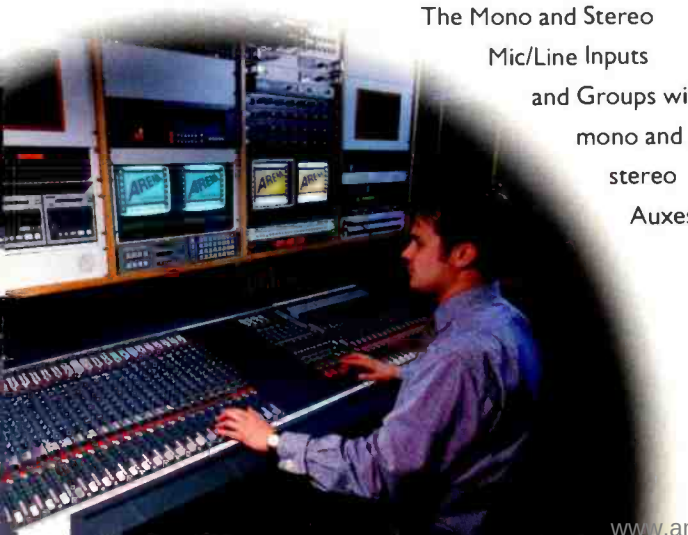

Location photography courtesy of Arena Mobiles

for instance.

The choice of mono or stereo groups. Or the comprehensive and flexible monitoring, including Surround Sound. And that every input channel features a clean feed/direct output.

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The interior of the Replay truck

the Mackie R1604, which is an excellent little field mixer. I mean, you could literally throw it off the truck while you're doing 60 down the highway and it wouldn't even know. On top of that it's quiet, it's got a lot of features and tremendous headroom, so that pretty well qualified it for work in the field. I had it modified by a company in California called Intercom Specialties to include a full communications module because, quite frankly, at the time the board cost less than $1,000. For that price you don't usually get a communications module in a console. So, we literally stole one of the microphone inputs and designed a full multichannel communications system, and therefore the submixer could be in contact with both his parab operators on the field and the main mixer in the truck.

'Once we had that done, it was just a matter of developing technique. We coupled that with the RF microphones and let the field mixer handle the four to six parabolic mics, and by doing that you have an individual who is sort of an audio director at that point. The parab operators have these listen-only walkie-talkies, and so the submixer can direct them around the field and position them as he would chess men on a board. What's more, since that person has got a bird's eye view of the stadium and, with a little luck, knows something about football, he can anticipate things. He's not relying solely on the ability of the parab operator which can vary depending on which city you're in. Some of them are extraordinary, some of them are good, and occasionally you get one who doesn't make the "good" rating. So at least you can say to that person, "Number three, go down to the far 20-yard line", when you can see a long pass being set up, and that person can then really hustle his way there. That kind of thing can help tremendously.'

Meanwhile, in order to pick up the crowd noises, a pair of Sennheiser 416 mid-range shotgun microphones were set up in an X-Y arrangement on either sideline. After all, being that Dolby Surround encoding was being used, the 70,000-plus people in the stadium were a fairly important component of the overall sound picture. 'They were spread to the sides in the rear channels and that filled out the mix very nicely,' says Gepner.

As for what the home viewers heard if they were watching and listening on plain old stereo or mono TV's: 'Well, you see, the one issue when mixing anything other than mono for television is that you have to maintain mono compatibility, so we worked very closely with Dolby Labs when we equipped all of our trucks. We even ship equipment on a show-by-show basis into the trucks that we don't own, and one of the things that they developed for us was a little monitor switcher which allows you to monitor Surround, stereo and mono literally at the push of a button. So, even if the stereoscope is not right in front of you and your monitoring environment is not ideal, the one thing that the mixer can always still check is the mono compatibility.

'That was crucial to me when we started setting this whole system up three years ago, because the majority of sets are still mono and the majority of cable systems in this country are mono. Nevertheless, if you have straight stereo you will hear the announcers positioned straight in the centre, and then off to the left and right we position sound effects as such. The music is in stereo, and, while we won't push the crowd out real wide, it'll be wide enough to give you some spatial dimension.

'One of the big considerations when you

'The Mackie R1604 is an excellent little field mixer. I mean, you could literally throw it off the truck while you're doing 60 down the highway and it wouldn't even know'

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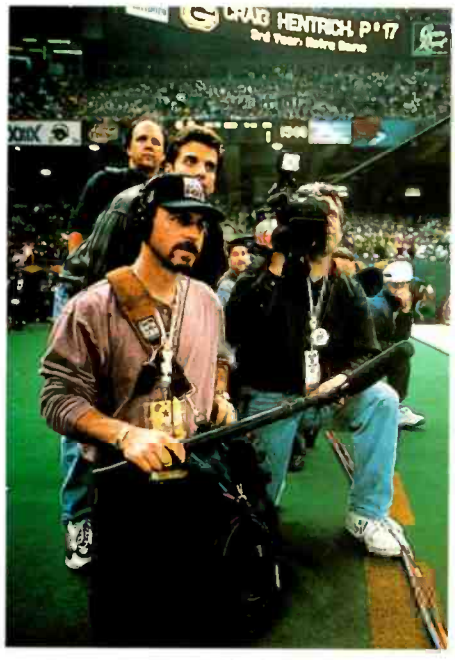

Pregame preparation at Super Bowl

start mixing in stereo for sports events is what to do with the sound stage, and boy, I tell you, we had some knock-down, drag-out fights over that in the early days of Fox Sports. There are two completely atypical ideas: One says that you change the sound stage and your perspective as you cut cameras; the other one says that you pick, say, the 50-yard line as your centre line, you position your left and right soundstage from there, and no matter what angle you're seeing on the screen that's your perspective. Now, that's the philosophy I chose, and we had some screaming-yelling matches!

'My argument has been—and I think it's now become accepted to some degree—that most television viewers are lazy. You know, you lay down and you watch sport on television. It's fun; wonderful recreation. But, if I were to force the viewers to rearrange how they were looking at each shot and listening to it by literally changing the sound stage, that would not be fun anymore. That would be work! Because at that point your aural perspective would be shifting with every shot. Now, technically is that the proper thing to do? Yeah, probably. But does it make sense within the context of a sports telecast? It would be a wonderful technical achievement to do it, and I know mixers who have tried over the years, but it's one of the most disorienting things I've ever heard in my life. Particularly if you start from the premise that people watch sports on television for enjoyment.

'We do the same things with cameras. We don't cross the axis in terms of where we place them. They're primarily only on one side of the field, and I felt that we should also do the same thing when it came to the audio perspective. So, your positioned pretty much dead-centre straight away, and what we're giving you is the best seat in the house.'

And what about if you actually do own a home surround system? 'Then you have fun because then you're sitting in the stands at about the 40 or 50-yard line, there is the crowd and PA behind you, the field is in front and to the left and right of you, and the announcers are just sitting straight in front and talking to you!'

> 'It's an extremely physical game and an extremely violent game, we don't make any bones about that, and we want to get that home. That's what it is about'

Jerry Gepner says that for next year's broadcast of the Super Bowl he would like Fox Sports to be working within an all-digital environment, incorporating 601 video technology with AC-3 audio.

'I think we're going to see AC-3 take over very rapidly as the high-end home format,' he opines. 'That'll help you hear more. AC-3 concentrates on the frequencies that you hear rather than the ones that you don't hear, and so what that means is that more of the sound that would come your way if you were standing on the sideline of a game is going to make it home to you. When a very good tackle is made, instead of that being the occasional blip of excellent audio it will become the norm.

'It's an extremely physical game and an extremely violent game—we don't make any bones about that—and we want to get that home. That's what it is about.'

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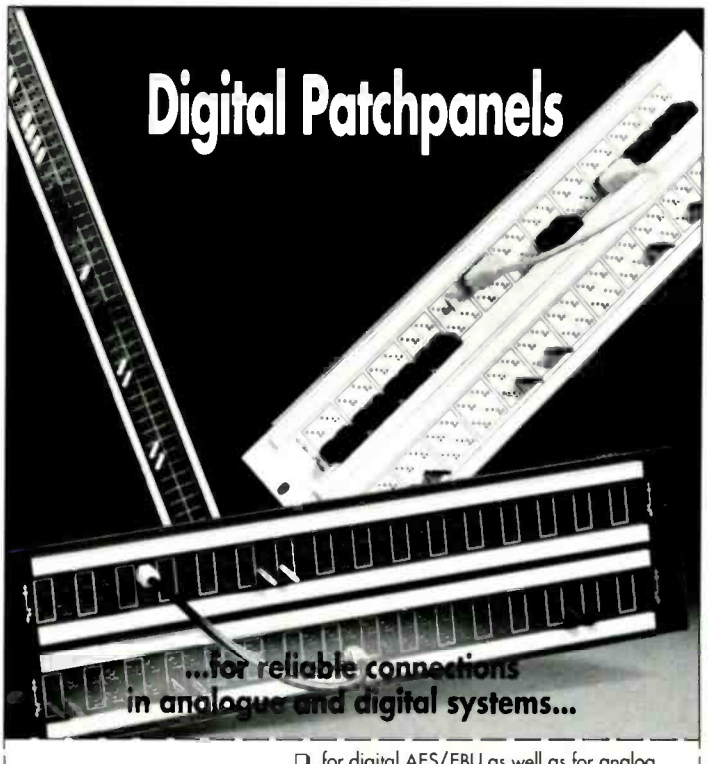

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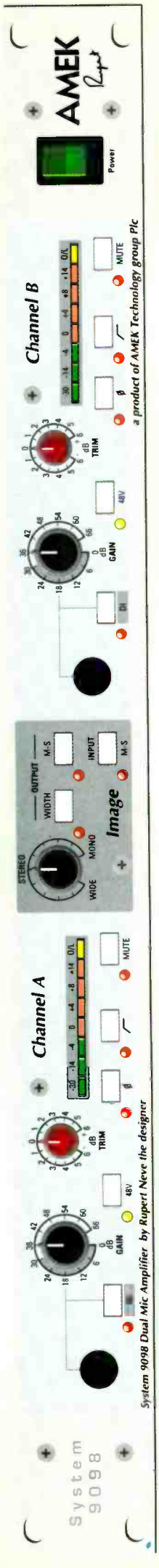

System 9098
Dual Mic Amplifier
by Rupert Neve the Designer

Rupert
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'The SYSTEM 9098 Dual Microphone Amplifier follows in the footsteps of the 9098 Console, the System 9098 Equalizer and the System 9098 RCMA Remote Control Microphone Amplifier, sharing many of the same features and impeccable clarity of sound quality. New features have been incorporated which considerably extend the field of usefulness.

'Although designated as a "Microphone" amplifier, the DMA will accept a full +25 dBu balanced signal without a pad, at unity gain. So it doubles as a Line Amplifier, which, of course, retains the processing power of the Stereo Matrix.

'The flexibility of the input circuits has also enabled use of the DMA as a Direct Injection Input. Industry standard single pole jacks have been used to provide unbalanced inputs at very high input impedance, well adapted to the requirements of high quality instruments.

'Dedicated STEREO inputs are a new feature. It is, perhaps, surprising that with the increasing popularity of outboard equipment there are very few units that specialise in the handling of stereo signals and none, I believe, which combine all the features of the SYSTEM 9098 Dual Microphone Amplifier. The possibility of differential pick-ups used in one of the classic stereo modes is intriguing.

'One of the questions I am asked is: "Why use a stereo microphone? I only need a few Stereo Modules just for stereo returns, synths etc. I can do all I need to with a Pan Pot on the MONO module".

'The answer is that Panned Mono is produced using one microphone panned to Left and Right buses. If the soloist moves, both channels are affected in the same way and the image remains fixed at the panned position. A genuine stereo signal is produced with two microphones which are fed to Left and Right buses respectively. If the soloist moves the relative signals change in amplitude and phase causing the image to move also. A Stereo signal also contains ambience information which locates the soloist relative to his surroundings. With panned Mono, the ambience is fixed by the simple ratio of direct to ambient sound produced by the microphone/soloist positions. Panning cannot change this relationship.

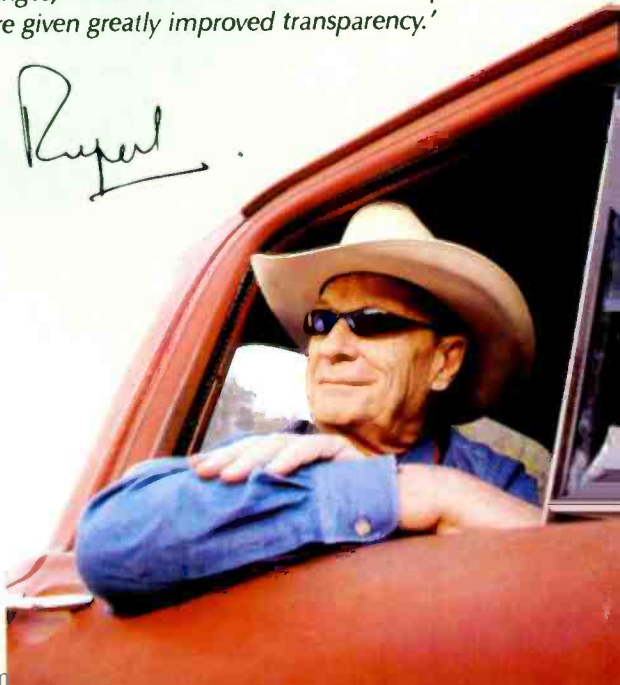
'The SYSTEM 9098 DMA is equipped with comprehensive AB and MS (Main and Side) circuitry, with Width control, to facilitate stereo microphone recording of all types and can be used not only with voices but also any source from a drum kit through to a full orchestra.

'I use transformers for the DMA output stage because they are a sonically superior way to couple the signal to other equipment. They provide complete freedom from ground dependence which eliminates low level noise associated with common ground paths etc. The output transformers, which are designed integrally with their driving amplifier, handle the full +25 dBu output down to 24 Hz and +20 dBu down to well below 20Hz. The high frequency bandwidth extends to 200 kHz without self resonances.

'Low level signals from microphones have traditionally presented a problem. In the SYSTEM 9098 DMA we have achieved very low noise over a substantially wider dynamic range than anyone else.

'The significance of the mid gain low output noise, which is typically 5 to 10 dB better than any other microphone amplifier, is that these middle gain ranges, which are used for close microphone work, are given greatly improved transparency.'

Rupert



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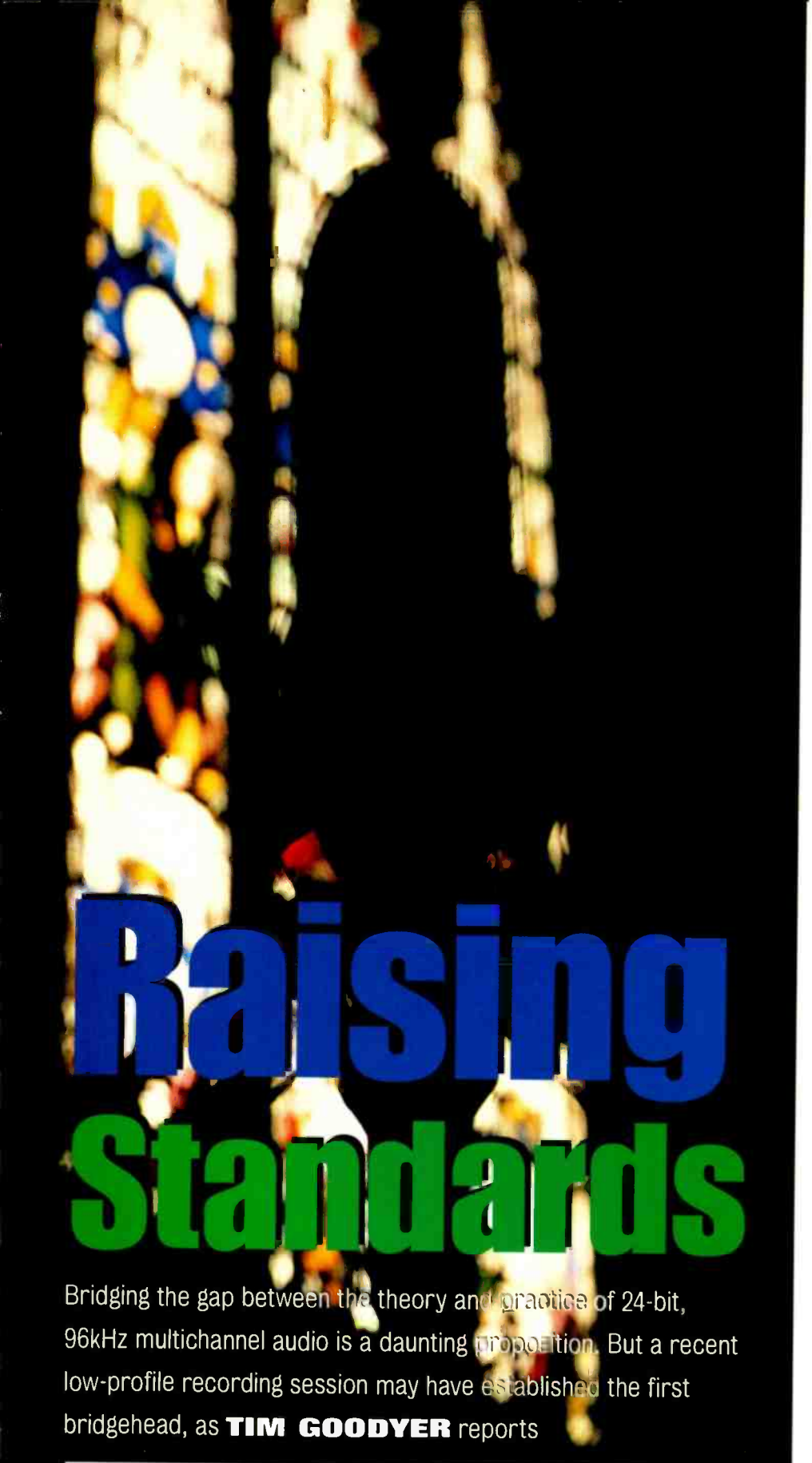

Raising Standards

Bridging the gap between the theory and practice of 24-bit, 96kHz multichannel audio is a daunting proposition. But a recent low-profile recording session may have established the first bridgehead, as **TIM GOODYER** reports

HIGH QUALITY DIGITAL audio took a significant step forward recently when a handful of audio's elite gathered to make the first 24-bit, 96kHz periphonic recording in history. The session, which took place in Cambridge's Queens College Chapel, will form the basis of research and development related to high-quality multichannel digital audio for the next generation of carriers—read DVD for the short to medium term.

The recording took the form of a B-format signal captured with a Mark V SoundField microphone via dCS high speed A–D convertors onto Nagra-D digital recorders. As the B-format recording requires four channels and the use of 24 bit resolution at 96kHz sampling rate effectively reduces the 4-track Nagra-D to a 2-track machine, it was necessary to use a pair of synchronised Nagras. Similarly, a pair of dCS 902 convertors were required to convert the four analogue outputs of the SoundField Mark V into 24-bit, 96kHz PCM. Additionally, it had been decided to record the MS output from the SoundField onto a Pioneer D-9601 96kHz (16-bit) DAT machine and a Meridian CDR recorder. So while the equipment —the microphone in particular—demanded little physical space, it represented some of the highest technology available.

Assembled for the occasion were representatives from all interested parties. Following the signal path, there was Peter Craven who invented the SoundField mic back in the early-1970s, Mike Storey who is instrumental in the design of dCS convertors and John Ruddling from Nagra GB. The session was engineered by Steve Lee from the Canadian-based Canorus Inc production company and consultation was constantly available from Meridian Audio's Bob Stuart whose presence was also significant in that he is Chairman of the Acoustic Renaissance for Audio.

The resultant recording will serve several purposes. With respect to the ARA, it will form the basis of an Ambisonic demonstration set to take place in Japan in May. This follows previous presentations made both to the ARA and by the ARA to the DVD consortium all with the common aim of establishing a suitable standard and format of audio for DVD which is presently described by Stuart as 'an open book'. The recording is also the only 24-bit 96kHz session with which Bob Stuart and Peter Craven can continue their research into lossless data compression—or packing—also with DVD in mind.

> 'It's really important to convince people to produce better than 44.1kHz, 16-bit now because the talent may not be alive to do it again later'—Steve Lee

'In October 1995 we did a demonstration in Japan of surround sound,' Stuart recalls. 'That was crucial because, at that time, a "better" carrier was considered to be a 2-channel one that went faster, not necessarily a 3-dimensional one.

'We feel strongly that there's enough data on carriers like DVD to encode everything we can hear—that's the full frequency range, the full amplitude range and the full three-dimensionality including height which is what we're doing here today. Another thread to that is the fact that we recognise that it may be necessary to handle this data not as linear PCM but as losslessly-coded PCM. There is no material that we could access, or are even aware of, of any real single-point acoustic recordings made at 96kHz and this kind of resolution with which we could complete the work on lossless compression.

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Hiding in the Queens College Pews–sync'd Nagra-Ds running at 24-bit, 96kHz

'Lossless compression is now working very well with 48kHz and particularly with up-to-date single-point capture,' he continues. 'There is a certain information about phasing and so on that we needed to make a final proposal, so the numbers from this recording will spend the next few months inside various computers.'

Setting up presented few problems although it was an intriguing scene that saw engineer and microphone designer discussing mic placement. The configuration of the choir was unknown before its arrival and there was some uncertainty as to whether it would divide to occupy the pews on both sides of the room or appear as a single body across the end. In the event it did both, performing a short piece by Charles Woods and John Keble entitled 'Hail, Gladdening Light' a number of times allowing also for different mic positions.

The analogue-to-digital conversion stage actually required the use of a third dCS box to provide the master clock for the other two. The master Nagra synced to the clock incoming on the AES-EBU feed and the second was locked to it by data sync. The D-9601 and CDR machine, meanwhile, were chained together and fed from the MS output on the SoundField. This output derives an MS mic pattern from the four SoundField capsules which appears in addition to the four necessary for the B-format output. A monitor system was used just once, briefly, as a confidence check.

Syncing the Nagras was probably the least smooth operation and was a result of the necessary lead having been flown in from Switzerland only four days previously. The other makeshift area of operation was the fact that, in spite of the representation of nearly all of the equipment manufacturers, much had to be provided by Richmond Film Services. Once set up, however, everything ran smoothly.

'The next challenge is to design something to play it back because at this moment although we have the hardware, we don't have the software finished for the decode speaker feeds since it was laid down in B-format,' commented Stuart as the setup was being dismantled. 'We took the microphone feeds straight to the D–A convertors so right now there isn't anything that can play this back. But we'll get there sometime this year–we wouldn't have done this if we didn't know where the hardware and the computing engines were.'

AS THE DUST SETTLED further, Stuart explained more about the background to the event.

'What we wanted to do here was to make a modern recording using the SoundField microphone so we have a single-point, total 3-D capture and to try then using modern processing techniques in decoding to do a credible decode. It's not only about Ambisonics because with the signals from this microphone we should be able to losslessly process to give any directivity so we will produce 2-speaker and 3-speaker surround mixes from this eventually.

'The other thread is that we've been pushing for high sample rates; at least the ability to encode somewhat higher than 44.1kHz and certainly with greater precision than 16 bits. The microphone doesn't quite have a dynamic range equivalent to 24 bits–it probably only gives the equivalent of 21 bits–but we're taking 24 bits down the idea being to have a high-resolution result.

'This is not a Trojan Horse for Ambisonics,' he asserts. 'We think that the multi channels on DVD video and audio should be used for conveying surround sound probably as speaker feeds not as an Ambisonic recording. We're just using one technique that we know of that produces an effective result.

'We think that Ambisonics works well–we did a periphonic recording today so we also have the height information but there will be other methods. As far as I'm concerned we're not trying to describe how to use a multichannel system, simply to demonstrate what can be done with it. I think in the future there will be a lot of multichannel music which is not relating back to an original performance but where real artistic or performance benefit can be obtained from the fact that the sound doesn't just come from this window in front of you but can come from all around. After all, that's how music started–performed live with people all around you. The whole 2-channel stereo thing is like a corridor that we've had to travel through.'

> 'Real artistic or performance benefit can be obtained from the fact that the sound doesn't just come from this window in front of you but can come from all around'–Bob Stuart

The SoundField–dCS–Nagra is clearly not the only route that would have yielded a 24-bit 96kHz recording. There are presently two other recorder options: the Genex GX8000 MO recorder would have offered eight suitable channels and a Sonic Solutions system could also have been used. Then there is the issue ☞

The 96kHz dream team–Meridian's Bob Stuart, Peter Craven; dCS' Mike Storey; Canorus' Steve Lee and dCS' Robert Kelly

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of miking.

'One of the difficulties at the moment in evaluating how to use multichannel for music is that people have no clue what to do with the microphones, observes Stuart. 'There have been a lot of experiments with different spaced microphones, some of which have been more successful than others. It's going to be like stereo—it's going to take a lot of time to learn how to do it and to evolve a "house" style. We've eliminated a lot of those problems and also gone after a particular piece of information which is that we've captured the sound at one point. Now we can look at the relationship between sound coming from different directions and be able to work that out quite accurately in our computers.

For Steve Lee, it is the recording medium that attracts comment: 'The 96kHz thing really started to happen when when we approached Nagra to say "yours looks like being the only way to do this because the Panasonic D-9601 is a 16-bit machine, the MO-based systems I have doubts about the longevity of the medium but the Nagra seemed like a sure bet. So dCS and Nagra collaborated in making this system available.

'We made it public at NAB last year and by June I had been able to arrange a recording in Germany which was done in parallel chains: 44.1 using a dCS convertor to a DAT machine and the same recording done at 24-96 on a Nagra with a dCS convertor. That was a Tacit production of Brahms' op114 recorded live to 2-track with a pair of microphones—an M49 and an M149 on the other side. We played those as a comparison at the end of May at the Stereophile show because that's where we thought the people who really cared about the quality would be. The mastering engineers and recording studio people there either had doubts about whether there was some sort of trick going on or they started to show a great deal of interest.'

Setting up the SoundField MkV–Steve Lee is watched by Peter Craven, and Mike Storey

The reasoning behind Lee's enthusiasm for high quality recording provides an interesting contrast to that of Stuart.

'There are really two points here,' he opens. 'We think 24-96 is a good practical production medium, as good as it can be today. The question remains, is it as good as we can get? With the tests that we've done, compared to 30ips analogue masters and live feeds, it's 99.9% there—and these are the words of the mastering engineers.

'What we see now is actually a shift in the recording business to put more of the money pie into postproduction and keep slicing back on the recording budget. That's why we see people running around with DATs and 16-bit authoring tools and editing tools but they're leaving a good portion of the music and artistry behind.

'It's really important to convince people to produce better than 44.1kHz, 16-bit now because the talent may not be alive to do it again later. Secondly, it's better to produce, record and master once at high resolution and keep the master in that format but to modify for release at 44.1, for example. Then you've got the work done up front—the original talent, the original intent, the original timing—for release on a higher format, whenever that is, and you have a much better source to work with. It's like having a 30ips analogue master that didn't die and that you can run 200 times.

'The work that we have ahead of us is to get more production studios and more

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Jon Caffery
La Chapelle Studio

Jon Caffery (left) Pierre Piront (right). Owners and Producers, Caffery Piront & Partners

La Chapelle, one of the most popular recording facilities in Belgium, is living their dream with a Euphonix digital control mixing system. Producer, engineer and musician Jon Caffery immediately saw the potential of the Euphonix, and knew it was the mixing desk he had wanted for a long time. The first recording completed on the Euphonix, Ende Neu: Einstürzende Neubauten, hit the charts in the first week. Other projects soon followed, with the band Die Toten Hosen's single Bonnie and Clyde making the top ten singles chart.

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producers to accept this medium as a good production medium. The dCS 972 digital-to-digital convertor allows them to downsample so we can already take the production medium through to a release medium and then the next step is to get it accepted as part of the surround specification for DVD audio.'

WHAT IS CONSISTENT, regardless of who you question, is that 24-bit, 96kHz working offers a tangible improvement in quality over the present 16-bit, 44.1/48kHz standard.

'The resolution window at 44.1kHz is improved by 220% at 96kHz because you're capturing a slice in time 2.2 times smaller so the impulse you can capture is significantly higher resolution. People say, "Why not go to 88.2kHz because the decimation is so much easier?". But you lose a 10% time-domain advantage when you do that. The only thing you need at 96kHz to go to 44.1kHz is very sophisticated math done in real time. You can throw enough processing power at it to get that done but you can't recapture that 10% difference if you go with 88.2kHz. The difference we heard on the Brahms recording came off mic feeds that we know roll off at 15kHz and by 20kHz they go to 10dB down –and these are tube mics. What happens if you put on some calibration microphones that go up to 40kHz? What would you hear then?

'In some of the demonstrations we do, we do something that normally would kill digital. We use things that have an energy level that is identical or higher in harmonics than it is at the fundamental–things like shakers and cowbells–things that are very difficult to reproduce outside of the analogue domain, and that is where we hear the biggest advantage of this time domain advantage. It is so demonstrable; it is a quantum leap forward in terms of resolution.'

'The benefit of 96kHz is not just increased bandwidth,' confirms Mike Storey. 'You'd expect cats and dogs to notice the difference but that most humans wouldn't detect a difference. But they can, so there is a difference and it has to be something more than just the usual frequency response considerations. It gives more spatial information like identifying not just direction but the distance to a sound source. That's one of the things I'd say is destroyed probably by the filtering you have to use with 44.1kHz.

'One of the things we found at AES demonstrations was that people who were quite mature in years were able to distinguish the difference between 44.1kHz and 96kHz. In those cases not only was their hearing not going above 20kHz, it probably wasn't going beyond eight. Most people commented that the bass came alive which on the surface of it is very odd.'

'One of the things we found at AES demonstrations was that people who were quite mature in years were able to distinguish the difference between 44.1kHz and 96kHz'–Mike Story

'We made some tests with a stand-up bass and the difference was that one was like a noise and the other was an instrument,' Lee adds. 'People were using audiophile terms like microdynamics. It's quite a different experience.

'I think almost everybody who's heard 24-96 recording agrees that it is as close to 30ips analogue masters as they've ever heard digital recording come–and that's very reassuring. It's certainly above 15ips SR in terms of linearity, neutrality and so forth, so they see it more and more as a viable production medium. The question then is that most people can't make the bridge between producing digital masters and being able to release them. They say, "I'll need to put a UV22 at the back end of that and produce a DAT master" but we're proposing that you think of this as a discrete production medium and that you think of the release medium as something completely separate.'

That support for improved audio to accompany the development of DVD and beyond is growing is beyond doubt. The concern that appears to remain is that the audio community agrees quickly on its requirements and makes appropriate representation to the appropriate bodies while the standards are open for discussion. With this is mind, the Queens session should go down in audio's history as an important event–perhaps even as a turning point.

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Music

From hefting the hammer that helped build the original studio rooms, David Porter has steered San Francisco's Music Annex through over 20 years of industry evolution. **DAN DALEY** talks to one of the longest serving studio instigators about his past and the future of the business

'RECORDING STUDIO: 1973, high mileage but meticulously kept. Many original parts but regularly maintained. One owner.'

If a recording studio were an auto for sale in the classifieds, that's how the ad for the California Bay Area's venerable Music Annex might read, followed by the caveat, 'Just Kidding—Not For Sale.' But for all Music Annex' many unique attributes—continuous operation for over two decades, two locations, a successful mix of music and postproduction—it is the 'one owner' part that stands out. Few of the classic facilities in the world are still under their original stewardship, and Music Annex' David Porter has prospered through three generations in the studio industry and is still at the helm.

'Very few people know this about David, but he actually built a number of the rooms at the studios,' says Keith Hatscheck, once an engineer at Music Annex who transitioned to running the facility's marketing until two years ago, and who now has Music Annex as a media relations client. 'I mean, he really *built* the rooms—he was swinging a hammer and putting in drywall. He's really a kind of throwback to another era of studio ownership.'

Porter, tall, thin and lanky, his hair and trimmed beard flecked with grey, and who looks like he would be as at home with power tools as with Pro Tools, is indeed an atavist among studio operators; as a self-made studio owner and former president of SPARS (1989–1990), he has seen this industry go through several generational shifts, many of which he anticipated, such as the change in emphasis at the upper end of the business from music to post in many markets. Music Annex has a long history in both camps, but it is the facility's nimbleness in the rapidly changing world of film, television, commercial, audio duplication, and—increasingly—multimedia post that has probably been one of the major keys to its success.

Necessity is the mother of invention, and geography in many ways is destiny. As a studio market, San Francisco is considered on a secondary tier, but compensates by being incredibly multifaceted in terms of markets: music (from the acid days of 1967's Summer Of Love through the current generation of Green Day postmodern punk bands, the Bay Area has always been America's cultural Petri dish whose more successful experiments yield major trends), television and film (Hollywood is an hour away by air and the post overflow has been consistent over the years), commercials (in an age of narrowcasted cable TV, regional advertising and customisation of national spots is growing), and multimedia (Sega is simply the most high-profile MM developer to latch on to San Francisco's revivified warehouse districts).

In such a market, the opportunities are manifold, but so are the pitfalls. 'Location doesn't matter like it used to,' says Porter. 'Hollywood will always be Hollywood. They tried to move it to Orlando and Vancouver but the talent still wants to be in LA. But the rest of the world is now demanding Hollywood-style production and postproduction. And as a result, every city big enough to have a professional sports team—and that's a lot of cities these days—has the opportunity to have a good postproduction market. And technology has nothing to do with that anymore; everyone now can scrub and edit. The key is in attracting the talent.'

Porter seems to have figured that out long ago. As it is done in Los Angeles and New York, Porter's post rooms are built around their mixers, such as Patrick Fitzgerald, who was an intern at Music Annex fresh out of San Francisco State University in 1985 and of whom Porter jokingly says 'we raised him from a pup'.

Music Annex was born in the heart of musician, like many of the more tenured studios that are still in place. Musicians—like Porter, who describes himself as a 'recovering musician' and who played woodwinds in a succession of bands from San Jose while working his way up to San Francisco in the late 1960s and early 1970s—have as hard a time letting go of ideas as they do of their riffs. But he played on a commercial once and realised he liked the atmosphere of the studio better than he did that of smoky clubs. He was attending San Jose State University, working towards a masters in music (which he never completed). As part of his research for his final thesis—which would be to actually build a small recording studio—his instructor, a professor named Alan Strange, encouraged him to read as many professional audio trade periodicals as he could lay his hands on, which at the time were magazines like

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Annex

George Augspurger-designed Studio C with Neve 8128 console

dB and *Recording Engineer and Producer*.

'But I needed to get free subscriptions to the magazines,' says Porter, 'so I took some stationary with the school name on it and wrote to the magazines saying that my home address was the University's music annex. I not only got the free subscriptions, but I also got a little bit of work from the music department at my home studio, for which the school owed me $86. They wouldn't write a cheque to a student personally, though; they needed to write it to a business. So I had to scramble to the courthouse and register a name for a business and I registered as Music Annex. It's been that name ever since.'

The first Music Annex studio was in Porter's house in that Northern California region in 1973. 'I was willing to take whatever walked in the door,' Porter recalls. 'Music, corporate work, training tapes, even medical transcriptions. Even from the beginning I had what we'd call industrial business, and some of it was multimedia, which back then was things like trade shows that ran multiple projectors simultaneously. I also saw early on that, while we all loved working with musicians, it was the corporate clients who had money.' This eclectic initial client base laid the groundwork for the diversity that would follow and would help ensure Music Annex' future success. (And the experience from those years apparently never let Porter get overly sentimental about musicians as a client group. 'One thing I did learn was that in a secondary music market like San Francisco, you get the [music] stars on their way up or on their way down,' he observes. 'Once they'd made it, they went to LA or New York and you'd lose them every time until it was over for them. Then they'd come back. I learned from that that I had to keep the client base as wide as possible.')

That first studio reflected the start-up technology of the era: Porter purchased one of the first Tascam Model 10 consoles in the Bay Area, which cost him $1,800 when he bought it from a local guitar dealer who was still years away from dealing pro-audio gear in that innocent age. 'I gave him the deposit and said go get it for me, and since then he's become the biggest Tascam dealer in the area,' recalls Porter, adding with a grin, 'He owes me.'

The studio also had a second console which Porter fashioned out of the parts from four Ampex tube mixers; he also built his own multitrack machines from spare Ampex parts, including a 1-inch 8-track deck and a ¼-inch deck. 'That and two U87 mics and I was in business,' he says.

The diverse client range was evident from the start, and from that experience Porter says he learned one of the greatest truths about the recording studio business. 'The key thing was, I realised very early on that this studio was an incubator,' he says. 'I knew that any studio I had would keep changing, and hopefully keep growing. I never looked at a studio and decided that this was it, the end-all, be-all that I could do. And I also realised that I didn't want to keep a studio in my house forever. But the real key to it all was learning when it was time to change—when it was time to leave the incubator. Too soon or too late, the business is in jeopardy.'

For Music Annex' first incarnation, the incubation period was two years; after that, Porter moved to a succession of commercial locations, first in San Jose, then to a 12,000-foot² facility in nearby Menlo Park in 1977, where the second Music Annex location still resides and which it expanded in continuously as Porter's business built and other building tenants moved out.

While music production comprised the main studio clientele in the early years, Porter's well-learned lesson of diversity saw him pushing towards postproduction in the early 1980s. But Menlo Park's location south of the central San Francisco business district was difficult to persuade commercial and film producers—whom Porter says were used to tacking their audio work onto the end of video sessions—to come out to. So in 1985, he opened another facility in San Francisco near what was rapidly becoming the city's advertising ghetto, a term of endearment that virtually everyone who now works in its narrow streets of converted warehouses and townhouses uses endearingly.

Music Annex' urban location has four suites, with a fifth planned to open within a year. The first room, Studio I, was designed by George Augspurger, who had also designed Studios B and C at Menlo Park. The new suite, Studio V, will be designed by Michael Blackmer (son of one of the founders of dbx), whom Porter had earlier tapped to redesign Studios A and C in Menlo Park. Studio V will be chaired by mixer Jon Grier.

The current technology mix of the two locations is a mix of vintage and newer cost-effective platforms. At the San Francisco site, Studio I has a match of a Euphonix CS2000P console, an NED Post Pro and a DOREMI VI random access video system; Studio II has a Soundcraft DC2000 with a Post Pro, as well as a 35mm film chain; Studio III is an Amek 2520 with a Post Pro; and Studio IV sports an Amek Hendrix (with LCRS panning matrix) and Post Pro, as well as the facility's sole remaining multitrack deck, an equally venerable Otari MTR-90 24-track machine. All the Post Pros are 16-channel versions with autoconform feature. Genelec S30 monitoring is common to all four rooms. In addition, Music Annex San Francisco has a Digidesign Pro Tools III system working off line in conjunction with a Mackie 1604 mixer. The facility's transfer room has a pair of MTM 16/35mm film dubbers, as well as Nagra and Otari tape machine.

Over at the 4-studio complex in Menlo Park, Studio A has a discrete Neve 8036-Studer A827 combination with Urei 813 monitoring; Studio B, the multimedia and preproduction room, has an Amek TAC deck with ADAT and Fostex B-16 decks and Yamaha monitoring; Studio C offers a 56-input, Flying-Fader-equipped Neve 8128 board with Studer A827 deck and Urei 813C monitoring; and Studio D, along with its huge tracking room and two iso booths, has a DDA AMR12 console with a Studer A80 24-track and Urei monitoring. The facility also has a mastering department with a Sonic Solutions system with the Time Twist option, as well as PQ subcode editing and 12Gb storage capability, with monitoring via Audix Nile X, JBL 4430, Hafler Pro 5000 and Yamaha P2250.

In addition, Menlo Park has 50 Nakamichi cassette decks and several open-reel duplicating systems which are the remnants of the duplication business that once formed the third leg of the Music Annex revenue triad. Sold to Philadelphia-based Disk Makers in 1995, the Music Annex duplication facility in Fremont, California, was an 11-year venture that exceeded the usual convert-the-closet duplication services that many recording studios used to put in as an additional revenue stream. That service's origins are as nitty-gritty as the studio's itself. Recalls Porter, 'A woman from Apple Computer called the studio and asked if we could make a few cassette copies. I said sure, how many? She said, '40,000!' I ran out and bought some Otari high-speed duplicators and suddenly we were in that business.' Porter sold it off as profit margins in audio duplication became untenable for anything less than mega-sized operations.

MULTIMEDIA is the heir apparent to Music Annex' previous activities. Along with the de rigueur CD-R replication capability it has, Music Annex' San Francisco location

Studio 4's Amek Hendrix console with LCRS panning

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'We still make a few bucks from replication and duplication,' says Porter, 'but now the value-added services lie in moving data from point to point. In the old days, I would have made 30 dubs and messengered them to 30 radio stations. We had to be finished by around one o'clock in order to get the spots on the air by four p.m. Now we can finish at 3:30 and still make it to air by four.' The DGS service isn't a big money-maker or a costly one to the studio—DGS supplies the technology virtually free to the studio and charges its agency clients. As Porter puts it, 'They're picking up from Federal Express' business.'

However, such value-added services as DGS and the EDnet digital patch (audio and video) that Music Annex offers, are a routine requirement in the current commercial broadcast market, one whose services are nearly as complex as the making of the spots themselves. When the irony of the fact that the technology used to do much of the postproduction work there—15-year-old Post Pros (although Porter's are 10 years old)—is several generations behind the DGS system, Porter simply raises his eyebrows, as if to say, 'Who knows?'

But the niche that's come to be known as multimedia is quickly becoming a leading client base at Music Annex. And once again, Porter's entry into this niche is not without an amusing anecdote.

'It evolved out of an experiment in 1991 in which we tried to sell retail music products—CDs and cassettes—over phone lines using an interactive voice response system,' he explains. 'We set up a toll-free number for each record company and had the music programs loaded onto huge hard drives. I lost my shirt on the idea but the one thing that came out of it was that we learned how to crunch low bit-rate files—8-bit, 8kHz sound—using a recipe of software systems and make it sound killer over phone lines. We learned to optimise the sound and make it better than ever before.'

The 'recipe' was a purely experimental combination of his Post Pro engines on the front end and processing with several audio software systems including Bit Works and an early version of L1, an Israeli-based program

Sound designer Ben Cortez with Elmos from *Sesame Street*

that was subsequently acquired by Digidesign. Word of Music Annex' success in the low bit-rate environment spread quickly among the nascent multimedia community that stretches from San Jose's Silicon Valley up through Microsoftland near Seattle, Washington.

'We started getting calls for file conversions from CD-ROM manufacturers wanting better audio,' says Porter, ranging from corporate projects, such as a major campaign for DHL's new global package tracking system, through game manufacturers, where Music Annex has had its most high-profile successes. The studio's work—particularly staff sound designer Ben Cortez—with toy consultant Mark Johnson-Williams resulted in the sound for the hottest-selling toy of the year, Tyco's Tickle Me Elmo doll, based on the 'Sesame Street' character, which had crazed parents in the States poring through the classified ads before Christmas, throwing money—as much as $400 and $500 per doll—at the prescient few who had anticipated the demand for the $30 toy. Based on the work done with the abortive music-on-demand project, Cortez had developed into the studio's low-res audio expert. Together with Johnson-Williams, he created the audio signature for the doll. One interesting aspect of the project was that, rather than the usual record-and-edit-later methodology of voice-overs, Cortez would record scripted lines directly to a Texas Instruments LPC Processing chip burner and check them in the same technology environment in which they would ultimately reside.

'The resolution is so lousy at the low-bit structure level that sometimes if the actor's inflections were off even a little, if they raised their voice just so, the whole thing would turn into digital ticks and garbage once it was transferred to chips,' says Porter. 'So we burned the chips in real time to make sure each take was good.

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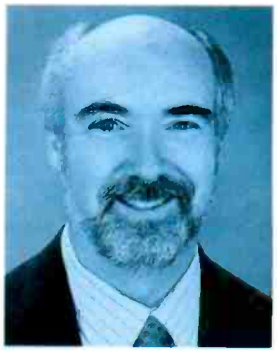

Music Annex President David Porter

Then we'd optimise them using a lot of the techniques we learned from the other project, and turned them into sound files.' Those files were then sent, via the Internet, to the Hong Kong factory that made the dolls. Tickle Me Elmo was simply the project with the highest recent value at Music Annex in this new market. As Porter points out, the studio was also heavily involved in several major CD-ROM-based games, including the creation and execution of the audio for Electronics Arts' *Wing Commander IV* game, which with an overall developmental and production budget estimated between $9m and $12m is the most elaborate game yet to hit on disc. Music Annex was also involved in the audio for another popular doll, Teddy Ruxpin, one of the first celebrity chatterboxes to send the milk-money set agog. And if you want to take it back to the beginning, as Porter repeatedly does, Music Annex was also the home of the audio for the first talking calculator in 1981, which brought the equivalent of Braille to mathematics.

Porter is fond of illuminating the links between his early post jobs, when the studio was still sharing a kitchen with him, and the multibillion-dollar industry that's grown up around new media.

'Everything is connected,' he says, 'and the lessons we learned years ago doing medical transcriptions still apply when it comes to the business of doing post. The technology changes all the time. But quite frankly, it's not the technology that makes you successful anymore—if it ever was. It's the talent and the intuitive ability to provide the right level of services for each of your client bases. And to have more than one kind of client.'

Postproduction is totally talent-driven from Porter's perspective, and his adherence to the vintage Post Pro and proclivity for cost-effective, rather than top-name-brand technology underscore that.

'The hard part now is not getting the equipment—anyone can get that at any number of levels,' he says. 'The hard part is finding the talent. If a mixer is really talented, he or she will find customers, who are always searching for talent, whether you work in a large full-service facility or in a cottage. It's interesting—the new technologies do level the playing field between small and large studios. But it's also making the talent harder to find. When you see something on the Internet, who knows who made it? That's why I think it's better for a lot of these mixers to be with a big facility like this, where they can make a name for themselves. But then there's the possibility that once they do, they'll retreat back to their own cottages. That's the biggest fear for a guy like me who owns a large facility.'

That's just one of the concerns facing modern studio owners. Another is rates—while post rooms are commanding three and four times what music rooms can, it undermines the incentive to stay in music. Also, there is a fragmenting of the audio post market itself, as a 500-channel world is demanding more and more content with ever-lower budgets.

'There are two distinct cultures in post,' observes, Porter. 'The factory-style approach of the large facilities—usually working in film or episodic TV—and the specialty boutique studios, who tend to do more short-form and specialty multimedia. There's a lot of cross-pollination between the two right now, and as trends they tend to swing like pendulums in terms of which types clients prefer to use. Ultimately what happens is that a business at one end of the pendulum moves towards the other as the winds shift. Right now the business is being boutiqued to death. I think what we'll start seeing more of in the near future is more consolidation as the boutiques either grow and become larger facilities themselves or merge with the larger facilities. The one thing that never changes is change.'

And as long as Porter can keep placing winning bets on when to leave the incubator for each new stage of his career, Music Annex will probably be around another 25 years.

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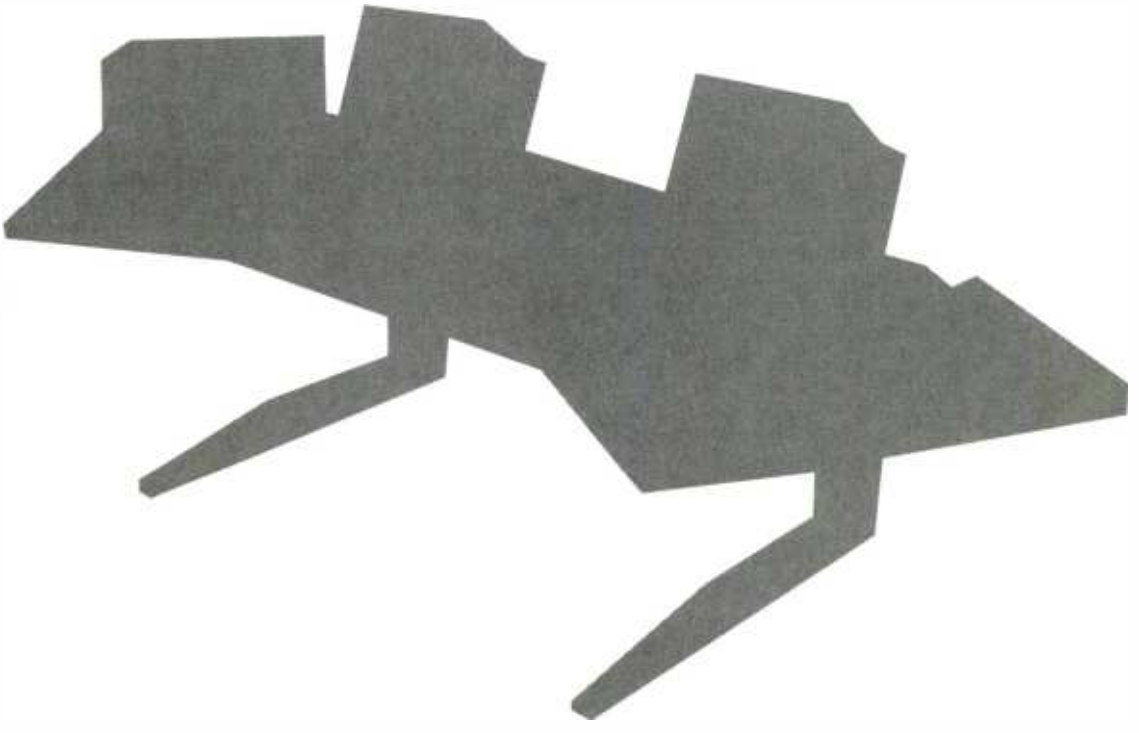

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Hooking up to the Highway

Almost everybody has by now heard of ISDN. But, like Siberia, while many know the name, few have been there. **BILL FOSTER** takes the uninitiated on a guided tour of the unknown

THE INTEGRATED Services Digital Network is the generic name for the digital telephone network that has largely replaced analogue systems throughout Europe, the US and the Pacific Rim. ISDN service is now readily available in most major cities and many outlying areas of more than 40 countries worldwide. It is currently delivered to the end user in two configurations: Basic Rate Access (two channels) and Primary Rate Access (up to 30 channels).

In fact, the ISDN now forms the backbone of all modern digital telephone networks and so any area served by a digital exchange should have no difficulty in gaining access. Where ISDN is available, connection to the Basic Rate service is relatively straightforward because the final link to the customers' premises is via conventional copper wires.

Primary Rate Access, however, requires a dedicated multichannel coaxial or fibre optic link and may have to be laid in specially. (It also uses a different interface from the Basic Rate service and may require an adaptor unit to enable connection to an audio coding unit—most of which are supplied with BRA interfaces.)

Each ISDN bearer, or 'B', channel can carry 64 thousand bits of data per second (64kbit/s), which is relatively slow compared with the 1,440kbit/s data rate of an audio compact disc. In order to send audio via the ISDN it is therefore necessary to 'compress' the data to a more manageable number using a device known as a codec (coder-decoder). To avoid using too much compression—which would audibly degrade the sound—more than one ISDN channel may be needed to carry the audio data. How many channels will depend on the application, the choice of codec and the audio quality that the particular job requires.

Despite the ubiquitous nature of the ISDN today, there is still only a handful of recording studios worldwide that are connected to it. Interestingly, most of these are in the US, even though service availability in some parts of the US is still far from comprehensive.

The reason for this limited take-up may be largely historical. Five years ago, getting hooked up to the ISDN was complicated, as well as being expensive. A call to the local telco would usually be met with a blank response from the sales representative, leading many to dub the network 'I Sure Don't kNow'. Telcos in the US were more willing to respond, but the charges in some areas at that time were so high that Americans interpreted the acronym as 'I Smell Dollars Now'!

Thankfully, all that has changed. A call to the local service provider nowadays will normally produce results within a few days —and, while still more expensive than a voice circuit, an ISDN line is now in most cases an affordable commodity.

MOST TELCOS PROVIDE Basic Rate Access service via an interface which is similar in appearance to a normal phone socket—the notable exception being the US where the line and the interface can be sourced separately. Each ISDN line (two 'B' channels) requires a separate socket.

The most logical place for the socket(s) is near the codec, and in single-room studios this is not a problem. But in multiroom complexes a decision has to be made on whether to site the codec in the Central Apparatus Room (if one exists)—where it can be patched to all rooms—select a dedicated 'ISDN Studio' and put the telco interface there, or have ISDN sockets in each room. The latter choice gives a great deal of flexibility—especially as the ISDN system provides the option to have separate numbers for each socket on the same line—but the installation and line rental costs will be higher.

However, just putting in a line is not what it's all about: from a studio's point of view there are a number of key factors that also have to be taken into consideration.

To send audio over the ISDN at a realistic cost not only requires it to be converted into a digital bitstream, but also that the data rate be reduced to more manageable numbers. The codecs used for this purpose have analogue —and sometimes digital—audio inputs, and output a data stream to a box known as a terminal adaptor (TA). This connects to the ISDN line(s) and converts the data into a form recognisable by the telecomms network. (Some codecs, incidentally, are now supplied with built-in TAs.)

But there's a complication. A single ISDN channel does not provide enough data bandwidth to transmit high resolution audio unless a very high compression ratio is used, and this in turn causes a processing delay that makes the link virtually unusable for 2-way communication. The solution is to multiplex two or more ISDN channels together. Inverse multiplexing—or I-MUXing as it is known —allows higher data rates to be transmitted by spreading the data over a number of individual ISDN channels, and then reconstructing the data stream at the receiving end.

But while I-MUXing is a highly effective solution, it was historically very expensive. In 1993, one full bandwidth system was priced at UK £12,000, of which more than 60% was the cost of the I-MUX unit. Prices have since fallen dramatically, although the I-MUX still forms a significant portion of the purchase price for systems that require four or six ISDN channels.

One of the major considerations when choosing a codec is the intended target market. In recent years different sectors of the audio business have tended to settle on one or two coding systems that suit their particular application.

Broadcasters probably use the widest range of systems: both MPEG Layer II and Layer III; the APT system; and, for contributions from football matches, foreign correspondents and so on, the single channel 7kHz G.722 format.

Each has its own advantages and disadvantages. MPEG Layer II can provide full bandwidth mono or 'joint' stereo (as opposed to two discrete channels) using a standard BRA ☞

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connection—two 'B' channels. This is ideal for recording voice-overs from remote locations and for delivering radio commercials to radio stations.

MPEG Layer III is not so useful for voice-over work as the processing delay can be irritating, but the ability to send a 15kHz bandwidth mono signal over one ISDN channel—or discrete stereo over a BRA—makes it ideal for many broadcast applications such as studio to transmitter links and other 'single ended' applications.

The coding algorithm developed by apt has the lowest delay of any full-bandwidth system, making it ideal for studio-to-studio links where dialogue between the two parties is required. But the trade-off is higher data bandwidth: to transmit a stereo 15kHz signal requires four ISDN channels—six are needed for full 22kHz 'CD quality'.

Another major player in the market is Dolby, which has developed its own AC-2 and AC-3 coding algorithms. AC-2 provides a full-bandwidth audio link over four ISDN channels and it has become the de facto standard within the film industry. Also, largely due to the efforts of EDnet in the United States, it has been widely adopted by the top-end audio studios, as well as leading producers and recording engineers in the US.

FROM A RECORDING studio's perspective, there are two main applications for ISDN-based coding systems: checking mixes and overdubs.

The quality of data compressed audio from one of the 'full bandwidth' systems is generally very good nowadays—although it is not yet good enough for the purpose of sending stereo mixes for mastering. However, if one or two 'tracks' of a multitrack master have been recorded over the ISDN, any minor loss of quality is unlikely to be noticed when they are mixed in with other uncompressed tracks. This means that a vocal overdub or guitar solo by an artist who, for whatever reason, is unable to attend a session, can be added from any of the 40 or so countries where an ISDN service is currently available. To achieve this does require some advance planning and a few synchronisation tricks, but it is being done successfully, and with increasing frequency, between studios worldwide.

Producer-engineer Bob Clearmountain has been a regular user of the ISDN for some time. This quote, from a recent EDnet newsletter, explains how he uses the system.

'Right now I use these systems for mix approvals. I work for artists and producers all over the world and it's extremely difficult for us to be in the studio together after the tracks have been recorded. People's schedules are just too complex. So I mix in my own studio and use EDnet to deliver my mixes electronically to the producer or artist at whatever location they might be.

'Typically the studio on the receiving end runs off a DAT and delivers it to the producer's hotel or local residence. In less than a day I've received back his instructions or comments and I'm back at work. It's quite efficient and it keeps the mix process fresher. Occasionally I'll be lucky enough to find the producer at work in a studio that can receive a digital audio transmission and we have the luxury of being able to discuss the mix as he hears it.

'Once in a while I use it for overdubs. Recently we did guitar overdubs with Sony's studios in New York for a Daryl Hall project. The guitar player was in my studio and he played directly to tape in New York.'

Now that costs of both equipment and connections are coming down, it is the lack of a 'standard' coding system that is without doubt the key reason why most studios have yet to invest in ISDN equipment. Murphy's Law says that whatever coding system a studio buys; the first client through the door will want to connect with a facility that has chosen a different one.

One alternative is to rent—and there are now a number of places worldwide that offer this service—but there is a fundamental drawback in adopting this philosophy. ISDN is about immediacy: most times when an ISDN link is required it is because the client needs it now—not tomorrow or the day after. Unless the studio is within easy reach of the hire company the whole point is lost as a tape can be shipped almost anywhere in the time it takes to get a rental unit from, say, Paris to Marseilles or Sydney to Adelaide.

For those without easy access to a rental firm, there is an alternative. If, for example, a studio equipped with an MPEG Layer II system needs to hook up with another facility that only has an apt unit, it is possible to route through a transcoding service. Admittedly there are only a very limited number of facilities offering this service at present—and the connection cost can be high if such a service is in a country other than that of the sending or receiving studio—but the option is there in case of emergency.

There is, though, one other drawback of transcoding and that is the issue of cascading codecs, which can cause significant audio degradation and result in long coding delays. It is, in fact, unlikely that audio routed in this manner would be useable for any mastering or lay-back application.

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ISDN Codec Roundup

Practical use of the ISDN network in professional audio requires that sound be digitised and data compressed before transmission which inevitably results in a compromise in quality. **MIKE COLLINS** assesses some available systems

Dolby DP524, DP503 and Multiband VSX

THE TELEPHONE NETWORK is regarded as pretty sexy these days. and with the cost of switched connections and bandwidth set to come down rapidly over the next few years, it's set to become more so.

ISDN is a digital connection to the telephone system using 64kbps channels. The basic installation known as ISDN2 –Basic Rate ISDN (BRI) in the US–provides two 64kbps data channels, so two or more may be needed for extra bandwidth. If you need more than three pairs of channels, then it is more cost-effective to go for ISDN30 –Primary Rate ISDN (PRI) in the US–which can provide up to 30 64kbps channels using a single cable.

The bandwidth of 16-bit, 44.1kHz audio requires data transfer rates of more than 1.5M bits per second, so at 64kbps per channel you would need to use maybe 24 channels to achieve real-time transfer. For this reason, various data compression algorithms have been developed to allow real-time transfer using less channels.

All the units considered here feature A–D and D–A convertors to which you can hook up your analogue or digital audio feeds, with codecs to compress the audio before transmission and to decompress the audio in real time on reception. Depending on the transmission path used there will always be a propagation delay, which could be as much as 250ms or more. You also need to take into account the processing time for the encoding -decoding which varies significantly between different systems. When two-way communications are involved, you should choose a system with the minimum processing delay, so the apt codec beats the Layer III codecs, for instance. For other applications, the delay times may not be an issue or you may be able to compensate for these.

Dolby, apt, CDQ and Telos are the systems mostly being used. The CCS and Telos units are widely used for broadcast applications while Dolby is used mainly in postproduction for film and music recording. Most of the Japanese AM and FM stereo distribution network uses apt DSM100s and these are also used by Classic FM, several ILR's and various postproduction houses in the UK.

The Telos units will be of great interest to recording studios as well as providing compatibility with the CCS units for broadcast work–

> **Depending on the transmission path used there will always be a propagation delay, which could be as much as 250ms or more**

as the Layer III coding is more than acceptable for auditioning purposes and could certainly be used for overdubs. It is worth noting that the Telos and CCS units both offer stereo audio at 128kbps using Layer III while the apt and Dolby codecs can't send stereo at less than 256kbps–so the former will cost less in connection charges. As far as compatibility is concerned, the Telos and Dolby units will connect with the CDQ units at up to 128kbps using Layer II, although APT won't as it is a proprietary system.

Previously, compatibility problems stemmed from the fact that different manufacturers designed their own IMUX implementations –so Layer II codecs on one could not talk to Layer II codecs on another. The ITU have now defined the J.52 IMUX standard which is intended to be an integral part of a codec design so that any IMUX will be compatible with any other manufacturer's MPEG codecs.

Early ADPCM coding won't let you achieve more than about 7kHz bandwidth using the G.722 protocol so you would mostly use this for compatibility with older installations. Currently, Layer II is the most widely-used coding scheme, while the 'new kid on the block' is Layer III. A recent Technical Note from Audio Precision reveals that Layer II is restricted to about 10kHz when used on a single 64kbps ISDN channel. Also, Layer II's joint stereo mode reduces stereo separation when used on two ISDN channels. It turns out that nearly all the discrete channel information above about 6kHz actually appears on both channels of the codec's output. Layer III, on the other hand, gives you 15kHz mono on a single channel–which is a perfect match for FM broadcast work. Layer III also offers better stereo separation and can be configured for dual-mono on two channels.

These codecs all use 'lossy' algorithms ☞

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from which you can never recover all the original data. It is likely that much broadcast audio will be subject to multiple encoding and decoding as it is transferred from point to point before broadcast. This will inevitably lead to degradation of the audio using present codecs–so this should always be borne in mind especially if there is any intention to use the audio for mastering to CD. Probably the best way to use these real-time systems in music recording studios at present is to simply let the producer at the base studio audition in real-time until he has the take he wants–while the real audio is mastered to DAT at the remote studio and couriered to the base studio immediately afterwards. A quicker way to transfer mixes from remote locations is by using an ISDN circuit for non-real-time file transfer from a computer-based digital audio workstation. For instance, a Sound Designer II, AIFF or .WAV file containing the audio could be transferred at about 1Mb/min using the 4-Sight ISDN system which is available for Macintosh computers.

Apt-X MCE-D800

I TRIED Zephyr 9202 using Layer II Joint Stereo and the audio quality looping back from a remote unit was excellent. I could hear slight differences in the quality of the encoded-decoded audio compared with the original material coming from CD–amounting to a barely-perceptible coarsening of the sound. Layer III, on the other hand, sounded virtually indistinguishable to the source material on the selections I auditioned. The Dolby DP503 was similarly easy to program. A particularly neat feature is the onboard talkback which lets you talk to people at the far end without having to make a separate phone call. I auditioned the Dolby system hooked up to the same ISDN-2 as the Telos unit and used Layer II Mono to dial one unit from the other to make sure they were compatible–which they were.

Apt-X DSM100

To get an idea of how the other algorithms sounded, I set the Dolby unit to loop back to itself so that I could audition encoded-decoded audio. Using AC-2 at 384kbps or 256kbps I could hear no difference. Using Layer II at 128kbps all I could hear was a slight loss in quality at the high end. Using one channel of Layer II at 64kbps, the quality was easily good enough for speech, but left something to be desired for music. Using AC-3 at 128kbps the quality was extremely good, but there was a noticeable loss of spaciousness due to the high-frequency rolloff at 15kHz. At 256kbps there was a marginal loss at high frequencies and at 384kbps and above I could hear no difference. Using two channels of AC-3 at 64kbps I could hear phasing and stereo imaging shifts, while using AC-3 in mono over one 64kbps channel was fairly acceptable–despite the restricted bandwidth.

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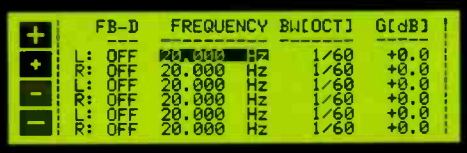

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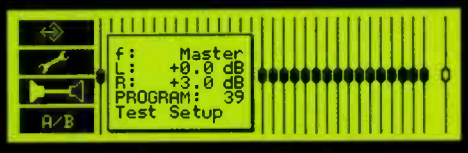

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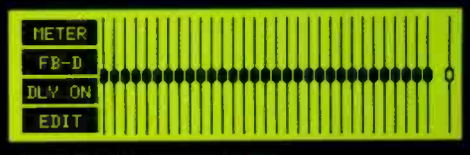

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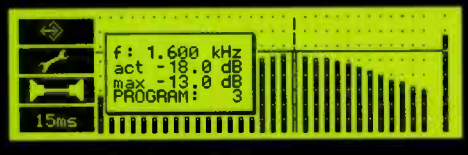

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THE CCS CDQ Prima units contain both an encoder and a decoder featuring 18-bit D–A and A–D convertors and offer mono, dual-mono, stereo or joint stereo over a wide range of transmission and sampling rates. The CDQ Prima 210 and 220 2U-high 19-inch rackmount units feature both analogue XLR line in and out, plus AES-EBU in, out and sync in. Units can optionally be fitted with SPDIF and optical digital I-O and both feature a dial and control keypad, while the 220 also provides push-button control over headphones and cue indication. Both units have built-in terminal adaptors, J.52 inverse multiplexing and automatic coding algorithm detection. Other optional features are contact closures, AES-EBU interfaces with rate adaption, synchronous data, 22.05kHz and 44.1kHz sampling rates, and so forth.

The codec supports MPEG Layer III and Layer II of MPEG1 and 2 at sampling rates of 16kHz, 24kHz, 32kHz and 48kHz, as well as G.722. Layer II is also available at 22.05kHz and 44.1kHz sampling rates. Codec configurations can be stored and later accessed by speed dial functions.

The original proprietary CCS inverse multiplexing is still supported for compatibility with the older CDQ2000 range. This only worked up to 128kbps–previously you needed an external IMUX to work at up to 384kbps. The new J.52 standard used in the CDQPRIMA now goes all the way up to 384kbps.

These models can also send and receive RS232-C computer data along with the audio –for computer file transfer, email, broadcast and traffic messaging systems or message printing at remote sites. CDQPRIMA also supports SMPTE for synchronising far-end video and audio recorders for voice overs.

EACH TELOS Zephyr unit acts as both a transmitter and a receiver and up to 20kHz audio can be transmitted on one ISDN channel using Layer III coding. Mono 15kHz operation can be accomplished on a single ISDN channel. The Zephyr primarily uses MPEG Layer III audio–which most listeners say they cannot distinguish from the source–and incorporates MPEG Layer II and G.722 codecs. You can use any of these for send or receive without having to choose the same for send as receive. Layer II coding requires two channels of 64kbps to achieve a mono audio bandwidth greater than 10kHz, whereas with Layer III you can get 15kHz mono with only one 64kbps channel, incurring half the call costs. You can then use the other channel for telephone calls or to connect to another site independently.

Sample rate conversion is available and rates of 32kHz, 44.2kHz and 48kHz are supported. You get an LED array for metering and an LCD screen to display settings, with a keypad to make the settings from the front panel. An autodial function lets you preset the codec settings and telephone numbers of the remote locations. A call-duration timer, headphone jack, mic/line inputs, input protection limiting, and a remote control capability are also provided. Windows software is supplied–featuring a Comms mode with two text windows for bidirectional communication between sites and a Control mode to program settings for local or remote units. An RS232 serial data port running at 9600bps allows communications and control data to be transmitted simultaneously with the audio. A terminal adaptor is built-in and an optional data port with V.35 and X.21 network interfaces is also available.

The original proprietary CCS inverse multiplexing is still supported for compatibility with the older CDQ2000 range

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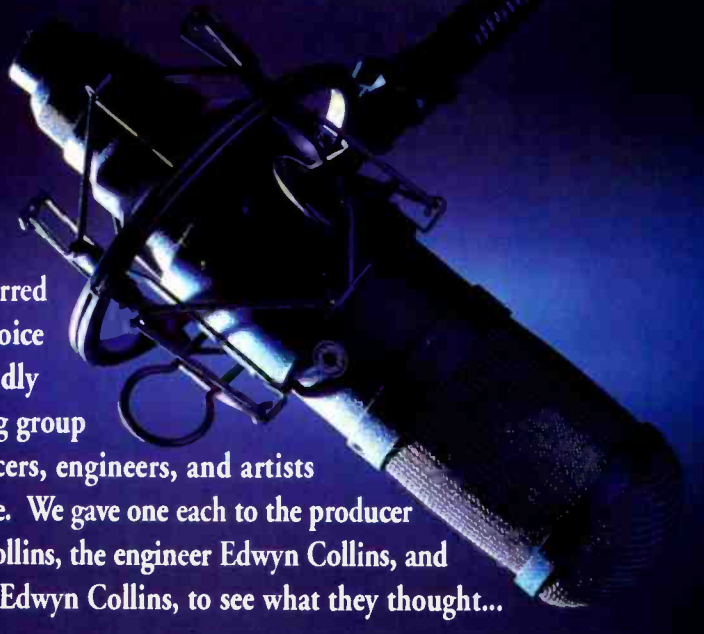

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Telos Zephyr digital network audio transceiver

mount and uses proprietary apt-X100 ADPCM data compression with a fixed compression ratio of 4:1. This is particularly suitable for live 2-way broadcast applications due to an exceptionally low coding delay–at best 2.8ms for 48kHz sampling rate audio capable of delivering 22.5kHz stereo.

The DSM100 features an integral digital sample rate converter, with time code and RS232 features and either analogue balanced line or digital AES-EBU connections. A range of sampling frequencies from 16kHz to 48kHz can be used–and the DSM100 uses a 16-bit, 64x oversampling A–D convertor with an 18-bit, 8x oversampling D–A.

A new unit is under development using apt-Q scalable compression operating from 256kbps up to 56kbps and supporting compression ratios between 5:1 and 18:1

You need a terminal adaptor to connect to the ISDN lines and if you are using an IMUX you need to use apt's proprietary design. apt recommends that you partner the DSM100 with their Pro Link Manager –which includes a terminal adaptor and an IMUX and lets you store up to 50 locations with their ISDN telephone numbers and bandwidth settings. Worldnet Voyager software is provided to let you control the ProLink and DSM100 using a PC.

Multiple 64kbps channels can be configured to deliver 15kHz stereo at 256kbps–requiring four 64kbps channels. To achieve 20kHz stereo, say for an orchestral session, (and especially if you require multiple encoding and decoding) you should use the highest bit-rates–requiring three ISDN2 lines to give 384kbps. One channel at 64kbps gives 7kHz bandwidth in mono, while with 128kbps gives one 15kHz or two 7.5kHz paths. Operational modes include one location, single-mono; one location dual-mono or stereo; or two locations, two separate mono–so you can make two fully independent mono links to two different locations at the same time. If a line drops, the system will drop back to the next lower data rate, automatically redial, and restore the channel within 100ms.

A new unit is under development using apt-Q scalable compression operating from 256kbps up to 56kbps and supporting compression ratios between 5:1 and 18:1. At 32kHz sampling rate it will deliver 15kHz stereo at 56kbps and at 48kHz sampling it will deliver 20kHz audio at 128kbps. So for live broadcast or for auditioning purposes one ISDN channel gives 15kHz stereo using one 64kbps channel with a compression ratio of about 20:1.

CDQ Prima range

DOLBY'S UNITS feature Dolby AC-2, AC-3 and Layer II coding algorithms, with variable data rates from 56kbps to 448kbps, a digital resolution of 18 bits and sampling rates of 32kHz, 44.1kHz or 48kHz, with a time delay ranging from 12ms to 210ms for the encode-decode process (depending on the coding algorithm selected)–excluding the network delay. Each unit has AES-EBU and SPDIF connectors–along with balanced analogue audio inputs-outputs. Front panel control of calls and algorithm selection is provided and Windows-based control software is supplied. The package also includes the Ascend TA/IMUX which supports either one ISDN2 connection, four ISDN2 connections, or ISDN30. The basic configuration has four ISDN2 interfaces allowing data connections at up to 512kbps. File transfers are also possible using the Ascend unit.

Record labels are using Dolby Fax for mix approvals direct from the A&R office to the studio and musicians can use the system to overdub from remote studio locations. Film studios use the Dolby Fax system for ADR so the talent can visit a local studio equipped with Dolby Fax and re-record the dialogue by transmitting audio in real time to the dubbing stage. The system is also used for mix approvals where the picture is at one studio while the audio originates from another. An optional time-code module is available to allow control of a remote VTR– transmitting and receiving both time code and 9-pin machine control during a Dolby Fax session.

Dolby AC-2 digital audio coding provides 20Hz–20kHz bandwidth in the standard units. The latest Dolby 2-channel DP503 encoders and DP 524 decoders now support

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AC-2, Dolby Digital (AC-3) and MPEG layer II algorithms at bit rates from 56kbps to 384kbps–allowing connectivity with other models from CCS, Telos and RE. The new units can also store the name, ISDN phone number and desired algorithm, enabling virtually automatic ISDN connection.

4-SIGHT'S SCII are available either as PCI or NuBus versions and are paired with 4-Sight ISDN Manager software to provide non-real-time file transfer over ISDN. A PC version has just been released. Other cards which will work with ISDN Manager include the Euronis Planet series, the Harmonix Quattro series, the OST MacSNet card and the Hermstedt Leonardo series.

You install the ISDN card in the back of your Mac and then use the ISDN Manager software to select any file or files from your data storage drives which you wish to transmit to a remote location. For audio, you will typically be using Sound Designer II, AIFF or possibly .WAV files–the PC-compatible format. You will also need an audio system with a digital audio connection such as the SonicStudio 16.24 or Pro Tools III to let you digitise your mixes.

A 45Mb stereo Sound Designer II 16-bit, 44.1kHz file took about 40 minutes to transfer across London between two project studios–with no problems encountered transferring in either direction. This is comparable with the time it would take to bike a tape from one side of London to the other, but for longer distances, this method beats any other–and no data compression is involved, so you can transfer files for mastering.

Some studios are now installing both this system and a real-time one which they use to approve the recording at lower quality before the finished mixes are transferred non-real-time.

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Mr Blue Sky

You love the euphemisms, but loathe the reality—vapourware or blue sky technology, none of it works. The idea of beta testing in the field is not new, but it's already frighteningly familiar writes **KEVIN HILTON**

Living creatures have a long, painful journey from inception to maturity. With equipment—which designers and manufacturers like to think of as having a similar birth process—it has to be more instantaneous: the idea is conceived, formed and then everyone expects it to work straight out of the box.

This final stage is heralded by the product launch, sometimes an elaborate jolly accompanied by speeches, warm drinks and a few dead things on sticks. As someone who has attended a number of such events, it's odd when you suddenly experience *deja vu*. This can happen because the phrase 'product launch' covers a multitude: there are prototype showings, previews, American launches, European launches, UK launches, relaunches and the type of launches bought by publicists who do very well out of organising all these things.

What soon becomes apparent is that although a product is being launched, it is not necessarily ready to be plugged in and used. If anyone starts yelling about this it could be interesting to look at the period between an introduction and when units start shipment. Early last year I was invited to see something new and talk to the designer, after which I wrote an article. That product has only now started shipping.

The joke is that during the interview I asked whether it was actually ready, much to the chagrin of one of the marketing people, who haughtily proclaimed that they didn't deal in 'blue sky technology'. The explanation is that although the product was in place, it took longer than anticipated to get into production.

While annoying, at least end-users in this case have not had to struggle through trying to make a barely finished piece of equipment work. Unlike other unfortunates.

The stories of blue sky technology, or vapourware, abound in broadcasting; tales of much hyped new formats that are immediately ordered by stations, who then spend agonising months, or even years, trying to get them to work properly.

There is the national TV station that took a large consignment of a new VT format amid much publicity, even though technical observers couldn't see why the equipment had been introduced at all because previous technology was still relatively new and working well. Stories were rife of visitors being shown round the machine rooms, proudly featuring the machines, which were then off-lined as soon as the strangers left with Post-It notes stuck on the facia panels warning engineers not to use them.

As you can tell from my reticence to name names, these incidents are not in the public domain, they are merely rumour, hearsay or whispered stories followed by the phrase, 'Please don't print this.'

Even if I wanted to, which I do, there would be trouble. Proving it is a problem because as soon as the notebook comes out, everybody clams up or the spin doctors are brought in to talk the manufacturer and client out of the hole they've built for themselves. Or the informants are written off as embittered ex-employees, who suddenly go very quiet when asked again about the situation.

Then there are the veiled commercial threats always levelled at trade magazines. So it went on—much to the frustration of those forced to deal with the situation and the journos who knew there was a story but were frustrated by smokescreens and stonewalling.

Then things changed—slightly.

Last year a fly-on-the-wall documentary called *Nightmare On Canary Wharf* was broadcast, chronicling the traumatic birth of UK cable channel Live TV. Amid the in-fighting, running, shouting and swearing as executives, production staff and technicians headed to the air date, there was a telling comment. Talking about the Avid nonlinear video system, soon to be departed executive Janet Street-Porter wailed, 'We've got all this wonderful technology and it doesn't work.'

It was a crystallising moment. Naturally Avid brought in the fire-fighters, who pointed to other, successful installations—in America, oddly enough—and laid the blame squarely on those operating the systems. Still, it was blood, if only a couple of cups rather than a bucket. It also reinforced a theory, that digital and computer technology was, logically, going to be more prone to start-up troubles due to its very nature.

Analogue could always limp along but if digital doesn't work, it doesn't work and once a computer crashes the wreckage is spread all over the jungle.

Whether *Nightmare On Canary Wharf*, and its sequel, has given people the confidence to be honest is doubtful but some are now admitting early mistakes. D-Vision, which set out to be 'Avid on the PC', recently held a press conference where its new president-CEO, Paul Reilly, admitted that the company had 'come to market too early', with software that wasn't finished. The repercussions included its UK distributor collapsing because the product wasn't ready.

The stories of blue sky technology, or vapourware, abound in broadcasting; tales of much hyped new formats that are immediately ordered by stations, who then spend agonising months, or even years, trying to get them to work properly

While early problems can perhaps be forgiven because the market was still trying to work out a very new technology, this is no longer the case. Computer-based and nonlinear is still a young technology but its widespread usage shows maturity and with maturity should come honesty.

It does nobody—the manufacturers, the suppliers, the broadcasters, even the mags—any good if everybody pretends that all is well when, deep down, we know that it isn't.

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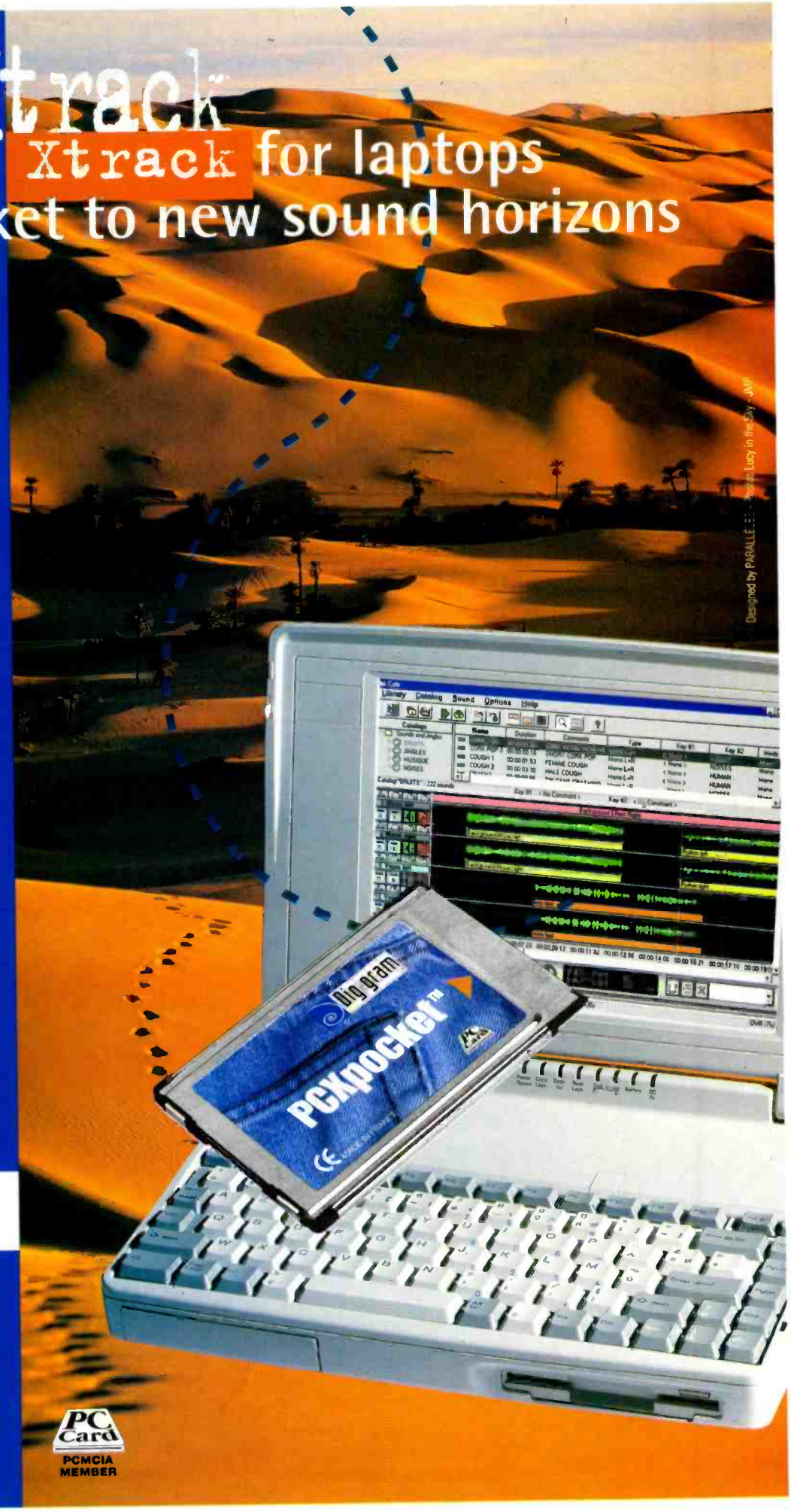

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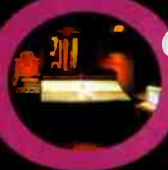

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The Rock Garden

If ISDN can claim to have changed any aspect of audio working it is that of broadcasting. **SIMON CROFT** catalogues the changes on an American radio show hosted from a London club

AS EVERYONE in radio-land knows, ISDN is a convenient and cost-effective technology that enables surprisingly good audio to get from A-B or even A-Z. Sometimes it can even be a lot of fun.

This was certainly the case when two radio stations from the New York area—WPYX and WHJY—got together for the 10th year running to host live programs from different floors of London club The Rock Garden. The event ran for the best part of a week. In addition to interviews with a list of guests that read like a slightly selective Who's Who from 30 years of British pop, the two stations got their captive stars to provide 'unplugged' performances on-air.

In the intimate atmosphere of The Rock Garden, the stations simply set up their wares on the same pub furniture provided for the audience. For those of us at the venue, this gave the event the feel of a slightly rowdy folk club—plenty of beer and good music, without everyone fawning over the performers.

Keeping the system running smoothly behind the scenes was Rick Carr of Remote Possibilities, based in Las Vegas. Carr provides sound services for radio stations all over the world and this was the eighth annual Rock Garden event on which he had worked. The technology was essentially straightforward...

'Basically, there's an ISDN line, ISDN 2,' Carr explains from the basement of the crowded venue. 'We're using the Comrex DXR codec and the terminal adaptor is called the Blue Phone, that's how they rented it to me.'

Because the ISDN line has two bidirectional channels, Carr was able to use the single codec and terminal adaptor to serve both stations simultaneously. 'The signal goes via digital ISDN to the station, where they have basically the same equipment and it gives you about a 10kHz mono feed in both directions. We have a CD player here but almost all the music and everything is done back at the station.

'What's coming from us is really the same as the jock's microphone in the studio—they just have to bring it up on the board.'

Carr says there were no problems caused by the difference between the Switched 56 system used in the US and the 64kbs ISDN found in Europe and elsewhere. On the other hand, the fact that British Telecom somehow lost the order for the line meant some last-minute help from an unexpected source.

'As long as BT get the line they're supposed to, then it works,' Carr agrees. 'But a lot of times when I get over here to London I call the phone company and say, "How come my line's not installed?", and like on this trip it was a case of, "Oops we forgot". So they came in Saturday morning and they installed it for us.

'They had some ISDN installers and these guys are mainly assigned to Buckingham Palace. When BT realised they had screwed up and forgot to put the order through, they just grabbed the guys that were available, took them away from Buckingham Palace and sent them here. They said, "Ah it's just a government job, it can wait!"'

WHETHER HM THE QUEEN lost a lot of valuable voice-over work that week as a result is unrecorded, so to speak. What is certainly true is that this simple system sent interviews and performances without hitch to WPYX in Albany New York and WHJY from Provident Rhode Island.

In contrast, Carr recalls the troublesome and delay ridden days of satellite links, 'When you had to get broadcasters to put in and then go up to the satellite from here in London, pull down in New York and then turned around through a domestic satellite in the States...' Carr pauses, as even he seems to have difficulty remembering how many links this particular chain was supposed to have.

'You had two satellite hops and the ISDN with the cueing from the States would come back over a regular telephone line and that had to be put through the system...' Suffice to say, by the time the audio had made it across the Atlantic, you could sing 'Blue Suede Shoes' through it.

'This is so much easier nowadays, and the quality is just as good,' Carr continues. 'There is virtually no delay because it is travelling through fibre optic at the speed of light, as compared to satellite which was microwave, so it wasn't the speed of sound but it was pretty close.'

For confirmation of this happy state of affairs, Heeere's Bobby!—a WPJX deejay with a real-life voice that sounds like a walrus making a late night phone call to Mrs Walrus.

'We do two broadcasts on the road a year, it's in the contract, one in London and one in Los Angeles and we go out on the road if we need to beyond that. It's gotten easier with ISDN,' he confirms. 'Without the satellite you don't have to worry about the slap any more. The sound is obviously much better.

'It is easier to do, the talent is always unbearable but at least you don't have to worry about whether it is raining! I can remember when you went out with a Shure mixer and that was it. Now with this stuff, we have the chance to do what we do in our own studios.'

Actually, the equipment list at the Rock Garden included a Shure mixer but it was only for backup. The two stations had virtually identical setups based on a Mackie 1604VLZ desk, two Shure Beta 58 microphones apiece —both loaned by the manufacturers—plus some Sennheiser MD421s of Carr's.

Taking care of the sound balance for WPJX was engineer Eddie Kramer, famous for his work with Jimi Hendrix. 'When we mixed Ian Anderson, we were using a DI right into the board and the Shure Betas,' he comments. 'It was very dry. There was no reverb, nothing and people like that because there is an immediacy to it.'

Perhaps 'immediacy' was something of an understatement, as Kramer explains, 'There is an urgency to the situation because you have to get in and get the sound. Literally, I've between 60 and 90 seconds to get the balance. You just do it on the fly.'

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The compression of audio for transmission or storage depends upon auditory masking to conceal the approximations due to bit rate saving. **JOHN WATKINSON** examines the action of stereo masking techniques and some presents practical listening tests

Compression and Stereo

PROGRESS HAS MEANT that there is increasingly less to say about the digital domain. When well engineered, the PCM digital domain does so little damage to sound quality that the problems of the remaining analogue parts usually dominate. The one serious exception to this is lossy compression which does not preserve the original waveform and must therefore be carefully assessed.

By well-engineered, I mean that performance actually meets psychoacoustic requirements. The appropriate criteria can only be found by subjective tests. Consequently I have been doing some research into stereo perception. This has led to some interesting conclusions, particularly regarding loudspeakers and compressors, which turn out to be related.

Experiments showed long ago that even technically poor stereo was always preferred to pristine mono. This is because we are accustomed to sounds and reverb coming from all different directions in real life

I have found that non-ideal loudspeakers act like compressors in that they conceal or mask information in the audio signal. If a real compressor is tested with non-ideal loudspeakers certain deficiencies of the compressor will not be heard and it may erroneously be assumed that the compressor is transparent when in fact it is not. Others, notably the late Michael Gerzon, have suggested that compression artefacts which are inaudible in mono may be audible in stereo. I have found this to be true. I have also found that the spatial compression of non-ideal stereo loudspeakers conceals real spatial compression artefacts. In my view, stereophonic reproduction must pay as much attention to the spatial accuracy as it does to the traditional aspects such as frequency response, but traditionally this has seldom been done.

THE HUMAN HEARING mechanism has an ability to concentrate on one of many simultaneous sound sources based on direction. The brain appears to be able to insert a controllable time delay in the nerve signals from one ear with respect to the other so that when sound arrives from a given direction the nerve signals from both ears are coherent causing the binaural threshold of hearing to be 3dB–6dB better than monaural at around 4kHz. Sounds arriving from other directions are incoherent and are heard less well. This is known as the 'cocktail party effect'.

Human hearing can also locate a number of different sound sources simultaneously by constantly comparing excitation patterns from the two ears with different delays. Strong correlation will be found where the delay ☞

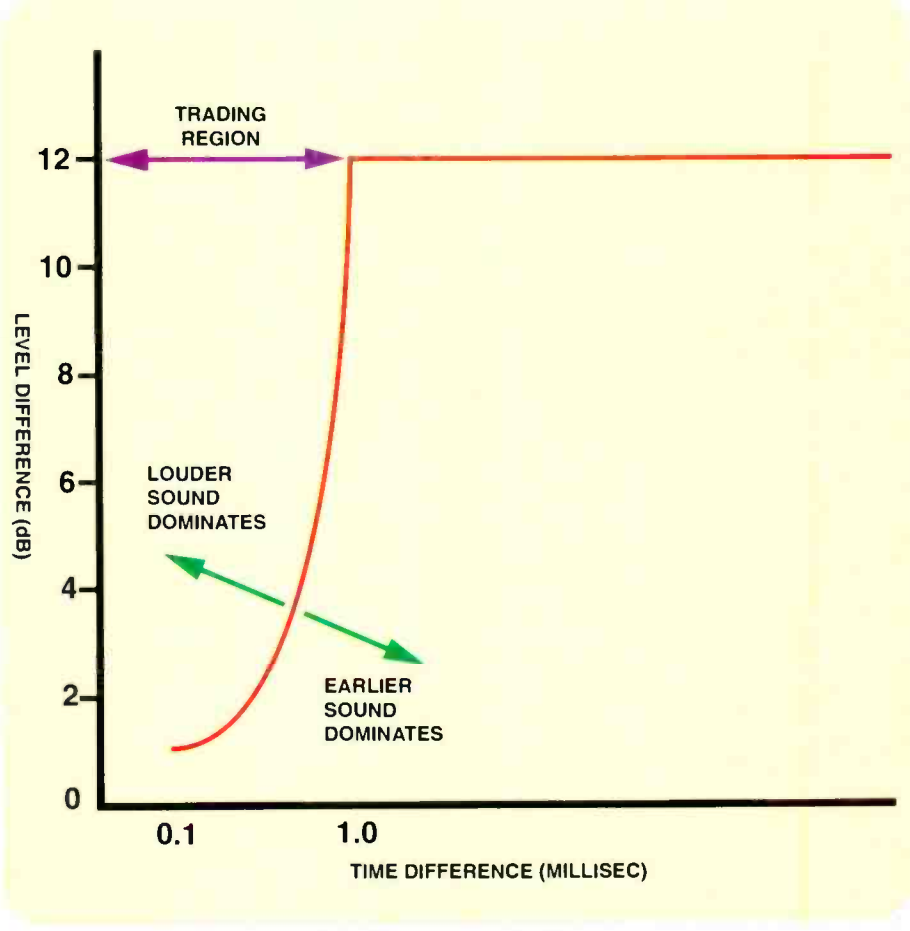

Fig.1: The time-intensity trading region

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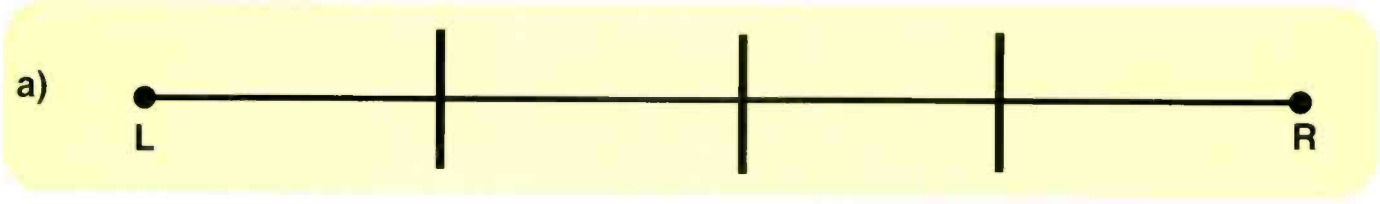

Fig.2a: Pan-potted sources have zero width

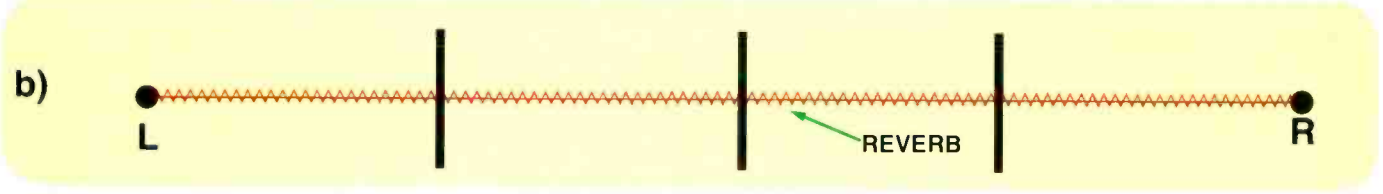

Fig.2b: Pan-potted sources with reverb

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corresponds to the interaural delay for a given source. This delay-varying mechanism will take time and the ear is slow to react to changes in source direction. Oscillating sources can only be tracked up to 2Hz–3Hz and the ability to locate bursts of noise improves with burst duration up to about 700ms.

Monophonic systems prevent the use of either of these effects completely because the first version of all sounds reaching the listener come from the same loudspeaker. Stereophonic systems allow the cocktail party effect to function in that the listener can concentrate on specific sound sources in a reproduced stereophonic image with the same facility as in the original sound.

Experiments showed long ago that even technically poor stereo was always preferred to pristine mono. This is because we are accustomed to sounds and reverb coming from all different directions in real life and having them all piled one on top of the other in a mono speaker convinces no-one, however accurate the waveform.

We live in a reverberant world which is filled with sound reflections. If we could separately distinguish every different reflection in a reverberant room we would hear a confusing cacophony. In practice we hear very well in reverberant surroundings, far better than microphones can, because of the transform nature of the ear and the way in which the brain processes nerve signals. Because the ear has finite frequency discrimination ability in the form of critical bands, it must also have finite temporal discrimination. When two or more versions of a sound arrive at the ear, provided they fall within a time span of about 30ms, they will not be treated as separate sounds, but will be fused into one sound. Only when the time separation reaches 50ms–60ms do the delayed sounds appear as echoes from different directions. As we have evolved to function in reverberant surroundings, most reflections do not impair our ability to locate the source of a sound.

Clearly the first version of a transient sound to reach the ears must be the one which has travelled by the shortest path and this must be the direct sound rather than a reflection. Consequently the ear has evolved to attribute source direction

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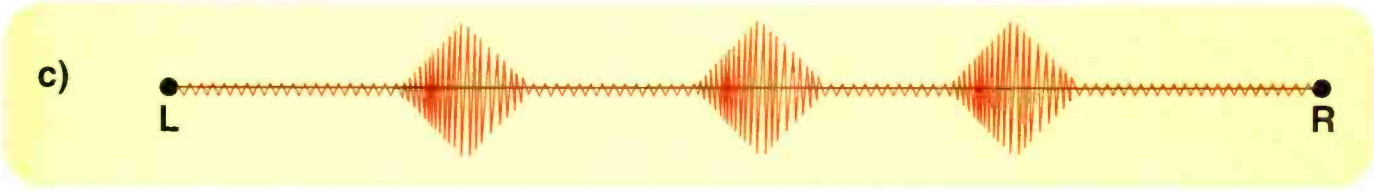

Fig.2c: Signal b) on diffracting speakers

from the time of arrival difference at the two ears of the first version of a transient. This phenomenon is known as the precedence effect.

Versions which may arrive from elsewhere simply add to the perceived loudness but do not change the perceived location of the source unless they arrive within the interaural delay of about 700µs when the precedence effect breaks down and the perceived direction can be pulled away from that of the first arriving source by an increase in level. **Fig.1** shows that this area is known as the time-intensity trading region. Once the maximum interaural delay is exceeded, the hearing mechanism knows that the time difference must be due to reverberation and the trading ceases to change with level.

Unfortunately, reflections with delays of the order of 700µs are exactly what are provided by the traditional rectangular loudspeaker with sharp corners. I have found that these are clearly audible, which is not new, but confirms what others have been asserting for decades.

Intensity stereo, the type you get with coincident mics or pan pots, works purely by amplitude differences at the two loudspeakers. The two signals should be exactly in phase. As both ears hear both speakers the result is that the space between the speakers and the ears turns the intensity differences into time of arrival differences. These give the illusion of virtual sound sources.

A virtual sound source from a pan pot has zero width and on diffraction free speakers would appear as a virtual point source. **Fig.2a** shows how a pan-potted dry mix should appear spatially on ideal speakers whereas **Fig.2b** shows what happens when stereo reverb is added. In fact, **Fig.2b** is also what is obtained with real sources using a coincident pair of mics. In this case the sources are the real sources and the sound between is reverb /ambience.

Fig.2c is what you get with the traditional square box speaker. Note that the point sources have spread so that there are almost no gaps between them, effectively masking the ambience. This represents a lack of spatial fidelity, so we can say that rectangular loudspeakers cannot reproduce a stereo image without fear of contradiction, except possibly from people who are trying to sell such things.

IN ORDER TO TEST these theories, I have built jointly with Richard Salter a number of loudspeakers, both electrostatic and moving coil, which are free of reflections in the sub-700µs trading region. Not surprisingly the imaging is much more accurate and actually reveals what is going on spatially. It is possible to resolve the individual voices in double-tracked vocals where the pan pots on each track have been in slightly different places.

These speakers were used to assess some audio compressors. Even at high bit rates, corresponding to the smallest amount of compression, it was obvious that there was a difference between the original and the compressed result. **Fig.3** shows graphically what was found. The dominant sound sources were reproduced fairly accurately, but what was most striking was that the ambience and reverb between was virtually absent, making the decoded sound much drier than the original.

What was even more striking was that the same effect was apparent to the same extent with both MPEG Layer 2 and Dolby AC-2 coders even though their internal workings is quite different. In retrospect this is less surprising because both are

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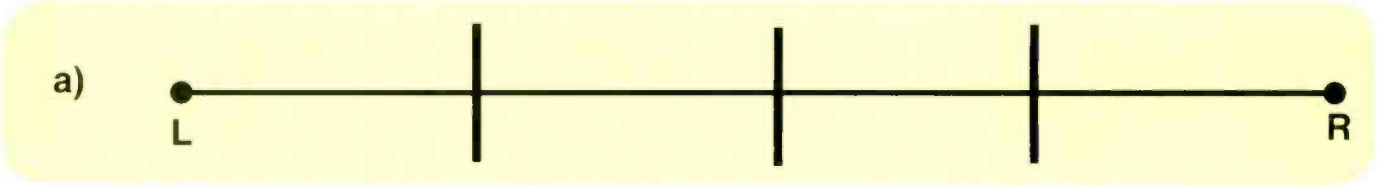

Fig. 3a: Input to compressor

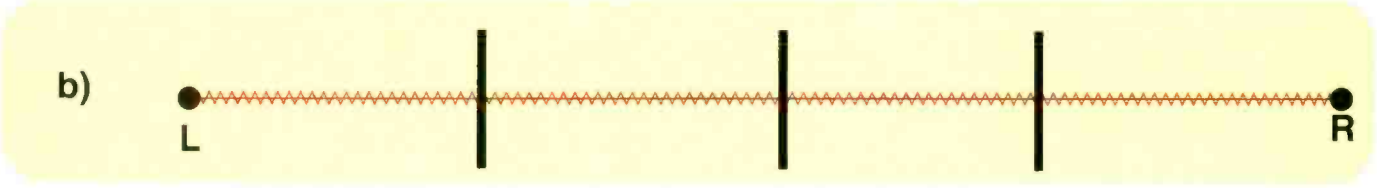

Fig. 3b: Output from decoder

Fig. 3: Graphic display of the result of digital compression on a stereo image. The ambience and reverb is absent in the decoded signal.

probably based on the same psychoacoustic masking model. MPEG3 fared even worse because the bit rate is lower. Transient material had a peculiar effect whereby the ambience would come and go according to the entropy of the dominant source. A percussive note would narrow the sound stage and appear dry but afterwards the reverb level would come back up. All of these effects largely disappeared when the signals to the speakers were added to make mono which removes the ear's ability to discriminate spatially. The effects are not subtle and do not require golden ears. I have successfully demonstrated these effects to an audience of about 60 in a conference room; hardly the ideal listening environment, but all heard it.

The ear has evolved to attribute source direction from the time of arrival difference at the two ears of the first version of a transient. This phenomenon is known as the precedence effect

I have concluded that whilst compression may be adequate to deliver postproduced audio to a consumer with mediocre loudspeakers, these results underline that it has no place in a quality production environment. When assessing codecs, loudspeakers having poor diffraction design will conceal artefacts. When mixing for a compressed delivery system, it will be necessary to include the codec in the monitor feeds so that the results can be compensated. Where high quality stereo is required, either full bit rate PCM or lossless (packing) techniques must be used.

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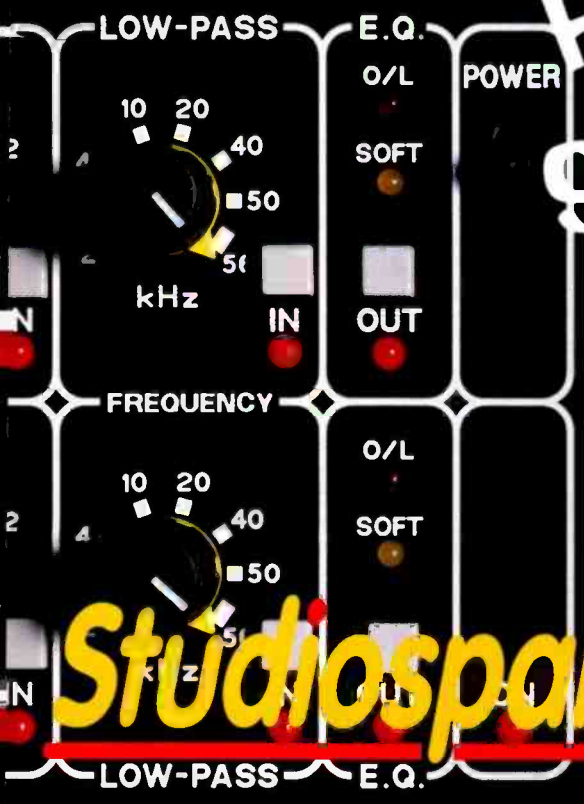

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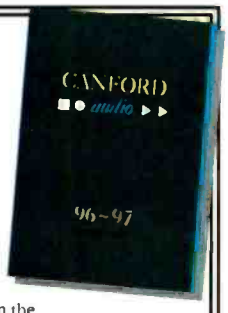

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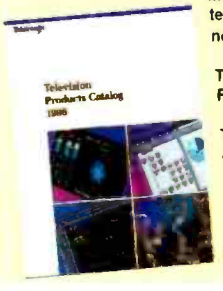

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Advertiser's Index

A+F MAKAY AUDIO 96
AKAI 13
ALLEN AND HEATH 85
AMEK 75
AMPSPEAKER 90
AMS NEVE . . . . . IFC
APHEX . . . . . OBC
APT 106
AUDIO LTD 69
AUDIO PRECISION 37
AUDIX/SCV 19
BAG END 20,21
BEHRINGER 95
BEYERDYNAMIC 59
BSS AUDIO 109
CALREC 87
DANIEL WEISS 74
DANISH PRO AUDIO 64
DBX 65
DENON 36
DENON . . . . . Bound Insert—98–99
DIGIDESIGN 57
DIGIGRAM 103
DYNAUDIO ACOUSTICS 94
ELECTRO-VOICE 39
EUPHONIX 79
F.A.R 78
FAIRLIGHT 52
FOCUSRITE 24, 41, 43
GENELEC 49
GHIELMETTI 74
HARRISON BY GLW 51
HHB 27, 111
H.W. INTERNATIONAL . . . . Bound Insert—50–51
JBL 22
JOEMEEK 29
JUNGER AUDIO 43
LA AUDIO 33
LYDCRAFT 112
MACKIE . . . . . IBC
MEDIA CONNECT 84
MEYER SOUND 34
MICROTEN GEFELL 110
MILAB MICS 99
MJQ 86
NEATO 43
NEDTEK 98
NEUTRIK 68
ORAM 104
PENNY & GILES 47
PRISM SOUND 120
PROJECT AUDIO Bound Insert—50–51
PROTAPE . . . . . Bound Insert—98–99
PUK STUDIOS 73
QUESTED 108
RICHMOND FILM SERVICES 78
RSP TECHNOLOGIES 91
SCHOEPS 54
SCV . . . . . Bound Insert—34–35
SEEM AUDIO 92
SENNHEISER 25
SONIC SOLUTIONS 63
SONY 6, 7
SOUNDCRAFT 71
SOUND FIELD 100
SOUNDSCAPE 55
SOUNDTRACS 10
SPENDOR . . . . . Bound Insert—34–35
SSL 4
STAGETEC 72
STUDER INTERNATIONAL 30
STUDIOSPARES 113
SUMMIT AUDIO 80
TANNOY 88
TAPEMATIC 81
TASCAM 101
TC ELECTRONIC 15
THAT CORP 45
TL AUDIO 41
WHIRLWIND 122

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March 1997

◆ **March 5th–6th**
2nd Sound Broadcasting Equipment Show (SBES)
Jurys Hotel & Towers, Ballsbridge, Dublin.
Tel:+44 1491 838575
Email: dmcv@pointproms.co.uk.

◆ **March 12th–14th**
Television and Postproduction Show
Business Design Centre, Islington, London.

◆ **March 13th–15th**
REPLItech Europe
Barcelona, Spain.
Tel: +44 171 287 2087.

◆ **March 22nd–25th**
102nd AES Convention
MOC Centre, Munich Germany.
Tel: +49 8142 14167.
Fax: +49 89 32399 351.
Email: 102nd-chairman @aes.org
Web: http://www.aes.org

◆ **March 23rd–26th**
SIB 97
Rimini Trade Fair, Italy.
Tel: +39 51 264003.
Fax: +39 51 238755.
Email: nets@nets.it

April 1997

◆ **April 2nd–3rd**
ABTT
London,UK.

◆ **April 5th–10th**
NAB 97 and Multimedia World
Las Vegas Convention Centre and Sands Expo Centre, Las Vegas Nevada, US.
Tel: +1 202 775 4970.
Fax: +1 202 429 5343.
Web: www.nab.org/conventions

◆ **April 15th–16th**
Intranet
Olympia 2, London, UK.
Tel: +44 181 742 2828.
Fax: +44 181 742 3182.
Web: http://www.intranet-expo.com

◆ **April 16th–20th**
NSCA
Charlotte, US.

◆ **April 21st–23rd**
Cable & Satellite 1997
Earls Court 2, London, UK.
Tel: +44 181 910 7884. Email: catherine.barrett@reedex.co.uk.
Web: http://www.cabsat.co.uk/

◆ **April 23rd–25th**
Entech 97
Melbourne Exhibition Centre, Australia.
Tel: +61 2 876 3530.
Fax: +61 2 9876 5715.
Email: Julius@conpub.com.au

◆ **April 23rd–28th**
The International Electronic Cinema Festival 97
Montreux, Switzerland.
Tel: +41 21 963 32 20.
Fax: +41 21 963 88 51.
Email: crawford@symposia.ch
Web:http://www.montreux.ch/symposia

◆ **April 28th–29th**
'The Measure of Audio' AES UK Conference
18.30hrs in the Conference Room, Baden-Powell House, Queen's Gate, London SW7, UK.
Tel: +44 1628 663725.
Fax: +44 1628 667002.
Email: AESUK@aol.com

May 1997

◆ **May**
Expo Comm Wireless Korea 97
Korea Exhibition Centre, Seoul, Korea. Tel: +82 2 555 7153.
Fax: +82 2 556 9474.

◆ **May 2nd–4th**
Internet Live
Brompton Hall Earls Court, London, UK.
Tel: +44 181 568 8374.
Fax: +44 181 232 8288.

◆ **May 2nd–4th**
Internet World International
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Web: http://www.iwuk.com

◆ **May 15th–17th**
Pro Audio Light and Music China 97
Beijing Exhibition Centre, Beijing, China.
Tel: +852 2861 3331.

◆ **May 21st–23rd**
MIDEM ASIA 97
Hong Kong.
Jane Garton, Press Manager.
Paris.Tel: +33 01 41 90 44 39.
Email: jane_garton@midem-paris.ccmail.compuserve.com

◆ **May 23rd–25th**
Music Instruments Asia 97 and Dance Tech 97
Singapore.
Tel:+65 337 5574.
Fax: +65 336 06239.
Email: create@pacific.net.sg

June 1997

◆ **June 3rd–5th**
REPLItech International
San Jose,California, US.
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Fax: +1 609 279 1999.

◆ **June 3rd–5th**
ShowTech 97
Berlin, Germany.
Tel: +44 171 486 1951.
Fax: +44 171 487 3480.
Email: otsa@montnet.com

◆ **June 4th–7th**
4th Annual Latin-American Pro Audio & Music Expo Mexico 97
World Trade Centre, Mexico City.
Email: chris@ssiexpos.com
Web: http://www.ssiexpos.com

◆ **June 7th–10th**
Nightwave 97
Rimini Exhibition Centre, Italy.
Tel: +39 541 711249.
Fax: +39 541 786686.

◆ **June 24th–27th**
Exposhow & Pro-Audio 97
LENEXPO Exhibition Complex, St Petersburg, Russia.
Irina Neduma:
Tel: +7 812 325 6245.
Fax: +7 812 325 6245.

◆ **June 25th–27th**
AES 8th Regional Convention 97
Sunshine City Convention Centre, Ikebukuro, Tokyo, Japan.
Tel: +81 45 939 7009.
Fax: +81 45 939 7091.
Web: http://www. aes.org

◆ **June 25th–28th**
4th Exposhow 97 and 4th Pro Audiovideo 97
LENEXPO complex, 103 Bolshoy pr.,V.O., St Petersburg, Russia.
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July 1997

◆ **July 1st–4th**
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◆ **July 14th–16th**
9th PALA 97
World Trade Centre, Singapore.
Tel: +65 227 0688.
Fax: +65227 0913.

September 1997

◆ **September 7th–10th**
PLASA
Earls Court, London, UK

◆ **September 8th–11th**
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Miami Beach, Florida.
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◆ **September 12th–16th**
IBC 97, Amsterdam.
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Fax: +44 171 240 3724.
Email: show@ibc.org.uk
Web: http://www.ibc.org.uk/ibc/

◆ **September 26th–29th**
AES 103rd Convention
Jacob K Javits Convention Centre, New York, US.
Tel: +1 212 661 2355.
Fax: +1 212 682 0477.
Web: http://www.aes.org

October 1997

◆ **October 2nd–5th**
18th Nordic Sound Symposium
Bolkesjø, Norway.
Contact: Seem Audio;
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Fax: +47 66 84 55 40.
Email: soundsymp@nrk.no
Web: http://www.nrk.no/soundsymp/

◆ **October 16th–20th**
International Audio, Video, Broadcasting and Telecommunications Show (IBTS 97)
Milan Fair, Porta Metropolitana Pavilions, Milan, Italy.
Tel: +39 2 481 5541.
Fax: +39 2 49 80330.
Email: MC1703@MClink.IT

◆ **October 20th–22nd**
Asia Cable, Satellite & Broadcast 97 (ACSB 97)
Putra World Trade Centre, Kuala Lumpur, Malaysia.
Tel: +6 03 264 5663.
Fax: +6 03 264 5660.
Email: acsb@mfsb.po.my

◆ **October 29th–30th**
22nd Sound Broadcasting Equipment Show (SBES)
Hall 7, National Exhibition Centre, Birmingham, UK.
Tel: +44 1491 838575.
Fax: +44 1491 832575.
Email: dmcv@pointproms.co.uk

November 1997

◆ **November 4th–6th**
Vision & Audio 97
Earls Court 2, London, UK.
Tel: +44 118 975 6218.
Fax: +44 118 975 6216.
Email: info@aprs.co.uk
Web: http://www.aprs.co.uk

◆ **November 18th–20th**
Digital Media World 97
Earls Court 2, London, UK.
Tel: +44 181 995 3632.
Fax: +44 181 995 3633.
Email: digimedia@atlas.co.uk
Web: http://www.digmedia.co.uk

May 1998

104th AES Convention
RAI Conference Centre, Amsterdam, The Netherlands.
Tel/Fax: +31 35 541 1892.
Email: 104th_chairman @aes.org.
Web: www.aes.org

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Not good enough

The old days of audio for audio's sake have passed, giving way to an audio industry driven by the considerations of big business. **PHILIP NEWELL** laments the decline of our standards

IN LAST NOVEMBER'S Open Mic column, Martin Polon spoke strongly about the way in which the music business has settled for eroded standards over profit. 'It is time to stop this, and make audio quality our byword,' he states. I couldn't agree more, but it will be an uphill struggle. Not only have economic recessions forced cutbacks, but also made possible recording facilities which, even 15 years ago, would have been undreamt of. On the other hand, such facilities lack essential capabilities. In reality, once standards are relaxed, it can be very difficult indeed to re-establish them. What's more, there are whole industries which are now geared up to maintaining the status quo, and a sort of Mafia of Mediocrity is taking hold.

The power of manufacturers is enormous, and it grows from day to day. The bulk of recording equipment is now made by multi-national conglomerates, and like most large companies, they exist for one reason—profit. Investors invest to make money, and companies are there primarily to serve shareholders, not customers. If writing the word 'professional' on equipment means it will sell more units, then manufacturers will use it, whether the equipment is 'professional' or not. I know of numerous companies who have ostensibly sold 'professional' equipment, without providing anything like the customer support that professional users would require.

Record companies also pursue profit, and most of them will work to the minimum standard (as dictated by cost) of recording that will yield the best profit. If something is too badly produced, it won't sell, but doubling the recording cost may only add 1% to the sales. This is seen as bad business, and the shareholders will not like it. Of course, I'm not talking about the Telarcs or Deccas of this world, who sell quality, or the Peter Gabriels and Pink Floyds, who work to their artistic limits, but they are the tip of a huge international industry. In many countries, the fast cars and large houses of the company executives come before the recorded quality of the music. It is business, pure and simple.

With the rise of project studios has come a huge increase in the power of advertising. I remember discussing this subject with the chairman of a well-known company making quite expensive mixing consoles. He told me that he did not remember a single sale coming direct from an advertisement. 'I advertise on behalf of my customers' he said. 'However, if we don't advertise, hardly anybody will buy our consoles, because their clients will not be likely to book a studio with a desk that they have not seen in the magazines'. Much of this is driven by an industry that is expanding faster than it can properly train staff, and so much happens as the result of hearsay, rather than experience.

Small manufacturers of audio products have a battle on their hands, trying to survive in a publicity dominated world. The sad thing is that the small, specialist manufacturers were at the heart of the quality development.

Another problem is the music-recording press. Magazines like Studio Sound are now all to rare, where open, uncensored, experienced debate can be undertaken. Many magazines aim at the mass-market sales, never publishing a derogatory equipment review, and only publishing articles of lengths suitable for people with minimum attention spans. Furthermore, in some countries not in the 'First Division' of the recording world, I know of magazines where they do not pay for articles, but will only publish an article if the writer, or writer's company, buys advertising space in the same, or a subsequent, issue. Dealers finance articles about the products which they sell. I'm not referring to small, Third World countries here, but large, European countries, including ones inside the EU.

In the world of blind people, the saying goes, the one-eyed person is king. Many dealers are seen, by their association with the big names which they sell, to be 'knowledgeable'. A two-eyed person, will be prevented from writing in the magazines, by threats of withdrawn advertising, if they try to give new eyes to the blind. There are dealer Mafias in existence which hold great sway over the press, and hold back the development of whole national recording industries. Just imagine that you cannot read this article, because you speak only Spanish, or perhaps Italian, which is in less international use. Where do you get your latest information from? There is little 'quality' Spanish language recording press, and some magazines which have Spanish versions, are not translations of the original language issues. The content can be very inferior.

All round the world, there are dedicated and experienced people, such as Martin Polon, who care about what is happening. There also exists an elite, international recording industry, which is perhaps the 'university' of recording. As Dan Daley said in his October 1996 column, though, there is little growth at the top, and the business is where the growth is. Unfortunately, however, this expanding section is the one most vulnerable to the power of advertising, rather than reason, and in this world, which sees the 'super studios' as being in another dimension, I fear that the worst of Martin Polon's worries have already become a reality—good enough is okay. It is peer standards, not absolute standards, which determine what is good enough for the bulk of the recording industry, and there are whole industries trying to keep it that way.

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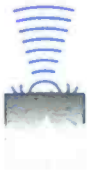
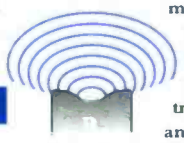


Like biamped speakers, wave guides aren't a new concept. But it takes optimized internal electronics and a systems approach to make them work in near-field applications.

The HR824's wave guide (Fig. B) maximizes dispersion, time aligns the acoustic center of the HF transducer to the LF transducer's center, and avoids enclosure diffraction (notice that the monitor's face is perfectly smooth.) The exponential guide also increases low treble sensitivity, enabling the HF transducer to handle more power and produce flat response at high SPLs.



(HR824)

CLEAN, ARTICULATED BASS.

Seasoned recording engineers can't believe the HR824's controlled low bass extension. They hear low frequency accuracy that simply can't be achieved with passive speakers using external amplifiers. Why?

First, the HR824's FR Series 150-watt bass amplifier is directly coupled in a servo loop to the 8.75-inch mineral-filled polypropylene low frequency transducer.

It constantly monitors the LF unit's motional parameters and applies appropriate control and damping. An oversized magnet structure and extra-long voice coil lets the woofer achieve over 16 mm of cone excursion. Bass notes start and stop instantly, without "tubbiness."

Second, the HR824's low frequency driver is coupled to a pair of aluminum mass-loaded, acoustic-insulated 6.5-inch passive drivers. These ultra-rigid drivers eliminate problems like vent noise, power compression, and low frequency distortion — and couple much more effectively with the control room's air mass. They achieve the equivalent radiating area of a 12-inch woofer cone, allowing the HR824 to deliver FLAT response to 42Hz with a 38Hz, 3dB-down point.

Third, the woofer enclosure is air-displaced with high-density adiabatic foam. It damps internal midrange reflections so they can't bleed back through the LF transducer cone and reach your ears. The typical problem of small-monitor midrange "boxiness" is eliminated.

A TRUE PISTONIC HIGH-FREQUENCY RADIATOR.

We scoured the earth for the finest high frequency transducers and then subjected them to rigorous evaluation. One test, *scanning laser vibrometry*, gives a true picture of surface vibration patterns. Two test results are shown in the upper right hand corner of this ad. Figure C is a conventional fabric dome tweeter in motion. You needn't be an acoustic engineer to see that the dome is NOT behaving as a true piston.

The Mackie HR824 Active Monitor. ±1.5dB from 42 to 20kHz.

Figure D shows our High Resolution metal alloy dome at the same frequency. It acts as a rigid piston up to 22kHz, delivering pristine, uncolored treble output that reproduces *exactly* what you're recording.

INDIVIDUALLY OPTIMIZED.

We precisely match each transducer's actual output via electronic adjustments. During final assembly, each HR824 is carefully *hand-trimmed* to ±1.5dB, 42Hz-20kHz. As proof, each monitor comes certified with its own serialized, guaranteed frequency response printout.

The HR824's front board has "radiused" edges to further eliminate diffraction; an "H" brace bisects the enclosure for extra rigidity.

Fig. C: Uneven fabric dome tweeter motion distorts high frequencies.

Fig. D: HR824 alloy dome's uniform, accurate pistonic motion.

Mackie is one of the few active monitor manufacturers that also has experience building stand-alone professional power amps. Our HR824 employs two smaller versions of our FR Series M·1200 power amplifier — 100 watts (with 150W bursts) for high frequencies, and 150 watts (200W peak output) for low frequencies. Both amps make use of high-speed, latch-proof Fast Recovery design using extremely low negative feedback.

TAILOR THEM TO YOUR SPACE.

Because control rooms come in all shapes, sizes and cubic volumes, each HR824 has a three-position Low Frequency Acoustic Space control. It maintains flat bass response whether you place your monitors away from walls *(whole space)*, against the wall *(half space)* or in corners *(quarter space)*. A low frequency Roll-Off switch at 80Hz lets you emulate small home stereo speakers or popular small studio monitors.

CONFRONT REALITY AT YOUR MACKIE DESIGNS DEALER.

We've made some pretty audacious claims in this ad. But hearing is believing. So bring your favorite demo material and put our High Resolution Series monitors through their paces.

If you've never experienced active monitors before, you're going to love the unflinching accuracy of Mackie Designs' HR824s.

If you've priced other 2-way active monitors, you're going to love the HR824's price AND its accuracy.

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