AES Preview
Equipment for Amsterdam

AUDIO RECORDING
Deutsche Grammophon 4D System; Sony DATStation; HHB Portadat

Digital Video Formats
Audio and Video: Convergent Technologies
"G Plus Sounds Excellent By Any Standards"

Allen Sides, Ocean Way

The world’s largest music console – a 100-channel SL 8000 G Plus – is installed at Ocean Way’s 'Record One' facility in Sherman Oaks, California.

"Record One and Ocean Way share a common ethic – to provide the best possible equipment, classic and modern, to meet the needs of both artist and producer. I have always respected the ergonomics and automation of SSL desks. The addition of Ultimation™, bypassing the fader VCAs, and new audio enhancements mean that G Plus sounds excellent by any standards."

Allen Sides, Owner
Ocean Way, Los Angeles

Solid State Logic

International Headquarters: Begbroke, Oxford, England, OX5 1RU. Tel: (0865) 842300
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www.americanradiohistory.com
Editorial
Where do common sense, business sense and freedom of choice meet—and are they irreconcilable considerations in the music business?

Music News
Effects processing with a keen edge is the strength of DigiTech's DHP55—Zenon Schoeppe's exhausted imagination bears witness

Sony DATStation
A portable DAT editing facility is now a reality courtesy of this unit from Sony. Patrick Stapley adds a DATStation to his mobile phone and laptop

DG 4D Overview
Deutsche Grammophon's 4D Audio Recording System revealed. Francis Rumsey visits Hannover to establish the technical facts behind the ad campaign

HHB Portadat
Many location recordists are still unhappy with the options offered by portable DAT machines. Dave Foister takes a close look at HHB's bid to satisfy them

AES Preview
As the memory of last year's New York AES Show begins to fade, Amsterdam beckons us to the first AES of 1994. Simon Craft offers a preview of what may be on show

Pacific Ocean Post
All-digital audio postproduction has rarely had a better setting than shore of the Pacific Ocean—or more up-to-date facilities, as James Douglas reports from Santa Monica

Letters
Maxell initiate further discussion of DAT ageing following the revealing DAT tape tests conducted by Studio Sound last year

On Air
Kevin Hilton brings a new regular broadcast column to the pages of Studio Sound: first off, ILRs, NTL's budget blitz and Soundcraft's latest

Perspective
US columnist Martin Polon asks telling questions about the aims of pro-audio facilities and offers some useful observations

Digital VTRs
Continuing his occasional series of investigations into the technologies making their presence felt in pro audio, Francis Rumsey tunes in on digital video tape formats

Index of 1993
A concise reference to the features, reviews and studio profiles appearing in Studio Sound during 1993

Business
Barry Fox discusses CRL's Sensauro; and reveals a potentially devastating rights problem for data distribution networks
Have you ever thought about professional digital audio editing? Too slow? Too expensive? Difficult to understand? SADIE™ Disk Editors have changed all that. For a start SADIE™ runs on a PC, so you get much more computer for far less money. It has a fully functional Windows 3.1* user interface, non-destructive sample accurate editing, real time cross fades and up to 8 track playback with real time digital mixing, bounce down, overdub, EQ and dynamics control. And real time saving.

SADIE™ Disk Editors have sold worldwide into broadcast, post-production, studies and mastering organisations, so its already been well and truly put to the test out in the field. SADIE™ Version 2 incorporates many of our customers suggestions. Talk to them about our commitment and service, if you don't know a SADIE™ user in your area, we can easily put you in touch.

If it sounds unreal - why not pause for a couple of minutes today and phone or fax for some more information.

Windows 3.1* on 486 host computer
Rapid graphical editing
Clear user interface
Local SCSI drive fast audio access
All crossfades calculated in real-time
Fully non-destructive, sample accurate editing
Up to 8 track playback with real-time mixing
Unique Trim Window allowing real-time adjustment of audio
log and shuttle scrub modes
AES/EBU, SPDIF and analog I/O
All standard sample rates
Full SMPTE timecode support with close and trigger lock
16, 20 and 24 bit digital audio editing
Bounce down
Overdub
Reverse playback
Real-time dynamics control
Real-time EQ
Real-time digital resampling
Real-time duration change
Real-time noise reduction

BRITISH INNOVATION
MANUFACTURED IN THE EUROPEAN COMMUNITY BY STUDIO AUDIO & VIDEO LTD
Playing the game

What price freedom of choice? What cost economies of scale?

It is a constant anathema to me that an industry (music) which trades on its vitality (musical and technological) is actually very, very conservative. Traditionally, the popular music of the day—jazz, rock 'n roll, protest, punk, rap and so on—has provided one of the channels of youth rebellion. Yet the industry charged with the responsibility of disseminating the music has increasingly been dominated by those against whom the rebellion is directed.

Let us be clear about this: music was not created to serve the music or recording industries, our industries have evolved to serve the practical needs of music. I concede that it is unrealistic to expect a business to selflessly reflect such volatile and unpredictable forces as those behind popular music, but to oppose them is likely to prove a destructive policy.

The complications all seem to arise when business takes an interest in art. While the pro-audio industry has it within its means to influence (and consequently damage) the work of the artist, larger business interests have acquired similar power over both music and pro audio.

In the formative days of music recording, it was the ingenuity of a handful of inspired people which shaped the traditions you and I inherited. There was no prospect of big business politics then, only the desire to create the technology demanded by musical progress. In music itself, the same forces were at work: the names of Les Paul and Robert Moog sit in tandem with those of Alan Blumlein and Rupert Neve. As the music business grew in profile, however, their success made such innovators logical targets for business forces.

Today Robert Moog's company, along with its instruments, are part of music's history. And while Rupert Neve continues to make a valuable contribution to console design, the company that bears his name is owned by a massive Austrian conglomerate. The work of these pioneers has either been displaced by big business or assimilated into it. There are many other examples (some probably better) but Moog and Neve serve us well.

Big business has plenty to offer a small industry—especially in times of economic hardship. But one of the consequences of monopoly, or even near-monopoly, of design, manufacture or supply, is the loss of freedom of choice. Quite apart from the loss of individual alternatives, standardisation is one of necessary evils of large companies; the creative individuals (including those involved in audio recording) suffer in the interests of economies of scale and other business 'systems'. While we desperately seek it in certain areas of our activity, standardisation has its disadvantages too...

Yet it is hard to justify having freedom of choice when we so often make little of it. Take the example of analogue recording tape: why, when there are new formulations of tape being devised to reflect the performance of digital recording systems and media, are so many recordings made on tape largely designed 20 years ago? Why should a large company, making business decisions, continue to make considerable R&D investment to offer us alternatives if we fail to take them up?

If we are to make the best of an environment controlled by businesses (and women), we need to learn a few of their rules. For without them we may see our right to choose take its place in history with Moog Music, the Spruce Goose and the wall drawings concealed in nautical caves of Lascaux.

Tim Goodyer

Cover: Studer D827 digital multitrack recorder
NEW! THE DIGIDESIGN TDM BUS™
The Digidesign Trans-system Digital Matrix Bus™ is the best thing to happen to digital recording since digital. So what is it? For starters, the TDM Bus is an open, 256-channel, 24-bit data highway for your studio — giving you the ability to route, automate, and process everything you do with full digital control. How “open” is it? At Digidesign, we believe a workstation should increase your creative options, not restrict them. So a variety of Development Partners — from established leaders like Lexicon, and savvy upstarts like Waves — are building hardware and software for the TDM Bus. And there’s not open enough for this.

You can even route and automate your beloved analog tube compressor within this digital environment.

• For the complete story, call us at one of our numbers below.

BOB CLEARMOUNTAIN

The mix, I’m telling you — a lot of them. Some are too long for a medium called ‘radio’ to play (and still have time for all those wonderful commercials). Others are simply too long. So when it comes to the ultimate editing medium, I turn to Pro Tools. And with 2.0’s multitude of new remarkable icons and features, the end product is creatively enhanced — better and faster than any other means I know of, or even can imagine."


WHY THOUSANDS OF AUDIO PROFESSIONALS WHO

In an industry overflowing with creative individuals, it takes exceptional talent to rise to the top. And in an industry loaded with workstations, it takes an exceptional product to rise above the competition.

Perhaps then, it’s no surprise that again and again, the industry’s top professionals select one digital workstation above all others as their system of choice. The system is Pro Tools, and the reasons are simple. Pro Tools delivers uncompromising power and performance for audio post, broadcast, or music production — with an uncompromising vision carried to the future. But there’s more to this story.

More Than Just Power. We can’t even begin to scratch the surface of everything Pro Tools can do for you within the confines of this ad. But frankly, what good is power if it’s cumbersome to use?

At Digidesign, we believe that the most advanced tools are often the ones that make a giant leap towards greater simplicity. Our advanced user interface proves this point rather elegantly, for speed and sheer productivity, nothing else even comes close.
PostView: More Than A Pretty Picture

Welcome to the future of audio post-production. Digidesign's new PostView option for Pro Tools offers full-frame, fully-synchronized random-access video to serve as a simple and fast tool for spotting sound to picture. You can even scrub your audio in real time and accurately sync with the PostView Movie on the same monitor screen as your Pro Tools session. Or, if you like, on two separate screens. PostView also includes VTR Control, an easy and effective transport control system for external video and audio transports which allows Pro Tools to serve as the control master. PostView: Think of it as picture-perfect audio-for-picture.

More Than Just Talk. Today. You'll be glad you're part of the Digidesign family, as Bob and Harry did, that when it comes to professional digital audio post-production tools, there's no substitute for Pro Tools.


NEED THE RIGHT TOOLS TURN TO PRO TOOLS

gentlemen pictured above — just two of the many acclaimed professionals who swear by their Pro Tools systems. And if you're still unsure, do the smart thing. Check out any other competing system, at any price. Check the user interface for speed, ease, and flexibility. Check the sound for pure sonic performance. Check how the system is for experiments today and tomorrow.

Then check out Pro Tools. We're confident that you'll find, just as Bob and Harry did, that when it comes to professional digital audio production tools, there's no substitute for Pro Tools.
Weiss takes over from Harmonia Mundi

From the 1st January 1994 the Harmonia Mundi Acustica BW102 system as well as the Penguin and the IBIS will be distributed and serviced by the designer of the system, Daniel Weiss Engineering.

Harmonia Mundi Acustica is no longer responsible for any issues regarding the BW102, Penguin or IBIS. The system names will change to Weiss 102 Series, Weiss Penguin Series and Weiss IBIS Series.

The reasons that led to the split are quoted as being to optimise business for lower overall costs; improvement of customer support in general and shortening of delivery times.

All enquiries should be directed to: Daniel Weiss Engineering Ltd, Florasstrasse 10, 8610 Uster, Switzerland. Tel: +41 1 940 20 06. Fax: +41 1 940 22 14.

Baccus to us

Our review of the Francenstein stereo enhancement system from Baccus professional in last month's issue has generated some very worthwhile enquiries. More worthwhile than normal perhaps as we printed the wrong telephone number by mistake. The correct one is 0234 840408.

Lucasfilm announces OMF support

Lucasfilm Ltd and Lucas Digital Ltd have announced that they have become official sponsors of the Open Media Framework (OMF) Interchange. On becoming sponsors, the Lucas companies, which include Industrial Light & Magic and Skywalker Sound, are solidifying their previously announced plans to develop all-digital postproduction environments within their facilities.

‘Based on the Lucas companies’ years of experience in the film, entertainment, visual effects and audio postproduction industries, we are well aware that one of the single biggest barriers to creating a seamless postproduction environment for artistic freedom lies in the current level of difficulty users encounter when trying to exchange digital media between proprietary applications and computer systems,' stated George Lucas. ‘OMF provides the solution to this problem.’

Industrial Light & Magic, Skywalker Sound and LucasFilm Ltd, have identified projects in each facility where the implementation of OMF-compliant products will be tested. Following these tests, Lucas companies will begin actively encouraging vendors of additional products used in the facilities to integrate OMF support.

Lucasfilm Ltd.
Tel: +1 508 640 9158
Harman and AKG merge distribution

In order to strengthen the distribution of AKG, Harman have announced that they will be transferring several AKG group brands to their Borehamwood offices. As from 1st January 1994, the distribution of AKG microphones and headphones, dbx signal processors and Orban broadcast products will be distributed directly by Harman from Borehamwood.

The announcement now confirms Harman Audio as the UK’s largest professional audio distributor, with a portfolio encompassing JBL, AKG, dbx, Orban, Allen & Heath, Urei, C-Audio, Steinberg, ART and Rivera. There will be no change to the existing distribution of EdgeTech Group products, which include Turbosound sound reinforcement, Quested monitoring and BSS signal processing products.

Harman Audio, Unit 2, Borehamwood Industrial Park, Rowley Lane, Borehamwood, Herts. WD6 5PZ. Tel: 081 207 5050. Fax: 081 207 4872

Sinatra duets with dummy head

CRL's new Sensaura microphone system mirrors the human hearing process, uses DSP to encode the signal from a dummy-head 'binaural' microphone arrangement and enabling it to be replayed on normal stereo speakers. (See right.) The resultant recording presents a 3-D sound image.

The system has already been used on Frank Sinatra's Duets album and on Milla Jovovich's forthcoming album and in many experimental classical recordings at Abbey Road and Symphony Hall, Birmingham.

CRL's engineers have been making Sensaura recordings using Yamaha AD/8X A-D converters, to supply a 19-bit digital signal to the Sensaura multichannel signal processor, and the Yamaha DRUS 8-track 20-bit digital recorder.

Yamaha-Kemble UK Ltd. Tel: 0908 249194.

The aftermath of the fire at Studio Tivoli in Slovenia. The studio was an ancient (their own words) Soundcraft model. Master tapes from two recent productions were in the studio. A backup copy of one was stored in a metal box and was playable!

Help wanted! Disaster in Slovenia

Among the horrors of the war in former Yugoslavia comes a story of disaster and possible financial ruin for an owner of a recording studio. Tivoli Recording Studio started in 1979 in Ljubljana, the capital of Slovenia. Late last year it was burnt beyond recognition not by any act of war but by a fire starting in the cabinet housing main monitors, video monitor and power amplifiers. The really bad news is that Aco Razbornik, the owner, had no insurance. He had not renewed his policy after the Croatian insurance company he was with had some organisational problems.

The studio is now asking for help in any form to put the studio back into shape. Aco Razbornik will be at the AES in Amsterdam drumming up support or he can be contacted at: Studio Tivoli, 61117 Ljubljana, Dolomitska 9, Slovenia. Tel-Fax: +38 61 574 850.

Nimbus apply video squeeze

Nimbus Information Systems are the first CD-ROM replication house able to offer a MPEG-1 compression service in house allowing the transfer of up to 75 minutes of full motion, full screen video on to disc. Emil Dudek, director of CD-ROM at Nimbus commented: ‘Nimbus has invested in the compressing facility because we strongly believe that video on disc will have a firm foothold in the market.’

Multimedia developers can now include video on PC, Amiga CDII or CD-I platforms.

NIS receives video material on D1 digital tape for treatment. The video can be formatted for CD-K, or CD-I or CD-ROM. It is returned on CD-R with audio multiplexed or separated, for further work to be carried out by developers.

Nimbus Information Systems. Tel: 0633 867777.

Contracts

- Euphonix UK—first sale of 1994

Phil Manzanera, Producer, Guitarist and Songwriter with Roxy Music is taking delivery of his new Euphonix CSII-CS2000 console for his new mixing facility within his Gallery Studio complex in Surrey, UK

- Mobile check out with a Sequel

ASIP’s Mobile based in Graz, Austria have recently fitted out their Mercedes truck with a Soundtracs Sequel, supplied by the company’s Austrian distributor, Audiosales.

- MF’s for London’s Battery

A large order of B & K 4006s, 4011s and 4011f have been ordered by Studio 4’s new 24-track recording studio. Also a package of 6 4006s and 12 4011 mics have gone to two studios in Russia.

- More DESAM 80s to Hollywood

Graham-Patton Systems have now supplied a total of 10 DESAM Series digital edit suite audio mixers to Hollywood Digital.

- Videolondon’s Synclavier feast

Over the last 15 months, Videolondon soundstudios have bought their fourth, fifth, and now sixth PostPro workstations to keep up with the new business they have gained.

- dCS and the Masters

Masterdisk, New York, have taken delivery of a dCS 9006 Reference A-D converter. Bob Ludwig’s Gateway Mastering have taken delivery of two dCS 980 SDIF-2 distribution boxes and a dCS 988 AES/EBU distribution box.

- Radio Stations for UK and US

Recent sales of the in-ear monitoring system from Garwood Communications include Michael Bolton with 4 systems; Lenny Kravitz, Luther Vandross; Deborah Harry; Tears for Fears; Depeche Mode; UB40 and DuranDuran.

- A Saphyrre for a church

The Metropolitan Church in Belfast has confirmed an order for a 52-channel Soundcraft Saphyrre console from Walker Audio.

- Focusrite sign up for BearTracks

Focusrite have announced the signing of a contract to supply a 72-input, Studio console to BearTracks, located in the country 30 minutes from Manhattan. The console will be the first in the US with Flying Faders automation.

- Iron Man opens with Autograph

Pete Townsend’s new rock opera The Iron Man has opened in London with a sound system by Autograph Sound Recording featuring Meyer loudspeakers and a CADAC desk.
Now You Can Add Digital Video To ScreenSound

ScreenSound V5 combines a new faster processor with major operational advances, like internal reconform of your audio to EDLs. You can even add random-access video with SSL's VisionTrack.

Together, the new, faster ScreenSound and VisionTrack provide instant access to audio and picture at any cue or mark point. With spool time and machine lock-up problems eliminated, you can dramatically speed up your editing, voiceover and ADR sessions.

VisionTrack even comes with its own machine control port and audio recorder, allowing you to load both sound and picture off-line, saving valuable ScreenSound time.

Digital video - just what you'd expect from the world's leader in digital audio.

ScreenSound V5 & VisionTrack
- New generation, faster processor
- 8/16 channel random-access recorder/editor
- Unlimited Unpeel/Remake of audio edits
- Random-access 525/625 video (dual standard)
- Instant Locate of audio and picture
- Insert/delete editing of audio and video
- Off-line loading of sound and picture
- EDL autoconform and reconform of audio
- ADR cueing and cycling with picture
- MO working discs/sound library
- Multiple machine control
- Multi-user networking capability
- Compatible with Scenaria and OmniMix

Solid State Logic, Begbroke, Oxford, OX5 1RU, England Tel: (0865) 842300
Paris (1) 34 60 46 66 • Milan (2) 262 24956 • Darmstadt (6151) 93 86 40 • Tokyo (3) 54 74 11 44
New York (212) 315 1111 • Los Angeles (213) 463 4444 In USA call Toll Free 800-343 0101

 QUEENS AWARD FOR TECHNOLOGICAL ACHIEVEMENT

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More space for Wembley

Wembley Loudspeakers have announced the release of a sound processing system known as 3D Storm. The full system comprises two products, both of which can operate as independent systems.

The first of these is the BASE processor which enhances the ambient acoustics present at the time of recording and has been on the market now for a number of years. The second part of the system has been developed by a company called Sound Dynamics who aim to provide a solution for all spatial sound scenarios. 3D Storm is a package of hardware and software that provides real-time control over the position and trajectory of sound in three dimensions.

As with the BASE processor when it is functioning independently, 3D Storm can be installed at almost any point in the audio chain, making it equally suitable for both live and studio-based operations.

The package is comprised of an Atari ST computer, the 3D Storm software, and a 19-inch 1U rackmounted sound processing unit which provides the interface between the computer and the audio signal. Options are available to control either the trajectory and position of a mono source or else a complete stereo image may be manipulated in real time.

The software provides the user with a window on the computer screen which represents the sound positioning area. Next to it is a list of library moves which, when selected using the mouse, are loaded into the window. A 'tape deck' facility is provided beneath the window to control the BPM (beats per minute) of the component moves within the sound pattern described, and the movement of the sound may be started, paused and stopped at any time using the tape deck symbols on screen. You can also describe your own sound patterns in the window and save them to the library.

A PC version of the software is scheduled for completion in the next six months. The UK price includes installation and two days training.

The popular SV3700 now available from HHB

HHB have secured UK distribution rights for Panasonic's SV3700 DAT machine. HHB went direct to the manufacturer to keep supplies going.

Engineered to fully professional standards, the machine features XLR analogue I/O with 1-bit A-D converters, switchable sampling rates, AES-EBU digital I/O, a shuttle wheel and infra-red remote control.

HHB Communications.
Tel: 081 960 2144

Alesis Monitor One

Alesis have started shipping their Monitor One nearfield studio monitors. The speakers feature SuperPort venting technology, which avoids the 'choking' effect of a smaller, shorter port, for solid high-power bass transients and low-frequency response.

The 1.5-6.5-inch driver is a proprietary design with a mineral-filled polypropylene cone and a 6.5-inch voice-coil wound on a high-temperature Kapton former. The 1-inch silk-dome HF driver is ferrofluid cooled and fed by a crossover network at 2500 Hz. The Monitor One features high power handling (120W continuous program, 200W peak).

Alesis Corp, 3630 Holdredge Avenue, Los Angeles, CA 90016, USA, Tel: +1 310 558 4550.
UK: Sound Technology, Letchworth Point, Letchworth, Herts. SG6 1ND, UK, Tel: 0462 480000.

JamMan from Lexicon

The JamMan digital sampler from Lexicon promises to provide an entirely new method for creating sampling effects. Extra features include echo and loop facilities.

In sampling mode, the sample record or playback can be controlled via tapping on a front panel switch, footswitch, or even by input level audio trigger. Foot pedal control of sample recording, playback and tempo allows you to 'play' JamMan like any other instrument.

In echo mode, the echo time can be easily set to match the tempo of the music played using the Tap Tempo feature, rather than having to set a delay time. The echo time can also be cut in thirds of the original time for quick, rhythmic changes while staying in time.

In the loop mode, the unit allows the creation of infinite repeat loops, with the ability to layer as much information as required on top of these loops, as well as being able to play over the top of them.

Lexicon, Inc, 100 Beaver Street, Waltham, MA 02154-8425.
Tel: +1 617 736 0300.
Fax: +1 617 891 0340.
UK: Stirling Audio, Kimberly Road, London. NW5 7SR, UK.
Tel: 071 624 6000. Fax: 071 372 6370.

In-brief

- **Soundcraft monitors show**
  Soundcraft showed their new top-end stage monitor console, the SM24, at the Live Show in London. SM24 features 8 mono plus 16 mono or stereo sends, and an additional dedicated stereo sidefill send, with logic controlled solo system.
  Soundcraft. Tel: 0707 665000

- **HHB secure SV3700 supplies**
  HHB have secured UK distribution rights for Panasonic's SV3700 DAT machine. HHB went direct to the manufacturer to keep supplies going. Engineered to fully professional standards, the machine features XLR analogue I/O with 1-bit A-D converters, switchable sampling rates, AES-EBU digital I/O, a shuttle wheel and infra-red remote control.
  HHB Communications.
  Tel: 081 960 2144

- **DDA introduce microFILE**
  DDA has introduced the microFILE VCA fader automation system designed for use with several DDA mixing consoles. The system consists of 8-channel VCA motherboards which link to an under-console-mounted proprietary computer via ribbon cables. It can be either factory-fit or field retrofitted to DDA QMR, DMR-12, and Forum Composer consoles. DDA.
  Tel: 081 570 7161

- **SoundTech power amps**
  SoundTech has introduced a new range of power amplifiers called the Power Source Series that are based on digital switching power supply technology. First out is the PS1300, a stereo amplifier capable of 650W RMS into a 4Ω load.
  SoundTech. Tel: 708 913 5511

- **Koss introduce the Quiet Zone**
  The Quiet Zone noise reduction stereophone unit from Koss incorporates active technology. It reduces low frequency noise (down to 50Hz). The processor generates artificial noise which counteracts the original sound. Koss.
  Tel: +1 414 964 5000

Lexicon bring you the JamMan
In a COLD HARD DIGITAL WORLD

 Bring warmth to your recording with the new TLA VALVE EQUALISER

- 2 channels of 4 band valve EQ
- Balanced mic & line in/out
- Phantom power (switchable)
- Insert points for compression or effects (post mic amp, pre EQ)
- 110/220 volt switchable

Four twin triode valves are used, arranged as a voltage amplifier followed by three active EQ stages per channel. Increasing the gain at the input stage allows the unique overdriven valve sound to be gradually introduced.

Suggested Retail £595 ex vat

Remember - Distribution enquiries welcome.

Classic Neve EQ also available £1195 ex vat

12 Studio Sound, January 1994

The d2d, designed specifically for glasstemastering direct from CD-R masters, without modification of the original system

d2d from StageTech

d2d, Disc-to-Disc mastering system, has been developed by StageTech for glasstemastering directly from CD-R. It requires no hardware or software modifications of the existing glasstemastering system.

The d2d simulates the VTR and the PCM 1630, which means that it monitors to the VTR remote and sends SMpte, Pq-bursts and SDIF 2.

Other features are continuous checking of the source disk's error rate, and read-after-write. The system also generates a report on laser printer that contains information about the error rate, the number of tracks, subcode information, CD format, etc.

The first generation is designed for one session CD Audio and CD-Rom. Other formats to be supported in the near future is CD-ROM XA, CD-I, PHOTO CD and multisession discs.

StageTech. Tel: +46 40 15 00 18.
Fax: +46 40 15 00 19.

An Aachen Head

Head Acoustics in Germany have launched their Artificial Head Measurement System, Aachen Head, after extensive research in conjunction with scientific institutes, universities and research companies.

The device has already been used by major car manufacturers for noise reduction inside and outside cars. Binaural acoustic testing of crankshafts, engine enclosures, diesel-driven generator sets, tyres, air conditioners and new damping materials has become essential for modern manufacturers.

By developing head-related stereophony in studio conditions, Head acoustics are capable of integrating sound sources with spatial integrity resulting in faithful loudspeaker reproduction.

The system consists of the BAS Binaural Analysis System, a 2-channel, human hearing equivalent acoustic measurement system for audio signals; the HPS II Head Measurement System, which is the artificial head, all binaural processing mechanisms as well as the effects of simultaneous, premasking and postmasking are taken to account; the HEADphone Playback System HPS III is used to reproduce signals recorded with the artificial head; BFS, Binaural Filter System, allows simultaneous filtering of the right and left channels; BHM, Binaural Head Microphone constitutes a wearable binaural Head measuring device for locations; HEAD recording system, HRS II, allows live recording with loudspeaker compatibility provided by electronic equalisation; and the Binaural mixing console, BMC, allows conversion of mono signals into human hearing adapted spatial events.

HEAD Acoustics GmbH, Kopfbezogene Aufnahme-und Wiedergabetechnik, Messentechnik, Kaiserstrasse 100, D-5120 Herzogenrath 3.
Tel: +49 2407 577 0.
Fax: +49 2407 57799.
UK: HEAD Acoustics UK Ltd, 4 St Martins Drive, Eynsford, Kent.
DA4 0EZ. Tel: 0322 863550.

For information, number and read-after-writing system, sends monitors to the PCM, the PCM reproduces the PCM and reads the PCM to be PCM. The PCM generates a PCM system, CD-ROM from the PCM, D2D from the PCM and the PCM is used to reproduce the PCM of the PCM, CD-ROM and the PCM of the PCM to CD-ROM to CD-ROM. The PCM generates a PCM system, CD-ROM from the PCM, D2D from the PCM and the PCM is used to reproduce the PCM of the PCM, CD-ROM and the PMC of the PCM to CD-ROM to CD-ROM.

12 Studio Sound, January 1994
The audio mastering revolution starts here.

Because now, Sony sets a new standard in audio mastering to take you into the next century.

MSdisc.

For the first time, there's an audio mastering system that incorporates the latest laser technology.

It means a storage medium on ready-formatted, erasable magneto-optical disc, providing random access that's virtually instantaneous.

It means a pristine recording surface, untouched by any part of the record/playback mechanism.

And it means that a single unit for recording and simple editing can be all you need. Compatibility with current and future Sony editing systems is guaranteed.

The new PCM-9000 MSdisc recorder is exceptionally compact, and because it has a modular design, you pay only for the functions you need.

What's more, it offers 80 minutes of full 20-bit digital sound quality today, with 24-bit capability already built in for tomorrow.

Put it all together and one thing's clear.

Audio mastering will never be the same again.
YOU DON'T HAVE TO TIE A KNOT IN IT...

...to remember the name of the world's best audio cable. Still, it's good to know that Mogami's unique construction not only makes it so flexible, but also makes it easier and quicker to wire a complete installation. Mogami sounds better too! So, with a wide range, from multicore to patchcords - all designed to be better – Mogami is the cable for every application.

Sennheiser introduced the K6 modular system to the replace the successful K3 system

Sennheiser change K3 range

Sennheiser UK has introduced a replacement for its K3 modular condenser microphone system, a standard for theatre and A-V applications, and used extensively with OB and ENG units.

The K6 system, like its predecessor, consists of a common power unit with a wide selection of interchangeable microphone heads.

New low noise electronics and microphone capsule designs have resulted in better quoted specifications, improved sound quality and greater operational versatility, with up to nine alternative capsules.

Changeable capsules include omnidirectional, cardioid, supercardioid, lobar and boundary microphones, as well as two new MKE 102-60 tie-clip and ME-65 vocal mic options.

Deltron extend

Deltron Components have extended their DGS pro-audio range. New are the Universal Panel cut-out multiple (XLR) plugs and sockets and a series of professional ¼-inch jack plugs.

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The Portable One Plus...the single instrument solution for both your bench and portable audio testing.
The German Behringer company have been making determined efforts in recent months, first to raise their profile through prominent advertising, with the result that more people are probably aware of its existence than previously. Their products are still not among the most familiar, however, this is despite comprising of an extensive range of signal processors, most of which are of the dynamic or control variety.

One of the units they have been pushing hardest is the Intelligate, a flexible expander, gate and ducker with one or two novel aspects. This is a 2-channel stereo device, (apparently) designed quite specifically with corrective gating functions in mind, with the result that it has few frills and extras on it; it makes up for this, however, with an unusually comprehensive set of controls for its basic function, making it a more precise, flexible tool than most.

Perhaps the most obvious indication of this is that the unit makes no distinction between the roles of gating and expansion, in the sense that there is no switch to select between the functions. Rather, it acknowledges that, in a way, an expander is to a gate what a compressor is to a limiter. Just as a limiter is nothing more than a compressor working very hard, so a gate is an expander at its extreme settings. Thus the Intelligate provides, in addition to the usual Threshold and time constant controls, both Ratio and Range adjustments. A range control is not that unusual, several gates allow the available gain reduction to be restricted; this ‘Closed’ does not necessarily mean ‘Silent’. Less familiar is the provision, alongside, of a control for the expansion ratio. For gentle expansion, this can go as low as 1:2.1, while the maximum of 30:1 gives, effectively, conventional open-and-shut gating.

The envelope controls provide wide and useful ranges of adjustment, with maximum Hold and Release times of 4s and 2s respectively. Behringer are particularly proud of their attack time, which goes down to 8us, and go into some detail about their Class-A VCA. This, they claim, has particularly good control feedthrough characteristics, minimising breakthrough of control voltages into the audio path and thereby reducing the possibility of clicks at attack times. I had not heard this suggested as a problem before; it is common knowledge that too fast an attack time on a signal with significant low frequency components is likely to click as it cuts into a waveform, but the danger of fast-rising control voltages being audible was a new one on me. That said, the Intelligate does seem much less prone to clicks, and if they were to be a problem the attack time does not seem to need so much backing off to eliminate them. This in turn means less damage to transients than is forced on you by some gates. Some units attempt to compensate for the occasional slight softening of leading edges by adding a peak of extra gain as the gate opens. Since there seems less need for it, this is not really missed on the Intelligate, but it is noticeable that this and some other features found elsewhere are not offered, such as Masking between successive openings and Delay
—never an audio delay but a pause between the signal crossing threshold and the gate actually opening. This kind of thing tends to be used for more aggressive, creative treatment, perhaps at the expense of the finer control necessary to deal with really difficult signals. The Intelligate obviously sees its role rather differently.

Of course, the facilities needed for delicate control are all there. Side-chain filters, at 12dB/octave and with a good range of overlap, allow frequency conscious gating, complete with a Key Listen switch for tuning the filters to the wanted sound. Metering and indication is helpful, with an eight-segment LED gain reduction meter and a novel 3-colour ‘traffic light’ level indication. As the signal reaches the threshold, the central yellow ‘Hold’ LED lights; on either side, a red ‘Below’ arrow and a green ‘Above’ arrow show where it is in relation to the threshold. This all makes it unusually easy to make the gate do what you want it to do, perhaps helped by Behringer’s ‘Interactive Ratio Control’ cirtucity, which is what allows the suggestion in the name that it is somehow intelligent. The claim is that the ratio is automatically adjusted dependent on programme material, making the unit ‘less critical of adjustment and... more tolerant in the presence of those signals which appear slightly above the noise floor.’ The accompanying diagram makes it appear that this is in fact a gate’s equivalent of a compressor’s soft knee, where the transition from a linear transfer function to the processed slope is less abrupt. Whatever is actually happening, it certainly appears effective.

Side-chain insert jacks (selected on the front panel) allow additional processing to be used in adjusting the gate, or, of course, a separate key signal to control its function. These will obviously be used when operating the unit as a ducker, which will become on pressing one switch. Stereo linking is likewise front-panel selectable, and in this mode channel 2’s controls become inoperative, with channel 1 acting as master. It appears from the manual that in stereo mode, control is derived entirely from the signal on channel 1, with the other channel’s signal having no influence, which seems a little curious; one would expect the inputs to be summed, or the higher of the two to take precedence.

Behringer are clearly keen that the Intelligate should be seen as a no-compromise unit. It only operates at +4dBm, balanced on XLRs, and 3-pole jacks (although the key insert points are unbalanced), and the manual makes much of the circuit design features, including Behringer’s own op-amps and high-tolerance components throughout. This seems to be borne out by the performance, which is exemplary in every way. Incidentally, although the review model did not use Deltron connectors on its rear panel, Behringer have recently opted to use these high quality British items exclusively on all units.

Like its stablemates, the Intelligate is distinctive without being gimmicky. Its capabilities and fine control are up there with the best of them, at a surprisingly reasonable price, and it deserves a wider audience.

Dave Foister

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Intelligate and mate—pictured here with the Composer
Fifteen years ago, EAW invited Tim Frost to visit their Massachusetts base to catch up on developments

In 1978, EAW cofounders Kenton Forsythe & Ken Berger, set out with no designs two weeks before that year's AES Show and still managed to launch seven products at the show. They have been pulling speakers out of the hat ever since and were celebrating their 15th anniversary at the recent New York AES.

Throughout this period, EAW have been working on two different fronts, producing sound reinforcement systems for general PA hire and installation, and providing a design-build capability for specific installations. This has culminated with the announcement that Siemens, the Austrian based multinational with its DM120m installation business, have taken on distribution of EAW for the German-speaking countries and several Eastern European centres.

For EAW, the Siemens tie-in gives the company access to some of the larger European installations. EAW President, Ken Berger, also sees it as an ideal opportunity to grow with the East European market.

"One of the visions we have achieved with Siemens, is to promote an educational programme for East and West Europe,' he states. 'In East Europe that will help increase the sophistication in the market and that will benefit us as a sophisticated product in the market and position us as a leader in that market place.'

Considering EAW have not had a particularly high public profile in Europe, that an 'institution' the size of Siemens have aligned themselves so closely with EAW may be a bit of a surprise. However since their inception, EAW have been deeply involved in using factory-line techniques to produce both mass-produced systems and customised designs that address specific customer problems. A major client continues to be Disney, who repeatedly return to EAW for both off-the-shelf systems and small numbers of completely customised designs for their theme parks and other venues both in the US and in Europe.

According to Berger, EAW's ability to produce small runs of individualised products alongside their usual product line is something they learnt to do at a very early stage in the company's development.

The phrase, "We've spent so much time doing so much with so little, that we can now do something with nothing," has a lot of truth in it around here. We now have three basic types of product. We do absolutely standard high volume product—all identical and put into stock.

'We have another set of special order products which are manufactured to a standard design but built only to order, and the last area is custom products where we will design and manufacture to meet a client's specific need.

The way EAW works today we define as "Agile production". Everything is built in separate quality controlled stages, so we can have five or six products in production simultaneously.'

The speaker design and manufacturing owe a lot to the abilities of Kenton Forsythe, Vice President of engineering. With manufacturing geared up to deal with small runs, working in parallel with manufacturing standard stock products, Forsythe has in place the structure to let him produce runs of completely new designs ready for installation 20 days from the initial contact with the customer.

"We have put a lot of effort into the structure, this allows us to do these specialised jobs,' he explains, 'but I can guess now why other people don't do it. Having all the mass-production structure in place can definitely impede you in reacting to quickly in low-volume business.'

A lot of engineering effort is also going into research on basic product design and development—at the AES Show, the company announced several new products and techniques including the AS945 ultra-high-power long-throw system and the KP852 Stadium Array system, which uses both HF and LP drivers.

Heavily computerised, EAW have made a lot of effort to make as much of their product data freely available as possible. They are supporting all the current speaker system CAD packages, supplying speaker plots for all their products in each of the various CAD system formats. Although Berger believes these CAD packages still have some way to develop, at a meeting of journalists and users to celebrate the company's anniversary, he reiterated EAW's commitment to openness.

"Some people were amazed that we would give out so much information about our product. We believe if is not directly related to our own specific product under development then our product specifications should be available openly. So we decided to support every software modelling system that would allow us to supply data to them.'

Kenton Forsythe (standing) and Ken Berger co-founders of EAW

He adds that the their ability to develop new product and be competitive in the market had less to do the data itself, and more to do with the people generating the information and designs.

'Veve put our investment in people. Our aim is that everything we do eventually flows out to become public knowledge, because what we think is special about us, is us.'

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"The integration with the AudioFile's Event Based Automation allows you to make changes to the edits, with the console automation following suit.

"I think the speed of it... the flexibility, is a standard I've come to expect now. I can sail through time consuming tasks and get on with the real business – getting a true feel for the mix.

"The on-board EDL conform allows greater control over source audio – saving on On-Line time – the system relays the tracks from first generation material.

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DIGITECH DHP55

The latest piece of pitch-shifting outboard from Digitech is aimed at instrument processing. The unit shares the outward appearance and livery of the TSR24 reverber-multieffects unit: a 20 x 2 line LCD is bordered on one side by the preset number display followed by no less than 34 buttons, an alphadial and individual left and right-channel input and output pots for the standard jack connectors on the back. It responds to MIDI patch change and continuous controller to parameter value change data.

The DHP55 has 75 mono factory presets, 25 stereo factory presets plus 140 user locations split equally into two banks. Presets are composed of configurations of the basic building effect blocks; these are fixed but offer 176 permutations of 16 effect types. The effect types include a 2-voice bass pitch shifter, chorus, chord shifter, distortion and speaker emulator, dynamic filter, 5-band mono EQ, 7-band stereo EQ, 31-band mono EQ, flange, multilat delay, 2-voice intelligent pitch shifter, 4-voice intelligent pitch shifter, sampler, stereo delay, string pad modulation, and 4-voice harmony pitch shift with regeneration.

For completion, the Eqs are all fixed frequency, there is a fully adjustable compressor and noise gate patched by default onto each configuration and the pitch shifters vary considerably in their complexity and sophistication—the two need not be linked after all.

Editing on the DHP55 could be regarded as tricky. You either create a preset from scratch in the Utilities menu or you call up a factory preset on a dial or on the program UP-DOWN buttons, edit and save it to a user memory. When working from scratch you are expected to identify the configuration you want from the list of 117, each of which has its effects sections represented as abbreviations—and to make life a little harder, the LCD flashes on and off awkwardly to make sure you have not more than one second at a time to view it.

It is far easier to edit an existing preset. You scroll through the configuration of effect sections with the PREVIOUS and NEXT buttons until you get to the one you wish to doctor, press the EDIT button and then use the same two buttons to scroll through the effect’s parameters entering values on the dial or with the parameter UP-DOWN buttons. Alternatively, you can access some sections directly using 11 dedicated effects buttons and alter them as above. Stepping back to the configuration page is achieved on the EXIT key.

Simple enough, you may think, but there can be a lot of parameters to get through (though they do slowly become familiar). The situation is compounded by the small size of all the squidgey front-panel keys (even the finger-tip recess in the large dial is too small for anything but a child’s digit) and if you are a guitarist with good old-fashioned finger-pickin’ fingernails on your dominant hand then you will learn to swear with renewed fluency before long.

It is not that the DHP55 is difficult to learn—I dismissed the manual fairly early on as truly the worst I have ever seen—and still got to grips with the unit quickly, it is just that it is awkward to use. The attempt has clearly been made to accommodate the user, yet the implementation is somehow inelegant—there is almost too much here. I hasten to add that this is not my overriding initial impression of the DHP55 because it is actually a fantastic-sounding unit. And it has not travelled the traditional route—there are no reverbs or super-drive tones in its factory presets for example, instead it has employed its considerable pitch shifting talents in ways that are unique. The DHP is a real processor that processes an instrument to extremes. There are sounds in here that I have never heard before, presets that make guitars sound like synths, splashes of pitch and haunting ethereal instruments that bear little resemblance to a six-string.

Pivotal to all pitch activity, of course, is the ‘intuneness’ of the incoming source, and the DHP55 has a slick tuner built in and can alternatively be tuned to something else across a narrow range. The pitch shifting, which is not quite in Eventide territory, is nevertheless consistent and reliable, making it very playable. It is further mixed with regeneration, delays, modulation, panning, and an intelligent key awareness. Some of the pitch-shifting algorithms are intended for single-note processing and are quite high harmonies while others concern themselves with chordal material. Add the other effect types and the power to transform the input source is awesome.

There are four distortion tones that do not spring into life until you add a rather good speaker simulator, but add all work well across a wide input gain range. The DHP can give a great piano-wire Strato tone and super smooth sustain but many of the configurations do not use the distortion circuit and clean sounds are where it’s at. The DHP55 seems more geared towards the guitar than any other instrument but you can also achieve some pretty wild and tasteful results with keyboards.

It would be wrong to consider this device as only capable of oddball effects although the ‘What the hell am I supposed to do with this’ feeling is strong on encountering certain patches for the first time and before you start to experiment with them. Much of this is down to the high profile of pitch shifting in the presets which can require a little thought but there are some fabulous arpeggios, shimmering choruses and a good selection of basic workable tones here as well.

I have not encountered a unit quite like this before; one that can change the fundamental qualities of the sound of a guitar so radically when it wants to. It can be pretty weird. There are some wonderful ambient-style totally engrossing presets which respond to attack velocity for the dynamic filter sections and some superb sparking effects.

It is inspirational stuff which is really likely to get you playing again. The presets are brilliant leaving you in the quandary of how to program equally good ones of your own. The answer lies in experiment and allowing yourself to make mistakes as the results can be very unusual.

I do not believe this unit will appeal to everyone—not because of the fiddly switches and operational quirks, but because of the way it sounds. Anyone looking for a traditional guitar multi-effects unit will feel less than grunted 30 presets into the DHP55. On the other hand, anyone looking for some innovation and originality not to mention a wedge of out-of-sightness will be stunned.

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Music News is compiled by Zenon Scoepe.
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I have to admit that when I first heard about Sony's laptop DAT editor, it conjured up images of a bleary-eyed producer flying Club Class compiling album running order; a radio journalist editing hot interviews in the back of a cab in the race back to the studio and a classical producer cosily piecing together takes at a weekend cottage. Just as the laptop computer created the portable office, so the laptop DAT editor looks set to produce the portable editing suite.

However, having spent some time with Sony's PCM-E7700 DATStation, I am not so sure that my original vision was a prophetic one. Firstly, the unit is not quite as portable as I had imagined—it certainly is not compact enough to slip into a briefcase, and the lack of internal batteries makes it unsuitable for remote use unless there is a power supply to hand. Secondly, the system appears to have been designed with broadcasters in mind and certain tasks, including music editing, are not as straightforward or intuitive as they might be.

'The system is primarily aimed at the radio broadcast environment,' confirms Sony Audio Product Manager Phil Wilton. 'Having said that, because the DATStation is a unique all-in-one package, we fully expect there to be interest from other areas. Essentially anyone who uses DAT, and the number now is substantial, has a requirement to edit it. We're aware that, as the system stands, its use is reasonably market restricted but it is a new concept that has only just hit the streets, and depending on the feedback and reaction we get, we have the ability to evolve the product in a number of directions. In fact, one of the things we are currently investigating is the use of the system as an integral part of video postproduction for on-lining audio.'

A significant difference between the DATStation and previous Sony digital audio tape editors, like the DAE-3000 and the RMD-D7300, is that it employs EDL-based auto-assemble editing rather than the assemble-insert 'record as you go' type procedure. This has distinct advantages and disadvantages; on the plus side is that all the edits can be built-up into an EDL, further modified and then executed at double speed. On the minus side is that auditioning edits is slow, and noncontinuous due to locate and memory load procedures.

As mentioned, the unit resembles a laptop computer with a lift-up EL (Electro Luminescent) screen—similar, although considerably bigger than the type used in the DAE-3000 editor.

The unit houses a player and a recorder with shared transport controls including a sunken jog-shuttle wheel. Interaction with the various screen displays is again reminiscent of the DAE-3000 with seven function keys accessing associated function boxes, and four cursor keys selecting items around the screen.

Sony's PCM-E7700 DATStation represents a new step in the application of DAT technology. Initial reservations overcome, Patrick Stapley takes on this all-in-one editing package.
The unit includes a small built-in loudspeaker, but a stereo headphone socket and unbalanced monitor output (on phones) are also supplied. Analogue and digital (AES-EBU) inputs are provided, and an RS232C connector is included for future use. The DATStation measures 380 x 121 x 422mm (WxHxD) (15 x 5 x 16½ inches) and weighs 8kg (17lb 10oz).

Operation
Before editing can begin, the source DAT will require time code; if a prerecorded tape does not include time code, it may be dubbed on in real time using the system's Insert mode. Alternatively, a programme can be directly recorded into the system while fresh code is added. The system reads and generates all regularly used codes and will operate with Absolute Time (A-Time).

To begin editing, a time-coded source tape is placed in the player. The screen will have defaulted to the Audio Edit display where edits are displayed sequentially either as segment bars or as a list showing time-coded In-Out points, duration and any ID information—either way, the screen shows four edit sections at a time out of a possible hundred.

Edit points are entered either by locating the position on tape and then hitting the large MARK key, or by directly entering time-code points from the numeric keys. They can be 'Marked' on the fly as the tape is playing, or more precisely, to 1ms accuracy, by using the system's jog facility which provides an instant, off-tape real-rock facility. This is the first time such a function has been available for DAT, and Sony remain tight-lipped about how it has been implemented as patents are currently being applied for. A shuttle function is also included with a range from 1/34th normal speed to 32x normal speed.

Once the first In and Out points have been entered a horizontal bar will appear representing the length of Cut 1. The horizontal scaling can be changed from 4 minutes to 128 minutes to accommodate segment length—thus if working with a number of short edit sections the scaling would be set to a low value. The minimum length of a Cut is five frames.

As edit sections are built up, the screen will show a column of Cuts either as segment bars or time-code numbers depending on the selected display mode. These Cuts can be accessed by the cursor and modified in a variety of ways. For example, In and Out points can be moved by entering new time-code positions or by adding-subtracting time from existing positions; fade-in or fade-out times of up to 3s (1ms steps) may be independently added to each edit point; ID information (if it exists) can be altered, and the overall level and stereo balance of a segment can be adjusted. Although level is adjustable, there is currently no facility (other than crossfading) to dynamically level adjust a Cut—thus manual fades are not catered for.

Additionally Cuts can be Moved, Copied, Divided, Delete and Recovered—also new Cuts and Spaces (digital silence entered in seconds) may be inserted into an existing EDL. All these functions are simply executed using the function and cursor keys. The current EDL is automatically backed up by the system's battery-powered memory, and will be reinstated at next power-up. Consequently before work can begin on a new EDL, the current list must either be saved to one of the unit's five memory locations or deleted.

Edits are auditioned prior to recording, using the Preview function. This operates by playing one side of the edit from the system's three-second memory while the other side is played off tape. Preview will begin from the edit point which is currently selected by the cursor, and will continue to the end of the edit list. The Preroll and Postroll times played before and after an edit can be set at 1-3s and 3-9s respectively—although it is possible to set the Postroll time to be the duration of the edit segment. Because the system has to locate, load, and locate again for each transition, the process is quite slow. Also there is no Repeat function to allow an edit to be played over and over again without first having to go through the data loading process—however, this limitation is something Sony are aware of and may change in the future.

Apart from adjusting edit points by keying-in new time-code values, they can be changed with the aid of the Locate function. Once an edit point has been located, the tape position display at the bottom part of the centre of an 8-minute bar; the operator may then advance or retard the tape using a combination of jog-shuttle and transport keys, and then re-mark the edit. A criticism here is that—apart from referring to the locate-point time-code read out—there is no precise indication of the edit's position. The scaling of the bar display is too coarse to show fine movement in certain applications. Also useful would be a 'Play From/Play To Edit' facility to monitor the exact position of an edit.

It is highly likely that an EDL will be built up from a number of different source tapes, and to cater for this, the DATStation logs a tape number against each Cut. The first tape to be loaded into the player is automatically labelled as Tape 1 and subsequent tape loading will cause a dialogue box to appear representing the current number of a tape.
The process

As the edits are assembled the system keeps a record of any detected errors, which will appear in an Error List. This list will show all interpolation and mute errors for both player and recorder, along with their respective time code positions.

The review unit, used in conjunction with Sony PDP-60 tape, displayed a very low incidence of errors in real-time recording, although a considerable increase of interpolation errors did occur during double-speed recording. However, these appeared to be small, inaudible corrections, and no mute errors were encountered. In addition to listing errors during recording, a prerecorded tape can also be error checked and a list produced—Error Lists may be saved to memory in the same way as EDLs.

Apart from the audio editing facilities described, the system also offers comprehensive control over IDs. Prerecorded tapes without ID information, can have Start, Skip, and End IDs registered on them; and tapes with existing ID information can be edited—thus ID points may be moved or erased, ID types and program numbers changed, and program numbers that run out of sequence automatically renumbered. Start IDs can be set up to record automatically in gaps at a threshold of -40dB or -60dB, and End IDs may be set to record from 2s–99s after the programme—the system default being 30s.

Straightforward tape dubbing is also catered for, and as with editing, this can be performed at normal speed (with the benefit of RAW monitoring), or at double speed.

At the bottom right of the screen is a stereo-level meter with a balance offset indicator above it. The meter can be set to peak hold (Auto, 1.5s, or 4.0s), have its release time set to 40ms or 80ms, and its over level sensitivity set between 1–7 words (default: 3 words). Below each tape deck are LED indicators for Mute and Interpolation errors, servo lock, and record inhibit (recorder only). The unit includes a number of setup pages where operating parameters can be changed to suit the user; personalised setups can then be stored in five memory slots and assigned as the default setup.

Alternatively the factory settings or the last active setup will be recalled on power-up.

Conclusion

Sony's DATStation offers a new approach to DAT editing both from an operational point of view by virtue of its integrated and portable design.

Although conceived primarily for broadcast use, the unit potentially lends itself to a variety of applications, and it now remains to be seen how Sony will adapt the product in the future to suit other markets.

Apart from the adoption of EDL-style auto-assemble editing, other notable features include double speed edit and dub (a first for DAT audio), RAW monitoring, and a real-time off-tape jog facility (another first for DAT).

The DATStation represents good value for money, taking into account the price of Sony's previous high-end DAT editing package, and has the obvious advantage of combining the three components—editor, player and recorder—into a single unit. This is a novel and intriguing product from Sony which is sure to attract strong interest from a wide cross-section of audio professionals.

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US: Sony Corporation of America, 3 Paragon Drive, Montvale, NJ 07645-1735. Tel: 201 930 1000. Fax: 201 930 4752.

Patrick Stapley began his career in pro audio in 1972 at London's Abbey Road Studios where he worked with artists as diverse as Paul McCartney, The Damned and Matumbi, and was involved in all four of Tubular Bells and Dark Side of the Moon. Patrick also runs his own production company and worked at Falconer Studios' Production Manager before beginning to write for Studio Sound in 1985.
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NEW DIMENSIONS

In recent months, considerable attention has been focused on Deutsche Grammophon's 4D Audio Recording system. The system is the result of a number of years of developmental work by the audio engineering department at DG, and the following article is a description of the system both as it is now and as it is intended to be in the near future. The description is based on discussions with DG engineers and recording staff at their centre in Hannover, which took place during a recent visit.

B4 4D
(Before 4D)

DG make all their classical recordings in the field, having no studios at its Hannover Recording Centre, and use locations around the world including London, Berlin and Vienna. For many years they have relied on established Sony CD-mastering equipment (PCM 1630 and U-Matic recorders) and digital multitrack machines. In the early years of digital multitrack, the SM format was used, and one machine is still kept in working order to replay and transfer old tapes, but more recently the majority of multitrack work has been recorded on the Sony PCM 3/34. Editing has been handled using DAE3000 units for stereo work, and a certain amount of editing is also carried out on the digital multitrack machines.

In common with the rest of the audio industry, DG have become increasingly aware of the need to make improvements to the digital signal chain, owing to the 16-bit limitations of established equipment. There is undoubtedly a desire amongst professional recording engineers to use digital equipment which 'has the edge' on consumer equipment in terms of performance, and this has led to a growth of interest in technology capable of handling more than 16 bits. Hand in hand with this has gone the development of processes designed to pass on as much as possible of the resulting sonic improvement to the consumer, through the medium of compact disc. The CD, though, as everyone should be aware, is only a 16-bit medium, and nothing except a genuine redesign of the format will make it anything other than this. Nonetheless, it is possible to improve the perceived dynamic range of the CD to give it a subjective performance which is close to that of the improved professional system.

4D, then, is the result of engineering developments at DG which combine commercially available digital audio equipment with in-house designs and systems integration. The intention is to ensure that the audio signal is carried through from microphone to the final mastering stage with as high a sound quality as possible. Where suitable commercial equipment has existed for this purpose it has been used unmodified, but modifications have been made in cases when certain features have not been deemed appropriate. Developments such as the noise-shaped requantisation used in 16-bit mastering were started quite a few years ago when commercial equipment did not have the performance required to meet the company's purposes, although today there are a number of systems which fulfil a broadly similar purpose. This is discussed in more detail below.

Francis Rumsey evaluates the Deutsche Grammophon 4D audio recording system which has been at the heart of recent debate

Audio performance and the bit budget

Digital audio is no longer as simple as it was ten years ago. Many improvements have been made to converter designs among other things, and it is my view that the days in which one could...
measure a system's performance simply in terms of the number of bits used are rapidly drawing to a close. In general, though, the more bits the better (unless you are in the business of selling data reduction systems!), but the old rule of thumb which multiplied the number of bits by 6dB to arrive at a figure for the dynamic range is far too simplistic for today's systems. For this reason a system's performance is far better judged on detailed measurements made both in the absence and in the presence of signals at various levels and frequencies and, of course, critical listening tests. It is also important to note that with professional equipment converter performance may well be poorer when a system is externally synchronised, owing to poorer clock stability.

For the very reason that performance is becoming more difficult to determine, the industry is in desperate need of a straightforward means by which similar digital audio equipment may be compared (particularly converters). Manufacturers will often play games with specifications in order to show their equipment in a good light, but, as admirably displayed in the exchange of letters between Apogee and Lexicon in the July 1993 issue of *Studio Sound*, there is still wide disagreement about the best way to describe the specification of a converter. Clearly, it is important to know how many bits of the signal carry useful information since it is otherwise difficult to decide what type of interface or storage to use. As a measure of performance, however, this is of limited value.

When considering the design of a complete digital recording system a number of bottlenecks may be apparent. It is important to be aware of the capabilities of each stage of the system in terms of the number of bits stored or transferred. The AES-EBU interface is capable of transferring up to 24 bits of audio information per sample. The Sony interfaces are capable of transferring up to 20 bits; the Yamaha interfaces will carry at least 24 bits, and so on. This does not mean that all the bits will necessarily be used or implemented in every system. Recording and storage devices will only store a certain number of the bits arriving over a digital interface or supplied from a converter. To date most recorders have stored only 16 bits, but a number of mixers and intermediate processors have been able to handle 20 or 24 bits. This has resulted in the use of 'intelligent' requantisation of the audio signal at the point where it is down-converted to 16 bits for storage. If an engineer is to record more than 16 bits, then there is currently a limited choice of machines available, but there are advantages to be had in leaving any requantisation until as late a point in the signal chain as possible, making it increasingly important to be able to record both stereo and multitrack material at resolutions up to 24 bits.

**System overview**

The 4D system consists of the following components: custom-made remote-controlled stageboxes housing special microphone preamps and A–D converters; a number of Yamaha DMC-1000 digital mixers, stereo or multitrack recorders (see below); a network of digital interconnects and a patchbay to handle distribution and synchronisation of all the digital signals; and DG's Authentic Bit Imaging processor for requantisation of the signal to 16 bits. There is also an in-house control system called Computer Aided Recording (CAR) which is based around an MS-DOS PC, designed to present system information to the operator in a useful manner, relying extensively on MIDI for communication with the DMC-1000 mixers.

The resulting system allows conversion of audio signals to the digital domain close to the microphone, and from then on all interconnects and processing are handled digitally. A key feature of the system is that it is not a permanent installation, but can be transported in flightcases to location recording sites, and will make possible high-resolution stereo and multitrack recording virtually anywhere. The aim has been to strive towards the achievement of a 24-bit recording chain from start to finish, and the remainder of this article will concentrate on the methods being used to reach this goal.

**Stageboxes**

Deutsche Grammophon's Stageboxes consist of two main parts: 8-channel remote-controlled mic preamps and 8-channel A–D converters. The mic preamps were designed in-house and use transformerless inputs to feed an amplifier which is made up of components individually selected for their noise and distortion performance.

The architectural specification was to construct a mic preamp which would complement the extremely low noise and distortion of the A–D converters which followed them, while at the same time allowing remote control of the preamp gain.

In order to be able to achieve high audio specifications at the same time as using digital remote control it has been necessary to ensure that digital activity is restricted only to certain areas of the stagebox, and a 'sleep' mode has been incorporated which means that digital activity only takes place near to audio signals when the gain is changed, after which the control circuit returns to an inactive state. The mic preamp has a transformer-coupled analogue output in addition to the digital output in order to provide feeds to third parties, such as those required during simultaneous broadcasts of recording sessions.

The preamp outputs are fed to A–D converters, which in their first incarnation were special versions of the Yamaha AD8X, but in a more...
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MIDI is used extensively in the automation of the mixer, and MIDI access has been provided to the tables which set up the EQ of each channel. The recent version owes considerably more to DG's own design. The 'original' ADX Special (now, incidentally, generally available through HHB) employs an interesting approach which extends the effective dynamic range through the use of two 18-bit convertors which operate at a gain offset of 18dB. The highest 18dB of the dynamic range is handled entirely by one convertor, and at levels below -18dB, the low-level convertor gradually takes over using dedicated DSP to crossfade between the two convertors. The crossfading and gain offset of the convertors are controlled such that excellent linearity is obtained over the whole dynamic range. The penalty is that the noise level increases slightly for audio signals which use the upper 18dB of the convertor, but the audible effect of this is minimised by the crossfader which introduces a gradual taper of one convertor from the other.

In order to determine whether this dual-convertor approach is suitable for its purposes, DG performed a large number of listening tests and were unable to detect audible artifacts of the dual-stage crossfading process, leading the company to adopt this approach for all its stagebox convertors. The more recent DGX-1I convertor employs the same DSP crossfading between convertors as before, but gives strikingly improved quiescent noise and harmonic distortion performance due principally to the incorporation of newer Crystal Semiconductors convertor ICs which have balanced analogue input circuitry.

Network system

The Digital Network System is the systems integration part of the 4D setup. Basically it involves the routing and synchronising of a number of stageboxes, mixers, a patchbay and the various recorders, as well as providing talkback and foldback to the studio floor. It is a small task (as anyone who has ever tried it will know) to put together a digital audio system consisting of equipment from a number of manufacturers located in different rooms, working in a variety of formats, and to ensure that they are all locked to a common clock. Cable lengths have been carefully controlled where bit synchronisation is considered important, and each of the multicore cables is terminated in robust multi-pin connectors designed for easy and reliable use in the field.

Digital mixers

The Yamaha DMC-1000 is proving to be extremely popular as a cost-effective digital mixer which handles inputs and outputs in a variety of interface formats. It incorporates Yamaha's own digital I/O ICs which have very flexible clocking and buffering arrangements, allowing digital inputs to arrive in a variety of phase relationships and still be accepted (unlike earlier designs which required very tight relationships to be maintained between the word clock and the digital inputs). The DMC-1000 is also capable of handling all 24 bits of digital inputs which carry them, and outputting wordlengths of up to 24 bits.

DG have adopted the DMC-1000 with a number of custom software features and in order to obtain the required number of channels, use more than one mixer synchronised to a common word clock. Using format convertors it is also possible to connect multitrack machines to the mixers.

MIDI is used extensively in the automation of the mixer, and MIDI access has been provided to the tables which set up the EQ of each channel in order that precise EQ curves can be drawn and displayed using external software. One of DG's projects has been to develop external 'viewer' software for the DMC-1000 which displays setup parameters on a PC so that the engineer can see more easily what is going on. It also allows off-line editing and storage of the mixer setup so that session configurations can be logged, and modified if necessary without needing to be near the mixer.

Stereo and multitrack recording

For stereo 4D recording in the field, DG are currently using the Novo-7 machine, which is an open-reel recorder capable of storing up to 24-bit wordlengths on up to four channels simultaneously. The company are also taking delivery of a number of the new Sony PCM-9000 recorders, which use magneto-optical discs, and which are also switchable to record up to 24 bits. If DG choose to switch to M-O discs entirely, the cost of media will become an important consideration. DG currently reuse all of their session tapes once the edited master has been approved, but would need to consider whether they could afford to keep a library of expensive master discs in the same way as they now keep...
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audio data across more than one track. A consequent reduction in the number of simultaneous audio channels will result, giving 16 audio channels at 24 bits from one machine. The multiplexer is an external device which does not require any modification to the 3324, and therefore uses the 3324 simply as a data recorder.

**Authentic bit imaging (ABI)**

ABI is a requantisation process designed by DG to handle the mastering of high-resolution recordings at the CD resolution of 16 bits. It uses recognised techniques of redithering and noise shaping to shift the quantisation error energy into the least audible parts of the audio spectrum, thereby obtaining lower distortion and a better perceived dynamic range from the CD than would be obtained if the high-resolution recording was simply truncated or rounded.

One of the most interesting aspects of ABI is that it employs switchable parameters in the requantisation process, allowing the operator to choose which version is most suited to the programme material. Unlike a number of researchers, DG have concluded that there is no one 'correct' set of conditions to be used in the process, but rather that the 16-bit sound can be improved by choosing the most appropriate parameters from a library of possibilities. In this way it is treating the process more as a creative tool than as an absolute set of conditions. The new ABI processor currently under development will offer up to 64 different requantisation programs, making possible a detailed assessment of which programs are aurally the most satisfying.

This is clearly an area which could form the topic of more detailed study by the audio community, since the process of noise-shaped redithering at lower resolutions will be used widely. Is such a process best treated as one controlled by subjective preference or should it be fixed by theory? Also, is one person's preference the same as another's?

**4D in action**

DG normally have up to six recording teams working in different places at the same time. A maximum of six complete 4D systems could therefore be in operation in any one week, and the ability to support this is really one of the principal achievements of the project. The investment in Yamaha DMC-1000s is quite monumental, since not only can there be four or five on one large session, there are also three in each postproduction suite at the Recording Centre. Clearly, as each element of the signal chain is improved, the limitations of microphone design become apparent, following the old adage of 'the more you open the window the more the muck flies in.' Consequently, DG are currently working with a manufacturer on microphone designs which will complement the high specifications achieved in their preamps, in order that the self noise and distortion of the earliest stage in the chain does not unduly compromise the overall system performance.

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London's HHB have been so heavily committed to DAT since its early days that one could be forgiven for assuming that they deal in nothing else. It is probably no exaggeration to say that HHB's enthusiastic espousal of the format was a factor in its early acceptance in the UK, and it was no surprise when they launched into manufacture. The HHB 1 Pro portable machine (designed and built in conjunction with Aiwa) was the first major venture and quickly became a very familiar sight indeed, while their 'own-brand' tapes are now highly respected, especially since the recent Studio Sound survey. HHB's position as 'Europe's largest supplier of DAT technology' means they are ideally placed to evaluate the market and spot gaps in it, and it is the identification of such a gap that has led to the production of the Portadat machines. In HHB's own words, the new machines are designed to meet the need for 'professionally equipped, cost-efficient portable DAT recorders, designed and built without compromise to withstand the rigours of continuous location use'. Unlike the earlier model, there is no longer an Aiwa connection; there is, apparently, significant involvement from a major player, but HHB are not able to divulge who that may be.

DAT's combination of small size, long running time and high quality audio is obviously very appealing to the location recordist, but few machines have ever been produced with the special, punishing demands of this field in mind. Even now, the Fostex PD-2 is probably the only serious choice in an area where the ruggedness of a tank is the main requirement, along with the ability to interface to, and synchronise with, a wide range of other equipment.

Into the fray come HHB's two models, the PDR 1000 and the time-code-equipped version, the PDR 1000TC. Although the TC model looks like the other one with an extra lump bolted on (in best location tradition), this is not in fact the case. It is theoretically possible to upgrade the one to the other, but since it would involve the replacement of the entire main processing board it would not be an economic proposition.

Everything about these machines makes it clear that HHB are deadly serious in their intentions to make them roadworthy. They are understandably keen to point out that the transport is not a modified domestic unit, but derived from the DDS transports used for heavy-duty computer data backup, and that as far as they are aware no other audio machine uses such a transport. Four motors—one each for the head drum, the capstan and both reels—significantly reduce the mechanical complexity, and fewer cogs and rubber bands should, of course, mean higher reliability. It is housed in a solidly built chassis and case which manages to remain streamlined, small and light, at only 2.4kg plus battery for the larger version. Like any location recorder, it positively bristles with switches and controls, but they are all recessed out of the way of accidental operation or breakage. Sensibly, the 'back' panel—onto which the machine would fall if it were dropped—is a chunky resilient moulding with no connectors or controls on it at all, although it does house the battery compartment.

The battery itself is not a NiCad, but one of the new Nickel Metal Hydride rechargeables, which will apparently power the machine for up to two

The patience of location recordists may just have been rewarded by the arrival of two new portable DAT recorders. Dave Foister gets an exclusive hands-on preview

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hours. This is good news as far as I am concerned; personally I have had nothing but bad experiences with NiCads, from battery packs to camcorder batteries to rechargeable soldering irons. They are forever letting me down, and it amazes me that a technology which needs such mollycoddling in terms of charging and discharging cycles is still considered adequate for the busy professional. If these new batteries overcome some of the problems associated with NiCads, as claimed, without the size and weight of lead-acids, then I hope it will not be long before they are more widely available. The machines will run either from these or from an external 12-Volt supply via a standard 4-pin XLR—there is no dry cell option, not that there is room for them anyway. The supplied AC adaptor doubles as a charger.

The input side of the PDR 1000 is typical of the way the machine addresses its specialised job. Analogue inputs are balanced, and are independently selectable between mic and line, with independent mic pads and high-pass filters. This would appear extravagant and unnecessary on a studio recorder, but in a situation where two independent mono sources might be involved—possibly even one at line level and one microphone—this versatility could remove the need for a separate mixer. Switchable phantom power is provided, along with a limiter for the mic inputs.

On the other side, off-tape confidence monitoring is provided by the 4-head configuration and a built-in loudspeaker. The monitor level control, shared with the headphones socket, is of the push-button recessable variety, latching out of the way when not required.

Field work
Operationally, the design is once again geared quite specifically to its market. Loading a machine with features can all too often mean loading it with so many controls that the main functions get lost in a forest of switches, whereas location equipment traditionally has sparsely populated main control panels with big, unmissable knobs and buttons. With this in mind, the controls which stand out most on the Portadat machines are the large red RECORD knob (a slide rather than a push-button, requiring a more deliberate action), the large yellow PAUSE button, and the large black RECORD LEVEL controls. These are arranged so that they can be used as a single stereo thumb-wheel control (although the concentric rings obviously allow for independent level setting) and are lockable against accidental movement; in the same way, all the transport controls can be locked out if required. While these main transport functions appear on the 'front' panel (the visible top surface when slung over a shoulder) the remaining buttons are on the same main surface as the cassette compartment, where one's hand naturally falls, and are thoughtfully set out so that they can be used 'blind'—they are different shapes and sizes, and have prominent barrier ridges separating them.

The main display appears on the same surface as the primary controls, and is exceptionally informative, showing transport status, a choice of several time-counter read outs, signal levels, battery condition, IDs, input and sample rate selection and so on. Despite this, it still manages to convey the most important information—time and levels—prominently enough to avoid confusion.

As if there were not already enough controls on the machine, there are more hidden under the cassette compartment lid, covering input selection, digital formats and sampling frequencies (including 32kHz) and clock-calendar setting. SPDIF and AES-EBU ins and outs are provided alongside the analogue XLRs, and perhaps the only disappointment is the unbalanced phono analogue outputs, although since the machine is unlikely to be used primarily for playback this is perhaps not important.

Subcode implementation is surprisingly comprehensive compared with other portables (remember that it is not that long ago since many so-called pro portables did not even record A-1ime).
and includes features still not common on studio
machines. Time and date recording, as distinct
from A-Time, is supported in the standard
format—compatible with, for instance, current
Sony machines—and Start and End IDs are dealt
with (although not Skip IDs). Start IDs-Program
Numbers can, in fact, be positioned manually
with some accuracy using a 'Rehearse' function, which
is still a comparative rarity even on mastering type
machines where it would be even more useful than
it is here. As an alternative, the usual Auto ID
facility is provided.

The PDR 1000TC time-code-capable version
looks, as has been noted, like the basic recorder
with an extra box stuck on the bottom. I have
heard this delivered as a criticism, although I can
not imagine it troubling location recordists, who
are used to carting around systems which look like
the contents of a junk cupboard gaffer-taped
together. Even if the time-code section was an
add-on, it would follow in the fine tradition of, say,
the Dolby A unit for the Nagra.

A moment's thought about what is involved in
inserting time code into the subcode areas of a DAT
recording is enough to explain why the time code
option could never really have been a question of
buying another box and fitting it on. The TC model
is a quite distinct machine, although to all intents
and purposes the upper half is identical to the
basic Portadat version.

The extra facilities appear to cover just about
everything that might be needed in terms of time
code in the field. It can, of course, record incoming
code, and also has its own generator with several
operating modes. It can be jammed to supplied
code, or left free-running; it can generate time-of-
day code, presumably driven from the recorder's
real-time clock; or it has the expected record run
mode, where the end result is contiguous code
however many times the recording is stopped and
started. It can read and generate all the standard
frame rates, and like certain other machines offers
the surprisingly useful feature of converting
A-Time to time code. The machine can be
synchronised to incoming composite video
(complete with a loop-through socket) or word sync
and can also provide word sync for other equipment
to slave to.

One thing which marks this system clearly as
professional kit is the comprehensive handling of
time-code user-bits, which can be set manually or
left to automatically record the date; in addition,
incoming user-bits can be recorded directly.
—or—and this could get confusing—the PDR 1000's
user-bits can record incoming time code while
the main recorded code comes from the internal
code generator.

One thing the machine cannot do is record code
and audio separately from each other—tapes can
not be either prestripped or poststripped. It also does
not incorporate a chase synchroniser, but again,
these features are hardly likely, by definition, to be
required in the application for which it is designed.
And that is perhaps typical of the concept:
everything you are likely to need and very little
that could be considered superfluous. Busy location
people are not going to be impressed with functions
they will never use and which will get in the way;
neither will they be impressed by equipment which
can not do what is needed or take the pace.

HHB seem to have got the balance just about right.
The machines I saw were prototypes, but looked,
felt and behaved like the kind of grown-up machine
you could depend on. Production units may be
available from late January, and then we can start
to find out whether they can deliver the goods in
the field. At the moment they would appear to have
no competition at the price, and will perhaps be
seen as the machines this specialised market has
been waiting for.

HHB Communications Ltd, 33-75 Scrubs
Lane, London NW10 6QJ. Tel: 081 960 2144.
Fax: 081 960 1160.
USA: Independent Audio, 26 Forest Avenue,
Suite 121, Portland, Maine 04101.
Tel: +1 207 773 2424. Fax: +1 207 773 2422.

NSOLE SHOULD COST 7486% MORE

Next time you audition a console, from anyone at any price, ask
whether you are better off. It looks like this: We
select 'headphones' across the board, and assign every channel to the
mix bus. We crank up the studio monitor amp, all the way. We
push up all the channel and master faders, all the way. We turn
the console's monitor level up. All the way. Next, we
listen to each customiser to place his or her ear right next to one of the
monitor's tweeters.

Gingerly, they listen, to not much at all.

Then, we bring the monitor down from what would be
a speaker-destroying level to a merely deafening level. Before
ears are plugged and music blasts forth, we invite one last, close
listen, to confirm the remarkable: Even with everything
assigned and cranked up, a D&R console remains effectively
— and astonishingly — silent.

Of course, a D&R is much more than the quietest analog
board you can buy. So we equip each handcrafted D&R with
dozens of unique, high sonic performance features. And we back
each board with our renowned factory-direct technical support.

How much is all of this worth? Well: if silence is
golden, then every D&R is worth its weight in gold.

In which case, until we raise its price about 75 times, the
D&R console pictured at left is one truly impressive
investment opportunity.

D&R ELECTRONICA BV.
Rijkslaan 135, 1392 CS Woens, The Netherlands
Tel: (+31) 2040-49094 • Fax: (+31) 2040-49087
D&R WEST: (818) 291-9383 • D&R NASHVILLE (615) 661-4982
D&R SOUTH PLYMT. (404) 755-3273 • D&R USA: (404) 388-3411

D&R handcrafts consoles for recording, live sound, theatre, post-production and broadcast, for world-class to proper facilities. “Weight in gold” comments based upon HHB market prices.
JANUARY SALE

CONSOLES (USED)   was  SALE
DDDA S Series 32/4/2 New..........................£4,495 £3,995
Dynamix 16/8 .......................................£695 £595
Raindirk Series 3 10/4 ..............................£1,495 £995
Soundtracs IL36/32 p/bay..........................£11,995 £9,995
Soundtracs 32/24 p/bay ..............................£11,995 £9,995
private use. Immaculate ............................£11,995 £9,995
Soundtracs Solo new with free studio furniture .........£3,542 £2,995
Soundtracs 16/8/16 ..................................£1,250 £995
Soundtracs FM8/4 .....................................£995 £750
TAC Scorpion 16/8 ......................................£2,500 £1,995
TAC Scorpion 2 30 channels inc. 6 stereo, 4 fx ret. p/bays & looms £4,995 £4,750
Trident TSM 32/24/24 .................................. POA
Trident Series 80B 32/24/24 immaculate £13,995 £11,995
Trident Series 70 20/16/16 ..................................£5,995 £4,995
Amek Angela 39 frame fitted 28 channels £7,995 £6,995
Harrison MR3 32 channels p/bay .....................£9,950 £8,950
Harrison Series 10 ...................................... POA
Neve 8128 28 chs + 4 fx ret. ..........................POA
Raindirk Concord 28 ch. p/bay .......................£3,995 £3,500
Soundtracs CM4400 32/24 p/bay .....................£3,995 £3,500
TAC Matchless 26 ch. p/bay ..........................£6,995 £4,995
Tascam Model 50 8/4/8 ..................................£750 £495

VARIous (used)  was  SALE
Apex Compellop ........................................£995 £750
Audio & Design Vocal Stresser ......................£995 £695
Audio & Design Voice Over-Limiter ..............£995 £695
Audio % Design F760 x 4 in rack ..................£995 £695
Calrec compressors x 6 in rack ......................£995 £750
DBX 905 Parametric eq. x 2 ..........................£395 £295
KRK 6000 nearfield monitors new ..................£495 £445
Manley Valve Reference Series .................POA
Mic with psu. ex demo ..................................£1,850 £1,495
Neumann U67 without psu ............................£995 £750
Publisson compressor/limiter ......................£595 £495

RECORDERS (USED)  was  SALE
Alesis D-Dat 3 months use .........................£2,250 £2,000
Fostex E16 .........................................£2,250 £1,795
Fostex M20 TC ......................................£550 £495
Fostex 4030 + remote ................................£995 £750
Lyrec 532 24 track 2'' .........................................Offers
MCI JH110 2 track ...................................£750 £695
Otari MX80 24 track private use. vgc ............£9,995 £8,995
Otari MTR90 MK2 8 track + rem. low hours ......£11,995 £10,995
Otari MX5050 2 track ...............................£595 £495
Otari MX80 32 ch H/B + 8 audio cards £1,995 £995
Revox C790 2 track .................................£1,495 £1,250
Saturn 624 24 track 2'' ...............................£9,995 £7,995
Private use - as new .................................£9,995 £7,995
Sony JH24 24 track 9' autobulate 3 ..............£9,995 £6,995
Sony APR 5000 2 track 1/4'' private use £1,995 £1,495
Tascam ATR60 2 track 1/2 '' ..........................£1,495 £995
Fostex D20 ...............................................£2,995 £2,750
Soundcraft MK3 24 track .............................£4,995 £3,995
Studer A80 MK4 8 track .............................. POA

VARIOUS (USED)  was  SALE
Pye 2 ch. compressor/limiter ......................£595 £495
Timeline Lynx Syncronizer Modules ..............£1,495 £1,450
Valley People Keepex 2 x 2 ..........................£295 £250
VTL CR-3A large capsule condenser mic. new ....£395 £350
MXR 01A Reverb .......................................£295 £195
Summit TLA100 Compressor .......................£995 £750

This is a selection of mostly used equipment from our stock when going to press. For a complete up to date equipment list please use our Dial A Fax service or contact our sales office.

Call Steve Gunn, Howard Jones or Tony Larking.

INSTANT EQUIPMENT LIST BY FAX

Send us complete list of equipment and send fax.

Call Steve Gunn, Howard Jones or Tony Larking.

W WAREHOUSE

www.americanradiohistory.com
The Audio Engineering Society’s 96th convention takes place in Amsterdam this year from February 26th—1st March 1994. The product highlights presented here are not intended to form an exhaustive listing of all products or exhibitors that will appear at the convention. In particular, there are a number of significant products on which details are embargoed until the convention opens. Further information will be given as it becomes available.

Preview compiled by Simon Croft

**AES AMSTERDAM PREVIEW**


- **Audio Follow**: D99. Two complete ranges of networked digital production equipment — DDO Broadcast and Contact — based on hard disk and MO storage, with dedicated controllers for broadcast and production.

- **Audio Kinetics**: G51. ES:Lock 111 system with latest software. Emulation of the Sony R5422 serial standard, as well as Adams Smith Zeta Three and 2600 synchronisers. Now capable of multiple machine control via a single R5422 port, supporting consoles including the AMS-Neve Capricorn.

- **Audiomation Systems**: D24. Displaying the Uptown range of motor fader automation systems. There are now three specialised packages of software which all run on the Uptown platform — music recording, audio-for-film and live sound.

- **Audio Processing Technology**: F24. Latest versions of compression technologies including DSI 100 digital audio transceiver, offering CD quality stereo over ISDN. **Apex**: B31. Line of graphic and parametric equalisers, plus CDR 40 CD recorder with new Digicon digital interface. CDR 40 is a stand-alone 19-inch unit that records CDs. Digicon interface offers functions including transfer of start IDs from DAT, variable delay of 10-640ms and MIDI programme change.

- **Audix Broadcast**: D55. DXT digital phone-in system with digital telephone exchange. Maximum system configuration has 4 digital hybrids, 16 external lines, 4 studio interfaces and a pivotal control station. Also latest ABS consoles for radio stations. **Avid Technology**: C36. New Avid AudioStation cost-effective digital audio editing system, designed as transfer station for dialogue editing and other applications. Also: AudioVision with V2.5 software and Media Composer family of video editors.

- **Biamp Systems**: E55b. Advantage DEQ22SM dual 1/3-octave digitally controlled equaliser, DRC 4x4 digital remote control with audio level and mute functions. A further 4 channels of VCA control can be provided by the RCII unit. SPM412 stereo preamp-mixer, DDL11 with maximum delay of 1.023s, selectable in 0ms increments. **BSS**: Stand No. unconfirmed. Variable system and FPC300 remote controller. **Cadence**: F39. New options for J-Type sound reinforcement console. Sub-matrix module with programmable muting, as well as inserts on sub and matrix outputs. Motorised fader automation option with new Central Control Module. **Calrec**: D25. T Series digitally controlled analogue console for broadcast production, postproduction and recording. Maximum configuration 176 channels and 48 track sends. **Q Series** broadcast production console. Compact desk, Minimixer and RX range of outboard. **Canford Audio**: D01. Samples from biannual catalogue including MS microphone preamplifier. Hugen wireless earphones, headphone limiters, RFS slung microphone control and Rockustics loudspeakers. **CBT**: G36. Turnkey service to broadcasters and equipment

**The large diaphragms for Amsterdam — AKG C3000**
including transmitters, aerials and antenna systems, studio units and radio automation technology.

**Corporate Computer Systems Europe:** F33. Latest developments in codecs including CDQ2001 stereo music MUSICAM system with improved SNR ratio, additional sample rate of 32kHz, scale-factor error correction and concealment and a bit rate error counter.

**Crystal:** H30. Semiconductors including converter chips.

**Cyberlogic:** G92. Two 8-channel Power Systems now available, the NC-807 delivers from 450W 200 to 800W 20 and NC-812 delivers from 800W 20 to 1,400W 20.

**Digital Audio Research:** G21. New look workstation with a hardware fader, automation surface and touchscreen. Full colour graphics and second screen for track display option. Exabyte backup for both Delta and Sigma. Sobre optical disc and the DASS 100 digital audio synchronising system.

**Dolby:** F48. AudioFax, high quality ISDN independent signals. SD3002 delay line.

**EAW:** F47. CH Series mid-high array modules with ‘exceptional control’ of horizontal coverage for improved speech articulation in reverberant environments.

**Eleta:** D27. S440 Broadcast Control Centre and S340 Broadcast Facility Desk in special split version, with Integrated Automation. New S24 Reportophone Plus ready for use with the Eleta Audio ISDN codec if required.

**Felixon:** A36. New broadcast monitor system designed to produce loudspeaker stereo by wave synthesis and thereby avoid adverse effects of room on performance.

**Fidelispac:** F23. Dynamax DCR1000 series digital cartridge machine, hard disk system, sample rate converter, MX Series modular console.

**FM Acoustics:** E37. FM401A power amplifier delivers 1,500W RMS per channel into 1,500 ClassAmp M-1 REM mic preamp. Foreline 3 cable, with 0.662 k per m. 2.5D/216 line driver/line level interface, FM236 Series of linear-phase 36dB/octave electronic crossovers.

**Future Equipment Design:** F31. Steenbeck 1133 film editing flatbed tables with digital audio recording on MO.

**Geffen:** H52. M&E Organizer software demonstrating with three CD playing systems. The M&E Organizer locates sound effects from PC or Mac.

**CDJ Pro automated disc jockey system, CD Sound program for background music management.**

**Genelec:** A36/Rm R. Official launch of model 1033A monitor, replacement for 1019A. MDF cabinets have DCW design and house one 719mm woofer and one 19mm metal-dome tweeter.

**Gold Line:** F52. A portable Audio Test System for less than $3,000: sine wave generator, 4Bm, frequency and impedance meters, a gated pink.

**JWJ**

**Navigator programme assist software and Ednews news editing system.**

**Dalet Digital Media:** D37. On-Air Navigator programme assist software.

**Danish Pro Audio:** Stand No. unconfirmed. New Bruel & Kjær 4035 omnidirectional headband microphone with 140dB SPL and 40Hz-40kHz frequency response.

**Data Conversion Systems:** Stand No. unconfirmed. Converters including new DCS 9000 A/D converter with Super Noise Shaping option and Remote2 overload box.

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**Deltron Components:** Stand No. unconfirmed. Extension of their DGS pro-audio range, including universal panel cut-out multiple (XLR) plugs and DASS 100 digital audio synchronising system.

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**Gold Line:** F52. A portable Audio Test System for less than $3,000: sine wave generator, 4Bm, frequency and impedance meters, a gated pink.
The GS3V combines exceptional audio quality with the power of digital control to deliver an outstanding recording console.

Equipped with the world's most accessible fader automation which includes full MIDI capability, optional SMPTE synchroniser, graphic software and MMC function keys.

Designed with leading-edge technology and manufactured with the most exacting care to deliver the highest standards of consistent, reliable performance GS3V is unequalled in value for money.

If you would like more information, call or write to the address below.

Harmonia Mundia Acoustica: H51. FIAE digital audio editor, designed to eliminate loading and backup times. Has four modules: Organizer, AutoTemp, AutoSequence and AutoCompiler. Also showing PQ Junior and PQ Senior encoding systems. Harris Allied: D91. Enco DAD 490a cart replacement system; Arrakis Diglink modular studio system with simultaneous record-playback and Arrakis TrackStar recording and editing workstation. Haufe: D45. New transformerless output module and other active input and output modules. HHP: F-01. DAT recorders including Portraitool PDR1000 location recording unit and PDR1000TC time-code generator equipped version. Unspecified addition CEDAR range of audio restoration products, which includes DC-1 Decay and the CR-1 Decraclk.


Lab Gruppen: F50. PC-based loudspeaker processor DSP24, includes the EQ and crossover designer software. Measurement, Aided System Designer software enables creation of filters from acoustic analysis data. Also, three compact and lightweight power amplifiers. Lawo: H21. New MC30 digital mixing console for broadcast use. Modular design and integral digital crossbar with up to 496 inputs and any number of outputs. Maximum configuration 120 input-channels, 32 aux and sends and 32 masters. 18 and 20-bit converters, 32-bit internal processing.


Penny & Giles: D34. New VCA Audio Control Module, a stand-alone system that can be controlled by MIDI or patched to P&G MM16 MIDI controller. Each audio channel has independent inputs and outputs. Philips: C51. DCC mastering and duplication equipment. Professional Monitor Company: A10. Transmission line monitor systems, including new TB1 Hi-Fi Monitor Loudspeaker, which uses hybrid line system 'Transflex loading', a truncated transmission line system tuned to 700Hz. Prefer: H27. MBF-1 and MBP-24 microphone preamp mixers. CAM-30 professional portable ENG mixer with four balanced mic-line inputs, phantom supply, three-way parametric equaliser and two symmetrical outputs. Also on show: stereo power amplifier, announcement systems, cables, faders and microphones. Professional Sound Corporation: H15. Microphones, time-code devices and a solar rechargeable 12V power supply. Pro-Bel: H19. Routing and distribution equipment. 5022 sample-rate converter and synchroniser enables signals to be relocked as well as converting between two sample rates. Mini Digital Audio Mixer is configurable for six or 12 AES-EBU channels and offers PFL as well as main outputs. The system uses a standard electronics chassis but allows users to configure control panels. Publison: D21. Infernal Workstation with maximum capacity of 36 hours, latest time-code capabilities and new segment-based digital filtering function. Octane 2 4-track optical disc editing system with dedicated controller.

Quad Electroacoustics: F26. First of 200 Series of 'intelligent' amplifiers. For use on DC supply. Quad 255 is a 100W 100-70V line driver. Optional mains supply provides standby battery and charging facilities. Remote control facilities include level, thermal management, dynamic performance, source switching, security and performance logging. Established 240 amplifier and ESL23 electrostatic speakers. QSC: F58. QSC Control MediaLink connects EX-Series amplifiers for remote control and monitoring.

Sanken: D64B. New CSS-5 shotgun microphone with five rectangular capsules. Mono and stereo capabilities. Sample Rate Systems: G24. Digital transmission and crossover system for loudspeakers using a 20-bit sigma-delta converter. Also showing stand-alone DSP module for prototyping and limited production runs, plus CAD service for designers. Seem Audio: F12. New digital synchroniser and converter BDC-1, handling sampling frequencies from 27kHz to 54kHz. Control over audio format, sampling rate, requantisation and synchronisation. Monitoring functions are incorporated in order to help find the best settings. Word length is 24-bit, I-O formats AES-EBU, SPDIF and optical. Level and noise shaping included. Also expanded 12-channel frame for Segpot mixer. Semnheiser: G27. New SKM5000 UHF hand-held radio mic with integrated antenna and 16 switchable transmission frequencies and new condenser system.
WHEN QUALITY COUNTS

The ACE100 is the practical and preferred solution to the recording and playback of digital audio on a PC or Mac.

For manufacturers seeking to develop professional PC or Mac base audio systems, the ACE100 plug-in Expansion Card provides a simple, effective and economic solution - allowing the simultaneous real time playback/record of CD quality stereo audio. Windows compatible, the extended range of ACE100 products feature 15 bit architecture and balanced analog audio I/O and incorporate field-proven aptX compression. For details of the ACE100 range - call APT.

Making a world of difference to your training

For many years, Wood Norton has trained the personnel who've made the BBC the world's most respected broadcaster on TV and radio. Now this extensively equipped, up to the minute facility is available to you.

At Wood Norton, broadcasters, commercial companies and individuals alike can benefit from experienced and knowledgeable training on professional industry standard video, audio and production equipment.

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WHERE TRAINING WORKS

WHY NOT JOIN US ON A ONE DAY SEMINAR IN LONDON OR Evesham. CALL FOR DETAILS.
Changeable between omnidirectional and supercardioid capsules. For OB, new EK4015 UHF pocket-sized true diversity receiver pack can be switched between 22 frequencies. Also promoting EM1046 multichannel programmable switchable receiver system and range of microphones.

- Shure: B22. Wired and wireless microphones, plus compact mixers.
- Solid State Logic: A11. SSL's theme for this AES convention is the role of audio in multiformat programme production. Included are the G-Plus console system; ScenArt Omnisuit; Screencraft V.5 with Visiontrack; SoundNet; and SL8000 on-air production console.
- Sonic Solutions: B27. DiscVideo option for CD PreMastering System, allows the premastering and MPEG encoding of video and audio prior to recording to Karaoke CD, CD-I-FM', 'Full Motion Video' and CD Video. Now shipping Media Net in CDV I and FDDI versions.
- Sonix Broadcast: C38. New DPD2000 system stores as much as 14 hours of rolling programme. Access can be gained without interrupting recording. Also demonstrating Sound Screen HDX2000 hard-disk-based workstation with networking, newsroom editing and CD jukebox facilities. Disc cart replacement system, NAB carts and players.
- Soundcraft: C21. Professional Division. New SM24 stage monitor console with 8 mono plus 16 mono or 8 stereo sends, with logic controlled system New Delta Theatre with individual routing to the four groups busses, 6 aux sends with pre-post switching and 8x4 matrix. Also: Delta, Vienna II and SM16. Broadcast Division: new Series 10s modular on-air self-op desk. New BVE100S audio-for-video editing console. Also LM1, Series 30.
INTRODUCING APOGEE'S LATEST MASTERPIECE IN ENGINEERING: THE CRQ-12 MULTI-MODE PARAMETRIC EQUALIZER.

Featuring unprecedented sonic quality with dynamic range greater than 115dB and distortion less than 0.003% at +21dBu.

The CRQ-12 is rich with features. Twelve fully parametric filters (each adjustable from 20Hz to 20kHz), four shelving filters and four band-pass filters. All assignable through "Multi-Mode" operation into three distinct configurations. Fan cooled for ultra-stable filter settings. Four outputs (two per channel) each with level control and mute switch. Bypass level controls on all outputs prevent feedback in the event of power loss.

Finally, a sophisticated tool for absolute control that brings out the best in touring systems, control rooms and everything in between. Call or write for detailed information.
In hand—Tektronix' new AM70 fault-finder

There is only 1 VITALIZER
(But now 2 to choose from)

- SPL take the view the best isn't good enough. That's why they created the VITALIZER using a totally original approach to psycho-acoustic design.

The result? An uncompromising and appealing quality of sound that enhances every nuance of sound spectrum.

Manufactured by: SPL, Sound Performance Laboratory Tel: (49) (0) 212 213 80 64/49 (49) 2161 81228; Hauptstrasse 30, D-41322 NEUKIRCHEN; TEN International Distribution by: DLI, International Consulting, Dusseldorf, Tel: (49) (0) 212 2198 140; (49) (0) 212 2122 54; My Media, 23, D-61776 WIESBADEN, International Marketing: The Howe Office, Tel: (44) (0) 944 640 FAX: (44) (0) 945 1551, 173 HIGH STREET, TEDDINGTON, Middx. TW11 8AN

Unspecified new product, Plus Solitaire 24 bus inline console with the Soundtracs proprietary ADP dynamics package and Sequel 24 touring and installation desk. Input channels equipped with 4-band FDB equalisation. Available with ADP. Also established systems, including Jade production console, Solo live and Solo studio range. Stage Tec E57. Nexus modular digital routing system with as many as 256 inputs per Base Device. AES-EBU, SPDIF, analogue interface.


Tandberg Data: F14. TDC9200 digital audio logging system storing 24 hours on one cartridge; TDC9200 playback, editing and on-air system; TDC9400 archiving store with maximum 768-hour capacity. TBS: E36. Comp-Air digital radio system with centralised tapeless storage, networked workstations and on-air studio management.

Tectronix: P44. Hand-held AM70 Audio Pathfinder for portable fault finding in analogue or digital installations.

Toa Electronics: E53. Upgraded version of the ix-11000 digital mixing system for broadcast and postproduction with new ergonomics and features. New Integrated DSP system providing more than 20 different types of signal processing for sound systems. New processor controlled speakers, SR-F5 full range, SL.5 subwoofer and AC-D5 processor.

Ultrasone: F54. Headphones with 'in-front localisation and spatial hearing' including a 4-channel model for HDTV and Surround.

Weircliffe: C56. Latest deaging products for audio and video products.


Yamaha: D17. New M2000 console in formats from 16 to 40 channels, with M2000M recall scene memories and mute patterns. DMP9 digital mixer: 16 channels in 3-unit package. The mixer includes two internal multieffects processors. New software package for DMC1000 desk, with stereo channel and MS matrices for broadcast.

Two new programmable digital equalisers, the YDG2030 graphic and the YPG2006 parametric. New computer controllable power amplifiers.

EXHIBITION TIMES

Saturday: 11.00am to 6.00pm
Sunday: 10.00am to 6.00pm
Monday: 10.00am to 6.00pm
Tuesday: 10.00am to 6.00pm

www.americanradiohistory.com
Soundtracs have earned a reputation for introducing mixing consoles which continually set new industry standards for quality, innovation and value.

A reputation our competitors would desire.

Last year we sent them reeling with the stunning, high-end Jade Production console.

And if Jade turned them green with envy, our new mid-range Solitaire is set to give them the blues.

Awash with features and functions, the Solitaire Production Console combines the finest audio quality with DSP multi-processor control including the option of motorised faders.

Like someone once said - "Innovative in design, dynamic in operation".

Present on every channel the unique FdB Parametric Equaliser™ overcomes the problems of non-linearity in music and the ear providing precise control of all frequencies in the audio spectrum.

In addition, all monitors have a 2-band equaliser plus access to the FdB Parametric Equaliser™.

The on-board ADP, (Assignable Dynamics Processor), provides a comprehensive range of gating, compression, expansion, limiting, modulation and auto-pan functions on each channel.

Plus there's the precision automation, in motorised fader or VCA flavours.

Quite a specification. Quite a console.

Solitaire - much more than moving faders.

Soundtracs PLC 91 Ewell Road, Surbiton, Surrey KT6 6AH, England. Tel: 081 399 3392, Fax: 081 399 6821.
Throughout the video and film community, digital technology is opening up exciting new avenues of creativity. As recent blockbusters like Jurassic Park have demonstrated, digital scene composition and image manipulation can bring to the silver screen events that just a few years ago would literally have been impossible to achieve. And, as growing numbers of home viewers and movie audiences are beginning to appreciate, high-definition images need to be accompanied by high-definition sound.

In many respects, today's newer generation of all-digital facility have only become possible because of dramatic advances in signal-processing technologies, and the proliferation of talented design engineers who have been attracted to our sound community from the computer industries. Stir in a generous amount of R&D investment from well-heeled parent companies, and we now have available a wide selection of consoles, workstations and other components for the all-digital facility of just a handful of minutes into the future.

But selecting the hardware is just one facet of the decision-making process. Finding staff who can both design and install the hardware, and then use it in today's high-pressure, no-excuses postproduction environment, calls for strong nerves. One such West Coast facility that recently made a dramatic commitment to digital audio is Pacific Ocean Post, a video house which is not unfamiliar with leading-edge technologies.

Established in 1985 by video editor-director Alan Kozlowski, producer Sandra Hay (his wife) and partner Jerry Kramer, Santa Monica-based Pacific Ocean Post has earned an enviable reputation for state-of-the-art video editing and special effects.

'We pride ourselves on actively responding to day-to-day technical and creative requirements of the video postproduction industry,' confides POP president Kozlowski. 'Our video facility currently includes 17 editing and post rooms, including a PAL-NTSC on-line component D1 bay (equipped with a Sony Model 9100 editor with Model 8000 switcher); two on-line composite D2-D3 bays (Grass Valley Model 151 editor with Model 200 switcher); an interformat bay (VG 141 editor and 100 switcher); three NTSC-PAL nonlinear bays (Avid Model 2300 Media Composer with Quadra 950s); two digital telecine areas (Rank Ursa with DaVinci Renaissance colour correction); two compositing environments (with Quantal Flash Harrys and HAL); plus an integrated editing and compositing suite (Quantal Henry).

Adding a dedicated audio-for-video/film facility implied the same level of commitment. As Kozlowski explains, the integration of sound had always been part of his company's master plan.

The new sound facility has targeted a diverse client base in feature film, television and commercial markets, in addition to servicing our current clients. It was essential that our sound facility mirror the level of excellence that we've achieved in video postproduction. Within the last couple of years, all the critical elements converged—from recent advances in digital audio technology to the unique location of our new building. During the construction phase, we had the time to assemble a creative team based on long-standing relationships. It was a window of opportunity for POP to create on the digital audio front a sonically superior facility.'

Pet sounds

'What's unique about our new facility,' considers Marc Robertson, General Manager of POP's Sound Department, 'is that we can accommodate a broad client base from feature films through commercials, trailers and television shows. The design of the rooms, the equipment and the caliber of our engineering staff lets us provide, in one facility, the best postproduction sound quality for our client's specific needs.'

POP's new audio post division, referred to as POP Sound, is headed creatively by Bruce Botnick, a name that should need
little introduction as a music producer and scoring mixer of international repute. Botnick's award-winning work can be heard on such films as Aladdin, Beauty and the Beast, Basic Instinct and Total Recall. Last year, the producer-mixer relocated his former Digital Magnetics production facility within Pacific Ocean Post's Santa Monica site. Now a partner in the resultant audio-video complex, Botnick masterminded the overall design and concept for POP's new state-of-the-art digital-audio facility.

Acoustic design was by Bret Thoey of BOTO Design, Venice, CA, who also designed the now Radford Stage for Todd-AO and Prince's Paisley Park complex. Engineering design was handled in house by Tim McColm, POP Sound's Chief Engineer, and Ron Lagerlof, former VP of technical operations at Lucasfilm's Skywalker North facility, and now principal of his own company, Visioneering Design. Staff sound mixers include Jeff Payne, formerly of Waves; Peter Rincon, formerly of The LA Studios; plus Ted Hall and Tim Claman, both with POP.

POP Sound's new 17,000-ft² facility currently includes five dedicated audio rooms, with additional Foley and ADR suites under completion. And state-of-the-art in technical hardware is mirrored by specific attention to the entire environment, after all, producers do like to take the occasional break from multihour sweetening sessions. Housed in a mid-1930s building located close to POP's existing digital video post facility, POP Sound is furnished in what might be referred to as Mediterranean style; a white stucco hacienda features wrought-iron Palladian windows, a red Spanish-tile roof and juniper trees. The facility's interior has been laid out with varying levels of rooftops, plus multi-purpose facades—all of which create the feeling of a small, intimate village beneath a 30-foot bow-truss beam ceiling. Skylights, trees, flagstone and river rock have been included to provide an airy, outdoor ambience. Client lounges, a rooftop patio and an espresso bar are also available.

A fibre-optic cable running beneath the street links the two locations via eight digital audio tie-lines, D2 serial composite video, master house sync, communications and machine control.

"Our largest room, Studio A," Bruce Botnick explains, "measures around 30 x 25 feet, and is intended for larger film-style mixing and dubbing, or video sweetening and mix-to-picture. The room features a 108-input AMS-Neve Capricorn digital console—the first to be delivered to a US facility—equipped with eight monitor buses, LCRS panning, Dolby surround-sound switching, plus two Assignable Facilities Units. These dual AFUs allow system functions to be controlled from two independent operator positions. Just across the hall from Studio A is Studio B, a slightly smaller room that houses a 48-input AMS-Neve Logic 2 digital console, fitted with a 24-track AudioFile hard-disk workstation. Studio B is designed for film and video sessions that can be handled by a single mix engineer, or for premixing music and effects stems, for example.

Vocal/voice-over booths are located between Studio A and Studio B.

'We purposely designed each of the two larger rooms—Studio A and B—to handle different functions,' Botnick explains. 'Both rooms feature Apogee Sound THX monitoring systems, although all five of our current rooms are equipped for multichannel LCR monitoring, plus split surrounds. A and B are also of different sizes, to suit the requirements of medium-scale and large-scale mix-to-picture sessions. Clients have the option of pre-mixing in the smaller, mid-size room, and then moving the project into the bigger mix-to-picture suite. And with digital technology, there are no generational losses, frequency response compromises, noise build-up and the other problems we know all to well with analogue techniques. Our use of removable hard drives and magnet-optical storage within the disk-based editors means that projects can be moved on and off these systems very quickly.

'Studio C is designed primarily for commercials, of course. ..."
mix-to-picture, comedy shows, and the like. The room is designed around a 48-path, 12-fader AMS-Neve Logic 1 digital console equipped with four rather than two layers of assignable functions—the first one in the USA. Four-layer assignability allows the board's channel-strip modules to be assigned to as many as 48 signal paths, routing to a total of two primary groups, stereo and four mono-stereo auxiliary outputs. Full left-centre-right panning is available from each signal path.

Linked directly to the Logic 1 is a 24-track Spectra hard-disk workstation and random-access editor, equipped with two M-O drives and a conventional hard drive. Eight channels of digitised audio can be replayed from the M-O drives, plus 16 from hard disk. The Logic 1 accommodates 48 analogue inputs routing to 28 analogue outputs; inputs can be selected from 12, 2-channel AES-EBU format ports, 48 analogue sources, or 24 internal links from the Spectra editor.

‘As with the Capricorn console,’ Botnick continues, ‘each and every setting on the Logic 1’s control surface can be dynamically automated. Also, since our console and random-access editors are interlinked, in the near future we will be able to couple all of the dynamic automation data to, for example, sound cues in a time-code-referenced event list. If, during editing and soundtrack assembly, a particular sound cue is “moved” from one time-code location to another, all of the mix-level and processing information moves with it.’

‘Studio D is identical in equipment complement to Studio C; the room is slightly smaller in dimensions, but is designed to handle the same wide range of mix-to-picture and pre-ly assignments. In addition, Studio D also houses a full-function NED Synclavier and Post Pro system, which we use for more intricate sound design.’

‘Studio E, our final room, houses a bunch of equipment that I bought with me from my former Digital Magnetics facility. It currently offers an 8-channel Sony K-1105 digital mixer, various time-code synchronisers and a DAR DASS-100 digital sample-rate converter. It is where we handle the more “difficult” digital audio mixes and transfers, including remixing for foreign-language versions, CD mastering, and other video-related sweetening projects.’

Apogee Sound MPTS-1 monitor systems in Studios A and B are THX-approved, and feature Pacific Innovative Electronics power amplifiers driving left, centre, right speaker stacks, plus a dedicated subwoofer channel. Eight JBL Model 8330 cabinets—four per side—handle surround outputs. Dolby SEU-4 Encoder and SDU-4 Decoder units handle LCRS to Left-Right transfers, and monitoring the effects of Dolby’s 4:2:2 matrix-encoding process, now being used on an increasing number of video mixes for network and cable release. Studios C-E feature KKR monitors for LCR, plus JBL, Minimus 12 RMS surrounds, again powered by PIE MOSFET amplifiers.

‘We have made such a major commitment to digital mixing and processing here at POP Sound,’ Bruce Botnick concedes, ‘simply because the technology offers full reset plus recall of every and every system function. All signal elements, including assignment and EQ parameters of the Logic 1, Logic 2 and Capricorn boards, can be updated in just a few seconds, which saves a lot of time. It is not uncommon that we need to schedule pre-lay and mix-to-pic sessions one after the other, in the old days we could spend hours resetting the mixing console and reconfiguring the hardware. Now, it’s just a matter of pushing a couple of buttons, and the engineer can begin almost instantly!’

‘And digital sounds so much better than analoge. Our engineers can perform impossible edits on these hard-disk systems. During a recent session for Disney’s new Pocohontas [animated feature film], we had to replace some parts of a Mel Gibson song. Using the AudioFile, we were able to slip the lyrics word by word, in a remarkably short period of time.’

Central machine room

According to Chief Engineer Tim McColm, a decision was made early in the design of POP Sound to use sophisticated digital routing systems to interconnect each of the mix rooms to a central machine room, where the various processing racks, storage drives and reel-to-reel transports would reside. To an extent, he observes, that idea was only partially successful.

‘Our initial problem,’ the ex-BBC engineer confides, ‘was that a full-function routing system that could handle SDIF2 signals—such as the standard I-O for Capricorn, AudioFile and various tape transports—would have cost us around $250,000! Instead, we decided to compromise to a certain degree, and restrict the amount of cross routing we could offer between rooms.

‘In the end, we specified an NVision NV-4000 128-by-128 switcher—a system that accommodates AES-EBU-format signals at the digital-video sample rate standard of 48kHz. The NV-4000 is linked to a Vistek 48-by-48 video router, so that we can simultaneously switch audio and video sources. The routing system is controlled from each room via an Apple Macintosh LC III computer that runs custom-developed software written for us by Jonathan Egstad. We have lookouts to prevent people desecrating machines and sources during a session, and can even send EMAIL messages between staff members.’

The Capricorn room is assigned 16 AES-EBU-format inputs and 16 AES-EBU outputs (32 channels in each direction); Studios B, C and D each have 12 AES pairs; and Studio E currently offers eight 1-0s to and from the central router. All digital sources and destinations to-from the routing system appear on a series of standard TT patch bays, for manual overpatching as required. Each room is also assigned four AES-EBU pairs as digital tie lines. This configuration allows, for example, a DAT machine in one studio to be accessed from another area via the machine room.

Other sources are assigned to various devices located in the machine room, including a Lexicon LFX-10 digital format converter (two other LFX-10s are permanently assigned handling SDIF2 to AES-format conversions between a pair of Lexicon 480 digital recorders). Also available: a Sony DFX-2400 Sample Rate Converter (for 44.1/48kHz to 16kHz transfers and so on); a DAR DASS 100 Sample Rate Converter; and two Sonic Systems Format Converters assigned to Studio E.

The DASS-100s are particularly useful, McColm points out, during D1 transfers. The unit’s 4-in/4-out format allows channels to be combined and even swapped around, as necessary, during digital dubs. The NVision routing system also lets us diagnose potential routing problems, by selecting any source or destination to a local monitoring point.

Housed in the Terminal Room are the main processing racks for the Capricorn, Logic 1 and Logic 2 consoles. The central machine room contains a pair of Sony PCM-3324 digital multitracks, a Sony PCM-3348 48-track, a Sony PCM-3224A ‘better A-D converters that the 3224’ McColm points out, ‘plus a single AES-EBU I-O pair’; a Sony PCM-3224S (with four channels of AES-EBU I-O, plus two SDIF2 ports); four PCM-7030 time-code-capable DATs; Sondor mag transports; plus various analogue machines, including a Sony APR-24, Studer A820 24-track, Studer A807 4-track ➤
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Gone to ground

If analogue was tricky, as anyone that has even dabbled with digital systems will know all too well, without a properly implemented grounding and interconnect scheme, eliminating clicks, pops and buzzes can be a nightmare. And with a 90dB+ noise floor available from current-generation digital recorders, mixers and editors, even the slightest amount of signal noise is going to show up in a mix. Fortunately, POP Sound were able to take advantage of a power system specified by the building’s former tenants. The telephone company, Tim McColm recalls, ‘had installed a high-capacity, 240V single-phase supply. We were able to split this into two, 120 volt legs, which provided the flexibility to switch our system racks from one leg to the other to reduce phase anomalies and ground leakage. Although it involves a certain amount of trial and error to match leads on each leg—for example, the left-hand side of the Capitol is on one leg, and the right-hand side on the other—we now have a power distribution and grounding system that is remarkably quiet and buzz-free.

But a lot of facilities come to grief when the grounding scheme carries leakage currents because of incorrect use of the safety grounds. As is well known, the

Schematic of grounding (earthing) system employed at Pacific Ocean Post

PACIFIC OCEAN DATALINKS NYPD BLUE

One of the hit US network TV programmes this summer has been NYPD Blue, a fast-paced cop series from Steven Bochco, whose Hill Street Blues and LA Law proved extremely popular around the world. Set in the Big Apple, NYPD Blue also attracted a great deal of pre-season interest. Rumours were circulating throughout the industry that, because of certain ‘adult situations’, ABC Television would have trouble rating the show for a general audience. (As it turned out, with a few judicious cuts, the show passed the network’s internal rating office. The publicity did not damage audience viewing figures.)

Such is the pace of the show’s shooting, editing and post-production schedule, that Bocho often cannot leave his suite of offices on the 20th Fox Picture lot in mid-town Los Angeles to travel the dozen-or-so miles to POP Sound in Santa Monica where the series is mixed in the Capricorn-equipped Studio A. Instead, courtesy of an all-digital audio link, the studio travels to Bocho. A 256kbps 96kbits/second) EDnet link provided by San Francisco-based Entertainment Digital Network is connected to Studio A’s Dolby Surround Sound-encoded output. The 2-channel analogue mix is converted to digital and then passed through a Dolby AC-2 encoder. The 6:1 data-reduced information then travels via several GTE and Pacific Bell exchanges to the director’s viewing room where the original Le-Bright composite is decoded back to LCR and surround channels. Also provided on the digital link are additional 128kbps of information that carry conventional 9-pin serial commands via EDnet’s ED-100 machine-control interface, plus 2-way talkback.

A U-Matic video deck in Bocho’s viewing room contains a video work print with time code which is locked to the record master in POP Sound’s machine room using conventional Alpha Audio BOSS synchronisers. Because of inherent timing delays in the AC-2 encode-decode process, a 2-frame offset is dialled into the Sony edit controller at Bocho’s location. With the audio now in frame-accurate sync with the picture, the director can offer constructive advice and feedback on the Surround Sound mix being prepared at POP Sound.

To date, NYPD Blue is the only network show to make use of such a system, although other TV producers are reported to be showing a great deal of interest in the concept. What does such a system cost?

Within larger metropolitan areas like LA, digital 7-1 services are readily available from the local telephone companies. In this case, says Entertainment Digital Network president Tom Kobayashi, a facility would pay between $500 and $1,000 per month for the leased line plus an additional $450 for interface hardware and audio codecs. The firm offers its online networking service for $100/hour, with time synchroniser interface this becomes $125/hour.

In addition, a system of multeway connectors is used to tie various audio-video transports (remote control) units located in different studios. The Sony PCM-S series multitracks are accessed via a system of 50-pin D-Sub connectors, while conventional 9-pin serial interfaces handle directly compatible ATRs and VTRs, plus TimeLine Lynx protocols. In addition to Lynx II modules and Master Controllers, Alpha Audio BOSS 2 time-code-based synchronisers are also available.
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minimum requirements—and a legally required safety feature—for any facility to install power safety grounds to all equipment. In a regular installation, the power safety ground is bonded to building metalwork at multiple locations. Leakage currents in this scheme are not returned to the transformer in an orderly fashion, and will rise in level according to the number of circuits fed and the distance of the cable run. This is not satisfactory for an audio-video facility installation.

In the isolated power ground scheme, ground connections on power outlets are isolated from metalwork and separate wires run back to isolated bus bars in the power panels in a star fashion, one wire per outlet. The individual panel bus bars are subsequently connected to another main isolated bus bar in the main panel. This isolated bus bar is then connected to a point in the power room near the power transformer, where the centre tap, electrical company ground and neutral join together.

‘Now, since each outlet has a separate path back, leakage currents in this system can return to the transformer without affecting adjacent circuits.

‘A second part of the system is the clean technical program (signal) ground. The programme ground path is kept free of leakage currents from the power ground system by being directly disconnected from it—we simply drop shields at appropriate places. An XIT rod is situated as near as possible to the patch bays and technical equipment in the central machine room, and extends outwards in a similar way to the safety ground through a series of isolated bus bars to patch bay shield and the technical ground terminals of our equipment.

The XIT rod should never be subjected to AC leakage; it simply provides a quiet reference to the signal shields and equipment commons. By providing separate bus bars for the different types of signals, any digital noise, capacitively coupled audio band noise, time-code crosstalk and serial control noise drain back to the rod independently.

‘We route the Audio Ground via series of bus bars to each equipment rack. We even went as far as establishing separate bus bars from the digital, analogue and time-code-serial communications racks, from which we start out to the individual equipment. We drop local shields at the point of entry into the patch bays, and then shield back to the bus-bar points. In this way, we establish an integral clean-programme shield from the XIT Rod through the rack to the point of entry; the short length of chassis ground carried from the equipment to the patch bay provides shielding up to that point. But, by ensuring that no power leakage currents can flow within our separate programme shields, we make sure that the systems is entirely quiet.

‘We were again fortunate here at POP,’ McColm adds, ‘because we were able to literally gut the building of all power runs, and start from scratch. Studios often run into problems when they are forced to modify or add to an existing system for which wiring diagrams may no longer exist. In that case, a system that was well-behaved might suddenly start to pick up all sorts of outside interference whenever the new piece of hardware is connected or turned on. It can be a real nightmare.

‘It was definitely worth the effort here, because we wanted to be able to add and remove equipment as necessary, without having to worry about upsetting the grounding schemes. Also, we were doubly fortunate in having access to a totally separate three-phase, 240V supply that we are able to use for all non-technical needs, including air conditioning and other noise-producing devices!'
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DAT Ageing

Dear sir, with regard to the test result revealed in 'DAT Tape Ageing Test', Studio Sound, September 1993, we are very concerned and disappointed that Maxell DAT tape achieved results that indicate that our product was the poorest quality when subjected to the accelerated storage test.

As you may be aware, Maxell has accumulated experience of more than 15 years with metal tapes. We have never seen or heard of the problem described in the test article, that Maxell metal tapes may have a corrosion problem and be unusable after a long storage period. We would like to present the following technical information indicating we have the confidence that Maxell metal tapes can never cause such a problem.

According to the article, the three Maxell products tested showed serious corrosion across the tape surface throughout its total length appearing as streaks on the edges and spots in the middle of the tape. In our opinion this is not corrosion.

After inspecting the samples which were used in the magazine test, we have concluded that the 'spots and streaks' materialized due to the following.

We presume that a lot of condensation must have accumulated on the tape surface under the accelerated test conditions of 60°C, 90%RH (Relative Humidity). In the case of heavy condensation, a chemical composition, one of additives in the back coating layer dissolved into water and deposited on to the tape surface, which resulted in a sticking phenomenon between tape layers. The sticking phenomenon usually produces streaks on tape edges owing to an excessive tape running tension.

Table 1 shows comparison of magnetic properties for the tested samples returned from the magazine and for new tapes taken from the same production batch as the tested samples. The degradation of maximum flux density 'Bm' of the tested samples is only 4% compared with Bm of the new tapes. If corrosion had occurred which as pointed out by the magazine, more serious degradation of Bm would have occurred.

Table 2 shows changes of relative humidity when the controlled temperature varies under the conditions of two factors of temperature and humidity. The conditions of 60°C, 90%RH easily cause condensation depending on control accuracy of temperature and humidity, in the chamber where samples are exposed and when the chamber's door is frequently opened during the test. In this case, it should be a waterproof test rather than the accelerated ageing test.

Maxell measure the characteristics at accelerated conditions of 60°C, 90%RH for 90 days (regarding the evaluation of corrosion and any practical problems, these conditions are approximately equivalent to more than 15 years in normal room conditions). Figs.1 and 2 show the test result. In the figures, Maxell DAT tapes show equal quality level or better compared with competitors in the storage stability.

We have confidence that our DAT tapes do not incur any practical problems after the long storage period.

S. Ueda, Manager, QA Department, Magnetic Tape Division, Maxell, Kyoto, Japan.
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It's rarely easy to say it all in just a few words. In fact even those words are superfluous, since the dynamics processors COMPOSER and INTELLIGATE® are already among the best-selling signal processors in the world today. Whether they are working hard on stage, e.g. with Metallica, Def Leppard, Aerosmith and others, or being put through their paces in thousands of professional recording studios such as Lucas Arts LA, Robert Scovill etc. With our unique Interactive Technology and the famous Behringer quality, we have set new industry standards that are considered sensational by the international trade press.

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They do it for less
And if you still believe that excellence is only achieved by spending US$ 2,000, — on a unit, compare Behringer products with any other product on the market and listen to the difference. The sensational price of US$ 450, — and a full 5-year warranty and your only decision can be to invest in Behringer quality. If you want more information about the COMPOSER and INTELLIGATE or any others from the extensive Behringer range please feel free to contact us or your local distributor.

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Your Ear Is The Judge

*Recommended list price may alter slightly within countries.
Radio is an immediate medium but this does not usually apply to the equipment. However, Birmingham independent station Buzz FM needed to move quickly at the end of last year to remain on air. Muff Murfin, who used to run a single operation from the Basement Studio at 145 Wardour Street, Soho, bought the transmitter, licence and premises of the station, only to see the previous owner rip out and take away all the technical equipment on a local TV news programme.

Remaining calm, Murfin contacted Audio Systems Components (ASC) on Tuesday 22nd November and ordered a system that could at least get the station back on the air. ASC put together a package of a Soundcraft MBI Series 5 console, two CD players and a DART (floppy disk) cartridge machine, delivering it only 24 hours after receiving the order. Buzz FM went back on air on the afternoon of Thursday, 24th November. Murfin commented that the basic setup was only a temporary arrangement but that it was good enough to keep the station running. The Buzz licence comes up for renewal by The Radio Authority at the end of April and it is intended to install a more elaborate studio if the reapplication is successful.

Some 20 years after they first started to appear, independent local radio stations (ILRs) are now beginning to live up to the second part of their name. With all the major regions and cities covered by at least one commercial operation, a new out of licences has been concentrating on smaller communities.

The latest to go on-air was Yorkshire Coast Radio (YCR), which started transmissions on the 7th November 1993. Based in the North Yorkshire seaside resort of Scarborough, the station's broadcast region is bounded by Whitby in the north and Bridlington in the south, going in land-as far as Malton. This gives the station what radio advertising people call a total survey area (TSA) of only around 75,000 adults.

"All the big ILRs are gone," observes Len Lewis, Managing Director of Audio Systems Components (ASC), which supplied the equipment for YCR, "and nowadays it's all smaller stations and a lot of colleges. We did about 20-30 studio packages during 1993, each costing between £8,000 and £10,000." The YCR package was assembled at Aldermaston, transported to Scarborough and then installed in five days. This gave the station staff three weeks to work with the new equipment before going on-air.

The installation features an MBI Series 5 desk in the commercial production studio and a Series 10 in On-Air, with full racks, cabling, plus other equipment. An important aspect is the first UK use of the Digilink digital audio hard-disk system, a PC-based device which controls and programs the CD players and gives up to 16 hours recording time. "Automation saves money because you don't need people, and the costs are actually coming down," says Lewis.

Although people are essential for every radio station, when both your staff and broadcasting hours are restricted, automation can make life easier. 'Two hours a day are automatically triggered off the computer, including the links that we can record onto it,' explains YCR's station manager, Jerry Scott. 'The reason for it is our small TSA. It's the same as with any new business—you need to watch the costs and the ad revenue.'

YCR broadcasts 7am to 7pm Monday to Friday and on Sunday, while Saturday runs from 7 to 10pm. The night time schedule is covered by opting in to YCR's parent station Minster FM, based in York. The rest of the time is a mix of presenters (Scott himself and Heather Ewing take the bulk of the shows) and sequences on Digilink.

With an Edison transmitter supplied and serviced by NTL, Scott reckons that the station has been well equipped for a good price. "The rules on technical specifications have been relaxed now—before we would have had to have spent about half-a-million pounds but this cost us under £100,000. I hope this is the way radio will go—smaller stations."

While this seems like a trend, the UK still has a long way to go to match the USA (The New Mexico town of Albuquerque, which has a TSA of 470,000, sustains 37 radio stations. A long way to go...)

Audio Systems Components. Tel: 0734 811000.

This new generation of budget-conscious radio broadcaster is being targeted by Soundcraft operation National Transcommunications Limited. Now with a new corporate identity and name, NTL, the company is starting to shed the elitist research-led image held when it was the engineering division of the IBA.

NTL have launched a new range of 'off-the-shelf' transmission systems, which are totally standardised and range from 20W single-ended to 500W fully-duplicated, all housed in 19-inch racks.

Twenty years after they first started to appear, independent local radio stations (ILRs) are now beginning to live up to the second part of their name.

Prices start at just under £5,000 and rise depending on system power.

Explaining the move, Mike Thorne, NTL's Radio Business Manager, says, 'The one-off hand-built system is getting harder and harder to sustain, especially for lower-budgeted stations. By using a standard design which is common to the whole range, we can offer what people want without any fuss and at a price they can afford.'

NTL no longer have a monopoly over transmission and while still the major provider for television and the larger ILRs, a number of new companies have appeared in the small radio station market. Most obvious are Phoenix Communications and Sound Broadcast Services (sbs), both of which have recently undertaken transmission contracts in the UK and abroad.

Acknowledging this, NTL's public relations manager Bruce Randall says, 'We are now looking at the community, smaller radio stations and in this we are getting a lot of competition from Phoenix and sbs and we can't let that go unchallenged.'

NTL. Tel: 0962 823434.

Console manufacturer Soundcraft Electronics have long been successful in the recording and live sound markets. The broadcast market has not followed so readily, however, despite a number of offerings by the company, including the SAC range of radio desks towards the end of the 1980s.

Soundcraft Broadcast is a new attempt to capture the broadcast market. This new division will include the existing range of Soundcraft location recording, on-air and postproduction desks but is augmented by the radio and TV production consoles of MBI, which was acquired by Soundcraft's parent, the Harman group, in July 1991.

In charge of the new division is Adrian Curtis, who has been with Soundcraft for nine years. He is joined by head of UK sales Jon Ridol. To launch the operation, the company will be staging a series of open evenings at its factory during the early part of 1994.

The new division completes Soundcraft's programme of developing specific products and groups for its different consoles. Broadcast joins the established divisions of Professional (live and studio) and Spirit, which concentrates on budget boards for various markets.

Adrian Curtis acknowledges that Soundcraft were not well known for their broadcast products in the UK but added that it had a stronger profile internationally. 'We've customised many of our professional products for broadcast and now we are going to make this standard. We can also incorporate MBI and build on its profile,' he says.

Soundcraft Broadcast will focus on television, radio, location recording and audio-for-video applications, which is seen as the crossover between some of its postproduction desks. Curtis recently hinted that there was the possibility of new product launches at both AES and NAB this year.

Soundcraft Electronics. Tel: 0707 685000.

Kevin Hilton

Introducing a new column dedicated to broadcast issues
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The leading instrument
Throughout the world, members of the audio and business are now asking themselves, 'why doesn't our business match the excitement, the enthusiasm and the forward motion of five years or ten years ago?' If the audio industry actually is in a kind of 'spiritual' decline as many observers have suggested, it may be because of a loss of pride in our product—effectively a loss of concern for the end user of our product. Many people in audio have ceased to care about the quality of that product or have no financial incentive to care about it. Consequently, the real question in the audio business should be 'what is our product today?' And the answer must be—as it was in a GEC advertising campaign of a few years ago—that 'quality is our most important product.'

One attitude that has continually plagued the pro-audio industry for over 50 years is the loss of connection to the audio consumer. We have all talked to professional audio people who act as though their job is where the audio product starts and finishes. Yet it is clear that the consumer of audio via any number of different electronic entertainment mediums, is far less enthusiastic about recent so-called advances in audio recording and reproduction technology than the industry itself is. In many cases, the consumer cannot even hear the audio improvements. Consider then, the following examples of how quality makes all the difference to the audio product for the consumer.

In the theatre: live theatre has always suffered from the classic paradigm, 'the audio person is the last member of the theatre technical team to be involved in any new production.' Audio concerns are invariably secondary to those of lighting, staging and set construction. Yet there is no good reason that state-of-the-art technology cannot be used to enhance the live theatre experience for every seat in the house. Most theatre companies, taking a show on the road travel with their own sound system. This eliminates the vagaries of having to use house sound installations. But the quality of what accompanies a show can vary wildly when the feet hit the street. For example, the road company of the theatrical and motion picture chestnut, 42nd Street, travels with an adequate sound system. But what may be adequate for some houses may be barely acceptable in others. In Boston, the sound was acceptable to the main house, just barely tolerable in the mezzanine and totally inadequate in the oxygen-starved heights of the balcony. The speakers and their hanging trapeze and frame are the minimal package with which one can travel. Contrast this with the production of My Secret Garden who, in the same house, succeeded in providing sound that expanded the world of what the theatre is supposed to be. The show carried the most elaborate sound mixing, equalisation, signal processing and wireless microphone matrix I have ever seen on a production. The My Secret Garden system used a video-computer display of the operating parameters of each mic (and there were many). The sound consultant and the union audio operator constantly moved about the hall checking audio quality at a large number of different seat locations spread around the auditorium. The difference between the two shows is that one was on its way to Broadway and the other has long since closed.

In television broadcast: the desirability of stereo surround reproduction of television in the home is of particular importance to the present and future prosperity of the professional audio business, since public enthusiasm for the process can increase the acceptance of home video theatre installations and provide increased business activity for studios offering facilities for more elaborate stereo mixes in audio-for-video postproduction. Yet it is curious to note that the syndicated Star Trek; The Next Generation and its companion series Star Trek: Deep Space Nine (as yet available in the UK on video only), provide the highest quality of stereo surround mixes and accomplish virtually flawless distribution to the individual stations that use the show via satellite. It is no exaggeration to say that this is an example of the best sound on television and proves that satellite distribution can be used with virtually flawless results week after week.

It is equally curious to note that one of America's three major television networks could not get the audio feed to stay in-phase for a popular theatrical movie during a network run in the East. Regardless of whether it was due to stereo sensing amplifiers on line changing phase to create pseudo-stereo assuming (incorrectly) a monaural feed was being used, or whether it was due to satellite phase problems or other associated transmission phasing errors, the result was that of audio cancellation on home televisions—for a film which has one of the best theatrical Dolly Surround Sound mixes produced in recent memory (mine, at least).

In radio broadcast: the average FM radio station uses so many signal processing, compressing, expanding and equalising devices that the sound begins to resemble the aural equivalent of baby food—note the recent unrest over compressed classical music broadcasting in the UK (and be prepared for it to spread to sound broadcast for television). The reality of FM radio listening still emphasises 'drive time' programming but with the migration of any musicalism from AM radio looking likely to be complete during the 1990s, it is true to say that FM listeners will present an increasingly eclectic pattern than they did five or ten years ago. In addition to this, the quality of car audio systems is now such that even factory installed systems offer significant fidelity improvement over expensive custom systems which might have been considered above average as recently as five years ago.

In Motion Pictures: one of the most important places to provide positive audio, both to encourage new audience levels of sound reproduction for the glories of Dolly Surround Sound with the concomitant de facto pitch for expanding the home theatre installation base. Yet outside of Los Angeles, which is a film studio 'company town' and New York City, movie theatres with state-of-the-art audio systems are the exception not the rule. Theatre owners do not tend to buy speakers exclusively from THX-approved suppliers. Instead—and unsurprisingly—they tend to buy on price, and the low bid remains the province of many pecuniary theatre-chain owners. It is possible in Boise, Boston and Buffalo, for example, to view recent major releases like Lost Action Hero and The Fugitive with mediocre monaural sound.

Worse than this, however, is the fact that the decision of whether or not you will see a film with the mix designed for that film is likely to depend upon the state-of-mind of an overworked projectionist responsible for between two and 14 theatres in a modern multiplex complex. Add to all this the consideration that the majority of projection booths are not equipped with acceptable stereo monitors (if they are equipped with any at all) and frequently utilise automation systems that default to ordinary monophonic sound far too readily. It becomes clear that good movie sound is actually achieved far too infrequently.

The point here is to suggest that we as members of the audio industry do everything in our power to give our 'public' the very best audio that we can. Not only could this be made in the audio of the world of electronic entertainment serves both the public and the industry very badly. The corollary to this is to provide the best possible quality in production despite the problems in final reproduction. Too many theatre setups achieve only the more monotonous and frequently mixed to accommodate lowest common denominator—the ordinary multiplex theatre.

I can not offer any simple solution to these perceived problems, but I am confident that if we do our best as part of this important industry, we can surely 'improve the breed.'

Outside of Los Angeles, which is a film studio 'company town', and New York City, movie theatres with state-of-the-art audio systems are the exception not the rule.
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CLOSE TO THE EDIT

Pursuing an understanding of postproduction practices, Francis Rumsey offers an audio engineer's account of digital video tape formats.

Last October I began an occasional series designed to introduce the audio engineer to 'peripheral technologies' such as video, computing and multimedia. I think it is vital for audio engineers to understand more about such fields, since the 'audio-only' business is increasingly difficult to survive in—requiring a diversification of one's business to embrace other types of production. To follow the explanation of digital video data reduction, I shall provide a summary of the essential features of the most recent professional digital video tape formats. It is especially timely because last autumn saw the introduction of two new component recording formats, namely Sony's Digital Betacam and the D-5 from Panasonic.

Background

Commercially available digital video recorders appeared on the market slightly later than digital audio recorders, mainly because they are more complicated and required technology to develop further before they became economically viable. Digital video recording was capable of offering the same advantages over analogue recording as in audio—namely no generation loss in copying, high signal integrity, ease of timebase and dropout correction, and direct interfacing with digital signal processing for effects purposes. The large number of generations through which a video signal typically passes in postproduction often exceeds the number encountered in a typical audio operation, and the quality loss that resulted with analogue recorders meant that postproduction flexibility was limited.

Video recording formats fall into two basic types—those which store composite video and those which store component video. As introduced in 'Less is more', Studio Sound, October 1993, storing a video signal in 'component' form (consisting of a luminance and two colour difference signals) results in better picture quality than when it is stored in composite form (where the colour information is combined with the luminance), because the possibility for cross-modulation effects is reduced, among other things.

In the late 1970s and early 1980s, open-reel formats such as the composite 1-inch 'C' format were widely used in broadcast operations. These machines used digital timebase correction to restore the correct timing relationships of the video signal on replay, but were basically analogue recorders. U-Matic camcorders, and such camcorders have formed the mainstay of news-gathering operations around the world. To date, sales of Betacam have exceeded those of M2 by a considerable margin, and the existence of this installed base is one of the key factors behind a number of Sony's decisions regarding Digital Betacam.

As far as audio is concerned, analogue video formats have provided a number of options. Both Betacam and M2 offered two linear-analogue audio tracks, with switchable Dolby C noise reduction, plus a time-code track, and there were also machines which were capable of storing stereo in FM (frequency modulated) form in the same area of tape as the video (rather as in consumer '8 mm' VTRs). The FM tracks could only be recorded at the same time as the video, and thus were not particularly useful in editing operations. A digital audio option was also introduced for both formats which allowed two channels of digital audio to be recorded independently of the video, with independent editing capabilities, but one of the analogue linear tracks was sacrificed for this purpose. The result was a hybrid machine which stored analogue video and digital audio, but proved useful for the high quality audio applications associated with NICAM stereo TV broadcasts.

Since 1986, there has been steady growth in the development and use of digital VTRs, both component and composite, and it is likely that all future VTR formats will be digital for the simple reason that it is more cost-effective in a number of senses—manufacturing, maintenance, and operationally.
First generation
digital VTRs

The first commercial digital VTR format to be introduced was D1, which came at a high cost, high specification machine designed to record component video to the CCIR 601 standard. (See Studio Sound, October 1985.) D1 machines were switchable between 525/60 and 625/50 formats, and used a 1/2-inch cassette available in three sizes, offering playing times up to 76 minutes. Video was coded to 8-bit accuracy, and because of the use of component recording this standard has been adopted principally by high-end postproduction houses where many generations of copying would be expected, and where it is most important to retain picture quality. Owing to the high cost of D1 machines, though, the format did not find its way into many broadcasting establishments.

The D2 format, which owed a lot to Ampex, was an attempt to produce a digital VTR with more mass-market appeal, and used composite recording in order that the machine could more realistically be used as a plug-in replacement for analogue composite VTR formats such as the C format. By using azimuth recording and a slower tape speed (similar to DAT audio machines) the D2 format consumed less tape and thus could offer a longer playing time, providing over three hours of storage on the largest tape (which was also of the 1/2-inch cassette type). Although portable D2 machines are now available, camcorders were never produced in either D1 or D2 formats for the simple reason that they would be too bulky for even the most diligent shoulder D2 machines are considerably cheaper than D1 machines, and thus have been more widely adopted in broadcasting.

Audio channels in digital VTRs

All of the digital VTR formats offer four independent digital audio tracks. These tracks are normally of 20-bit resolution (although this resolution may not be matched by the onboard converters), and sampled at 48kHz. The rate of 48kHz has stuck in the video world, whereas 44.1kHz is used almost universally in the audio world, leading to difficulties in exchanging signals that can only be resolved using sample-rate conversion. Although the 48kHz rate is easy to handle in 525/505 systems, it is less easy in 525/60 systems (or more correctly 525/59.94) because there is not an integer multiple of samples per TV frame. This has led to considerable difficulties in synchronisation of digital audio, and there is currently a certain amount of debate surrounding the correct sync point between audio and video for standards purposes. It is not intended, though, to delve further into this problem here because it has been well documented and would require a whole article of its own.

The increased number of audio channels, compared with older formats, has arisen largely because of the demands of stereo television. Both Sony and Panasonic are offering four channels in the new 1/2-inch component formats (See below: 'D5 and Digital Betacam'), and both suggest that more would be possible. It appears that Sony have left room in their format for eight linear audio channels, and Panasonic indicate that more audio channels would be possible using data reduction. Further audio features of the DVTR formats are described below.

Second generation
DVTR formats

Adding to the collection of D's, there are now D3, D5 and DCT formats. Digital Betacam does not have a number or an abbreviation. Apart from DCT, the more recent DVTR formats all use 1/2-inch tape. This makes them very appealing from a tape cost point of view, and also because of the possibility for camcorders and portable machines. The move at the moment is distinctly in the direction of component digital systems, largely because there is now a straightforward means of interconnecting such signals digitally using a serial digital interface (SDI), thus simplifying system installations considerably. Until recently, digital component video signals could only be interconnected using a parallel interface which covered limited distances, but the new serial interface now carries either 8-bit or 10-bit video with an optional four channels of audio at a rate of 270MHz over a single coaxial cable.

Apart from the D2 format, which is a composite format introduced in 1990, these second-generation formats are all component. The Ampex DCT has been established and available for about a year, while D5 and Digital Betacam have only just been launched and are appearing on the market at this very moment. D5 and Digital Betacam are competing head-on for the same market, but there are some interesting differences between them — which are promoted as either strengths or weaknesses depending on whose company you work for! The biggest controversy lies in the adoption or otherwise of data reduction techniques for the video signal.

Ampex DCT

DCT (Digital Component Technology) is an interesting format, based as it is on aspects of the D2 format together with technology borrowed from Ampex' data storage technology (DST) used in computing fields. Significantly, Ampex refer to the machine as being a 'tape drive', very much in computing terms.

It is a 1/2-inch cassette transport offering around three hours of recording time on the largest cassette, and is switchable between 525-line and 625-line formats. DCT uses mild video data reduction in order to make possible the recording of component video signals without compromising playing time, but this is not the same form of reduction as used by Sony in Digital Betacam. The format is clearly aimed at high end postproduction, and is part of a family of Ampex digital video products designed for studio work. Because of the 1/2-inch cassette it is highly unlikely that the format will ever find its way into camcorder designs, but the wide track pitch is likely to result in good interchange capability between machines and a certain degree of robustness (although this is equally dependent on the error correction system).

Ampex make considerable capital of the responsiveness of the transport from a mechanical point of view, it having very fast acceleration and cueing capabilities.

D3

Panasonic's D3 format is a composite format like D2, but uses 1/2-inch tape. This has made possible the development of portables and camcorders, as requested by the Japanese broadcaster NHK.
What a concept...

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The particulars are endless, but the bottom line is simple: Otari has done more than just reinventing midrange audio consoles.
and the format has found favour with a number of broadcasters including the BBC. It uses very high density azimuth recording, and is capable of storing video on either 14h or 11a tape. Using the thinner tape, around four hours of storage time is available, or three hours with the thicker tape. Again, a number of cassette sizes are available.

**D5 and Digital Betacam**

Sony and Panasonic had slightly different problems to contend with when they developed dissimilar 3/4-inch component formats. Sony had to consider a large installed base of analogue Betacam machines, whereas Panasonic had a rather lower, although still substantial number of analogue M2 machines. Additionally, Panasonic already had D3, which is itself a 3/4-inch format. Both companies had to consider how they could introduce a new digital format without inflicting too much pain on their existing customers, and while at the same time leaving options open for the future.

The upshot has been that Digital Betacam retains replay compatibility with analogue Betacam tapes, whereas D5 machines are replay compatible with D3 tapes but not with analogue M2 tapes. Analogue Betacam machines have also been introduced which have SDI capabilities to allow them to be integrated into component digital studios, and some Digital Betacam machines will replay analogue Betacam tapes via the SDI. Both formats accept the full 10-bits of video information from the SDI, but the most important difference between the formats is that Panasonic record linear PCM while Sony use roughly 2:1 data reduction for the video (but not for the audio). This is really where the battleground will lie between the formats, because in a number of other respects there is very little to choose between them. They both offer roughly the same maximum recording time of around two hours (although the Panasonic machine only achieves this using the thinner 1 1/4 tape), and the various jogging, cueing and slow motion facilities are similar. Although both formats include the promise of a camcorder in 1994, there are no camcorders in the first group of product releases.

Previously I described the various approaches to video data reduction which are used. Sony are using a form of reduction which is quite mild in comparison with what is possible, and it is based on JPEG-like principles in that it works only within single frames, rather than using any interframe prediction or motion compensation techniques. This is in order to make possible the freeze-frame and editing functions normally associated with VTRs. The very limited amount of data reduction is calculated to provide the benefits of low tape usage, long playing time and format ruggedness, and allows machines to retain replay compatibility with analogue tapes, while providing as near transparent recording quality as possible.

D5 machines, on the other hand, use no data reduction and record the full 10 bits of the component digital signal, thus offering a quality in excess of D1 (which used eight bits). This is achieved by using mechanisms of the same type as D3, but with a doubling of the linear tape-speed and the use of four recording heads instead of two. D3 tapes can be replayed by halving the D3 tape speed, and they may optionally be converted into a serial component format within the machine, allowing replay to be integrated within a component digital studio.

### 16:9 compatibility

A hot issue at the moment is the move towards 16:9 aspect ratio in television production, since many believe that wide-screen pictures are going to become more important in the near future. Both D5 and Digital Betacam will operate in a 16:9 mode, because the CCIR-601 sampling structure can also be used for wide pictures without changing any of its sampling parameters. The penalty is a slight reduction in horizontal resolution because the same number of sampling points is spread over a greater line width.

Panasonic have taken the step of allowing a second 16:9 recording mode which does not compromise resolution, using a higher sampling rate of 15MHz (as opposed to the normal 13.5MHz), although this only operates to 8-bit resolution. This they call ‘Extended CCIR-601’, and they have incorporated an extended mode SDI operating at a data rate of 360Mbit/s to carry this wide-screen component signal.

### High-definition recording

Panasonic have also retained the option of using the D5 recorder for storing high definition video. Since no data reduction was employed for the storage of conventional definition pictures it would be possible to add processing around a normal D5 machine to reduce the HDTV data rate by a factor of 4:1 and store the pictures without modification to the machine.

### Audio features

Both formats offer a means of monitoring the selected digital audio track in jog mode, using DSP to simulate reel rocking, and both offer variable audio crossfade at the edit point. It is also possible to perform read-before-write recording of both audio and video for postproduction applications which might, for example, involve the addition of effects or subtitles. Using read before write, such operations could be performed on a single machine.

Sony have a useful optional board which acts to correctly pitch audio during varispeed play modes. Since it is possible to replay video at 15% of standard play speed in order to shorten or lengthen programmes, audio would otherwise be slightly pitch shifted as a result.

### Conclusions

There seems to me to be little doubt that the future of conventional definition TV installations lies with component digital recorders using the SDI for interconnection. 3/4-inch formats will allow an integrated system approach from camcorder to postproduction. Digital Betacam has the advantage of compatibility with analogue Betacam recordings, and will thus prove attractive to the large number of users already committed to Betacam and who may want a slow changeover to digital component video. These people may have large libraries of existing Betacam tapes, D5s on the other hand have a number of attractive features: namely the uncompressed 10-bit recording resolution, replay compatibility with D3, the enhanced 16:9 recording mode and the implied upgrade path to HDTV recording.

As a postscript, it is amusing to note that digital video recorders have been offering 20-bit audio for a number of years now, whereas audio formats have notably lagged behind. It is unusual for the video world to beat the audio world at its own game! So much for the poor relation.
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A guide to features and reviews published in Studio Sound, Volume 35. The right-hand column gives the month of publication and the page number.
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New tape heads supplied for most makes, Tape Head Re-lapping/Re-Profiling, Same day turn round. Head technology, 11 Britannia Way, Stanwell, Staines, Middlesex. Tel: 01 527 566.


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IT may seem like only yesterday that Hugo Zaccharelli was telling us how Holophonics would change the world but it is actually ten years ago. We now have a new dummy head, binaural system. Holophonics, as the system was called, gave good binaural effects, thanks mainly to Zaccharelli's use of an early digital tape deck to preserve inter-ear phase relationships. The inventor got more than his fair share of publicity because he dressed the system up in a gable of impressive pseudoscientific theory, and promised that it would soon work with headphones. It never did, and Holophonics ended up as a sound effects system used to add zest to a few pop records. The effects recording—only record released by CBS—sank almost immediately, although I did once see it in the 'Comedy' rack of a record shop. The latest system is called Sensaura. It comes from Thorn-EMI's Central Research Laboratory (CRL) at Hayes in Middlesex, and is being used by EMI Records. For a (refreshing) change, CRL acknowledge that the idea is as old as the hills, and simply lay claim to the use of digital processing power to make it work better—and with loudspeakers.

In everyday life, the human head acts as a baffle. Sound has to travel around the head in order to reach both ears, producing a phase shift and level change between each ear. The brain decodes these differences in order to locate the sound source. A binaural recording system uses a head or baffle, with ear microphones, to create this phase and level information. When replayed through headphones, the sound mimics the original field. The effect is lost when the signals are replayed through loudspeakers, because sound from each channel reaches both ears.

CRL have been using a B&K head, digital tape recorder and digital signal processing. The DSP flattens the mid-range hump, of around 15Db at 3-4kHz, causing the well-known 'twist through the ear effect'. Sound passes through the resonant cavity of the head in the ear used during recording, and through the resonant cavity of the listener's ear during playback. The DSP can provide more accurate mirror image compensation than the analogue filter circuits previously used. But it was not easy to get right, and when CRL did get it right EMI Records said the recordings had to work when replayed through speakers as well as headphones. So CRL used DSP to play another old trick. Sound from one channel is led through to the other, in reverse phase, to cancel out the sound which leaks speaker to speaker. The sound from the bleed has to be stepped forward in time, because it must cancel leakage into the more direct sound path. So both channels are delayed. All this is easier with digital circuitry now that it was when JVC did it with analogue biphonics 20 years ago.

CRL also built an 8-channel mixer which can blend the sound from six mono spot mics into the binaural stereo feed. EMI's first release with the 'Sensaura—audio reality' logo was scheduled to be Frank Sinatra's Duets album, with 'Divine Comedy', a song album by actress Milla Jovovich, produced by Rupert Hine, pegged for January or February release. Both use only low-key binaural effects. Nine classical orchestral works in full-blown binaural follow some time later in 1994.

I heard demonstrations of several test recordings under conditions. The stereo from loudspeakers is wide with no hole in the middle, and a spread well outside the speakers. Switching to mono revealed no obvious compatibility problems. But on headphones I thought the system was a big disappointment. The sound stayed firmly inside my head, creating an effect no better than listeners will get from an 'ordinary' stereo recording. Where the ordinary recording is made with a simple crossed pair or similar mic setup, Sensaura may well deliver less on headphones.

CRL have done a very good job of making binaural recordings that play through speakers. But if the effect on headphones has to be sacrificed, then the question has to be asked is 'why bother?' With binaural stereo, as in life, there is no free lunch.

Keep an ear open for forthcoming full-blown releases and listen both on speakers and headphones.

In the USA the copyright agencies really do hang tough. The Harry Fox Agency, part of the National Music Publishers Association, are paying for music publisher Frank Music to pursue a test case through the Federal courts on behalf of over 140 other publishers. The publishers are using Compuserve, which describes itself as the world's most comprehensive computerised information services. The claim is for $70 million in damages and costs for copyright infringement in just one song. If the publisher wins, the HFA, which represents 12,000 publishers and controls the licensing of 75% of all the music played in the US, will claim from any other electronic distribution system which carries music.

By using Compuserve (as provider of the host computer on which the music material is temporarily stored) rather than individual users of the system, the music publishers are creating a precedent for the future. President Clinton plans an information superhighway which will let US citizens exchange electronic information by national data cable. If the HFA win their case against Compuserve, whatever government body controls the superhighway computer will be legally responsible for policing all data that passes through it.

Over a million owners of PCs around the world connect their computers to the phone line with a modem and use the Compuserve network to exchange electronic mail messages and access 1,700 different bulletin boards. Subscribers pay around $10 a month to post messages on the board service. The messages can then be read and replied to by other subscribers. Most of the messages are text—for instance, news and views on new technology. But one board, called the MIDI/Music Forum, allows subscribers to convert music into MIDI files and exchange them. One subscriber deposits or uploads a file and any number of other subscribers download it to control a MIDI instrument or produce sound through a PC with sound card.

By logging use of the musical bulletin board, the HFA have been able to cite what they describe as 690 'wilful acts of infringement', involving more than 500 songs owned by some of the 12,000 music publishers it represents. The Agency claims to have tried talking to Compuserve, but to have received no 'meaningful response'. So the HFA have now backed a 'class action suit' in the Federal Court for the Southern District of New York. Class action cases must centre on one specific example of alleged infringement. The HFA chose 'Unchained Melody', written by composers Alex North and Hy Zaret and published by HFA member Franck Music. In the UK we remember (or try to forget) this as the song that went with Jimmy Young.

The publisher and HFA are claiming the maximum penalty of $100,000 for each of the 690 logged acts of infringement. In addition to the $69 million claimed in damages, the HFA are also asking Compuserve to desist from all further infringements and to pay all legal fees. If the 'Unchained Melody' case is successful, the HFA will sue any other electronic delivery service which carries copyright music.

'So this matter is not being taken or given lightly by either side', says Edward Murphy, Chief Executive Officer of the HFA and NMPA. Murphy argues that it is the responsibility of any electronic delivery service to police the content of its host computer. 'If we can do it, they can do it', says Murphy.
For the first time, DENON is offering professional users the choice of drawer or cartridge loading in the latest two CD players from the company.

While the CD cartridge has become very popular, and not just with broadcasters, or for jingles, some users still prefer drawer loading. Now DENON is able to offer the choice, in machines designed and built for professionals.

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- RS422 interface
- Fader start option
- Single track or continuous play modes
- Automatic re-cue after single track play
- Narrow body

For more information and to arrange a demonstration contact Hayden Pro-Audio
By lunch time she had recorded forty-one spot effects, five background effects, and twelve music beds. She also made twenty-two cuts, eighteen fades, and built ten playlists. From there, she set up three music loops and nine effects loops. When she was done, she handed the entire job to the client—on a single disk.

Pretty good first session.