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REPLICATION

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Blue 330
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ON LINE
Townhouse Mastering

ON SHOW
REPLItech Review

ON TEST
Digidesign Masterlist CD
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DNA Dictator
Nagra-D

STUDIO
SOUND
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Visions of the future

The rise and rise of Digital Audio Workstations has had a considerable impact on the audio and video industries. DAWs have changed forever the way in which these industries work and the way in which we must work within them. But while this is readily recognised, the full impact of their development has yet to be felt.

Right now, one of the hot areas of refinement is in what is variously termed Open Media Systems, Open Systems Interchange and other similar variations on the theme. What this amounts to—or is intended to offer with its realisation—is ready compatibility between different systems from different manufacturers. This will be available both through compatibility of 'project' discs and over networks linking the systems or facilities. The logical extension of this is that completed projects could be 'downloaded' to a mastering facility in a similar way. The idea of transferring mastering work over a data network of some sort has already been the subject of considerable discussion—the prohibiting factor being that the data reduction schemes necessary to make such transfers necessarily produce sub-standard masters.

While we can look forward to a time when these shortcomings have been overcome, we can also feel apprehensive about a time when electronic distribution methods may well render the present concept of records (and videos) and record retailers obsolete. And the mastering, duplication and replication industries as we know them, equally so.

So what is to be done? Sabotage music and video-on-demand systems at every opportunity? Initiate industrial action against any parties involved in such schemes? Commission hackers and other Luddites to further the cause of material media? Maybe not.

If on-line distribution systems do pose a threat to established means of distribution, the salvation of the LP and the CD is surely self evident. Music is more than product—despite the idioms of the record business. Music is a culture in its own right. Music is about more than what comes out of a hi-fi system; it is about more than the artists who make it; it is about more than the record companies who determine what will and what will not be released. It is about albums and singles—about owning them, playing them, studying sleeve notes. It is about rarity and collectability, about catalogues and 'complete' collections. It is about fanaticism. It is certainly not about convenience or technology.

That music-on-demand (MOD) and video-on-demand (VOD) systems will be set up is certain. Whether they will be accepted as an alternative to physical media is not. Personally, I can imagine a day when VOD systems have replaced the majority of prerecorded video collections but find it much harder to envisage a world without record collectors and record collections. But it could happen. Market forces can be manipulated—the demise of the vinyl LP, for example, had more to do with decisions taken in Japanese corporate headquarters than with the instincts of record buyers. Anyone still unconvinced should consider the VHS-Betamax conflict for the ultimate proof. And so it may be with MOD—take away the physical media options, and the public have to choose between electronically distributed fresh recordings and their stagnant record collection. But keep everyone aware of the culture of the record rather than simply that of the music, and the future can be a very prosperous one for those manufacturing tomorrow's 'collectors items'.

Tim Goodyer

Cover: Focusrite *Blue 315* and *Blue 330* mastering processors

International News

Spirit of ROM

Premier CD-ROM manufacturer Nimbus Information Systems have adopted the *Spirit Folio* as their console of choice for generating audio for their MPEG video compression service. Presently, the *Folio* is employed in providing audio for Nimbus' sell-through Video-CD and corporate work but the company anticipate increasing use as their range of audio applications expands.
**Spirit by Soundcraft, UK.
Tel: +44 1707 665000.**

PMD Magnetics have entered the exclusive circle of international companies to attract the appreciation of the Japanese imaging corporation, Konica. In recognition of their support of Konica's line of software, the Japanese giant have endorsed a a plague (presented to PMD MD Geoff Dance by Konica UK's John Townsend).
PMD Magnetics, UK. Tel: +44 789 268579.

Ablex buyout

Racal Electronics have agreed a deal with the British Ablex concern amounting to approximately £2m with a further £5m available for European expansion. the aim is to position Ablex at the forefront of multimedia replication.

Headed by CD-ROM pioneer John Metcalf and Stephen McEwen, the move furthers Ablex' progress from cassette duplication for Decca through data and CD replication for Racal to state-of-the-art multimedia players. McEwan comments, 'The music industry needs to react swiftly to varying demand between cassettes and CDs for a single title. The software industry similarly needs to cope with the variation in demand for CD-ROM and floppy disk. We'll serve both these industries on a one-stop shopping basis, as well as offering the best facilities in Europe for the exciting multimedia market'.
**Ablex, Harcourt, UK.
Tel: +44 1925 680131.**

SADiE mastering

Launched at AES, Paris, SA&V's latest *SADiE* software (v2.2) supports mastering to *Red Book* CD-R and DPP 8mm Exabyte tape formats. The facility has quickly begun to prove itself popular with users of the hard-disk editor, including Brussels-based Musica Numeris.

The development coincides with moves towards CD-R and Exabyte as successors to the old Sony *1630* mastering standard. With the new software, *SADiE* will transfer data to both Exabyte and CD-R at in excess of 2x real time for stereo audio (over 5x real time, mono)—currently the only nonlinear editor currently able to do this.

Other v2.2 improvements include Exabyte backup, 16, 20 and 24-bit editing, a hardware controller interface and a high-quality time scrunch—The Speech Editor—for automated speech editing. ATM networking is currently under development.
**Studio Audio & Video, UK.
Tel: +44 1353 648888.**

Sony cassette copiers

General audio cassette copying has just become some 25% cheaper through the launch of four new Sony copiers—the mono *CCP1300* and *CCP1400* and stereo *CCP2300* and *CCP2400*.

The *1300* and *2300* models have one playback and three record compartments while the *1400* and *2400* slave units have four record compartments. Slave units can be added to accommodate the production of up to 43 copies at 16x normal speed.

The new line is ideally suited to any facility with a regular requirement for short-run cassette copying.
**Sony Corporation of America.
Tel: +1 201 930 1000.
Sony Broadcast & Professional
Europe. Tel: +44 1256 55011.**

Sony *CCP 1400* audio cassette copier

Responding to the rising standards in CD printing, Werner Kammann have launched to *Kammann 15-0* printer, offering 'photo quality' 120 lines-per-cm, 4-colour imaging at some 3000 cycles-per-hour. The *15-0* employs fully automatic offset and screen printing and incorporates accurately measurement of CDs (via a proprietary process) in order to deliver consistent CD finishing. A second print screen can be fitted for overprinting or varnishing which will also facilitate 2-colour printing (4.50 cycles-per-hour) with the 4C head disconnected. Werner Kammann, Germany. Tel: +49 5223 181-0.

Compar Checkers

Swiss QC people Compar AG have launched a new generation of CD checking equipment for inclusion in in-line replication systems. According to the company, CDs are identified by a code in the centre of the CD. This code consists of either alphanumerical characters, a bar code or 'special signs' which are monitored automatically by the Code Checker. Two signals from a PC or user interface readily initialise teach and test procedures, and the system can be incorporated into pad and screen print situations. It has a capacity of some 180 units per minute to match fast-running production lines.

Also, primarily for the CD-ROM market, Compar have a Cavity Checker for identifying molding defects in CD production. **Compar, Switzerland. Tel: +41 1 784 8833.**

German CD expansion

German CD manufacturer Optimal Production have recently begun to set up a new electroforming department for CD and CD-ROM manufacture at their Röbel plant. Already established in both audio and data CD manufacture, Optimal are looking to a dramatic increase in demand for CD-ROM—from its present level of 20% of production to some 30m units within three years—and then to development of Video CD and CD-i for their future. June 1994

The new facility will incorporate a number of units from fellow Germans, Technotrans—an *NB3* unit, plating preparation line, water purification and waste treatment, matrix back finisher and test equipment alongside other items such as an ODC mastering module. In addition, Technotrans—formed in 1970 and now operating worldwide —will be supplying education and support services. **Technotrans, Germany. Tel: +49 2583 3010. Technotrans, US. Tel: +1 310 597 3521.**

CD-R 4x First

Yamaha's *CDR100* is claimed to be the first 3rd-generation CD recording technology to run at 4x speed. And they are calling it 'affordable'.

Christened the *Expert Series*, and designed for use with PC (IBM and *Macintosh*) hosts, the system will handle the full variety of CD application—sound, data and image —in standard CD-DA, CD-ROM, CD-i, and CD-ROM XA formats.

Presently, the *Expert Series* consists of the *CDR100* Internal CD Reorder and the *CDE100* External CD Recorder interfaced via SCSI-2 to a PC. **Yamaha-Kemble Music (UK). Tel: +44 1908 366700. Yamaha Corporation of America. Tel: +1 714 522 9011.**

Future US expansion

Leading Hollywood mastering facility, Future Disc Systems, have acquired the 8000-ft^2 premises they have been leasing with a view to expanding to fill its entire space. Reluctant to change their location, but under pressure to expand their capacity, Future bought the building they have half occupied for 12 years last month. The immediate future for Future involves the construction of a sixth studio—which will be larger than any of the existing five—and a client lounge and reception area.

Already recognised as a quality facility, Future Disc Systems have 20-24-bit mastering and support all current digital music formats. **Future Disc Systems, US. Tel: +1 213 876 8733.**

Korea's Woong Jin Media are anticipating completion of a second Robi System CD replication line later this year. Woong Jin, based in Seoul, specialise in all forms of CD replication for the far eastern education information and cultural market, and are eager to court international clients. WJM President (above) comments, 'Our company is fully equipped to export high quality CD Audio, CD-ROM, CD-i and Video CD. As time becomes critical, we can provide our clients a full and quick service in handling their orders. We are now ready to export our products to other Asian countries and even Europe or USA',

Compar's latest CD QC system

Polished black plexiglass and bronze mirror spacers give this CD frame a obvious 'foyer appeal' for any facility involved in the production of CDs. Designed to be mounted either horizontally or vertically, the US Hit Rack company have done their homework well and can expect to be hearing from Producers, Engineers A&R Executives and mastering facilities around the globe immediately. Hit Rack, US. Tel: +1 818 788 3635.

Mastering On-line

New York City's Digital Domain mastering house have chosen on-line publicity via Internet's World Wide Web (WWW) as a route to interested audio engineers and musicians. Information regarding such issues as A–D conversion, dithering and tape preparation for mastering are now available from Chief Engineer Bob Katz on DD's Home Page.

Information is also available on Digital Domain's CD replication, graphic design and digital audio equipment are also available at any (relative) time of the night or day.
Digital Domain, USA.
Tel: +1 212 369 2932.
WWW: http://www.panix.com:/~ bobkatz.

Symetrix Leveler

Hot from the States comes the Symetrix 422 Stereo AGC-Leveler. The 422 is a sophisticated 1U-high line-level Automatic Gain Control-leveler featuring parallel input-output metering for ease of use. Controls include Threshold, Response (speed) and Peak Limiting. US price is a reasonable $595.

Launced at the American NSCA Show, the 422 is pitched at cassette duplication operations as well as Symetrix regular broadcast and audio recording market.
Symetrix, US.
Tel: +1 206 787 3222.

StageTech CD launches

The first of two new items from Swedish StageTech is the *d2d* disc-to-disc mastering system. Offered as an input system suitable for making glass masters directly from CD-R discs or replicated CDs, the *d2d* dovetails neatly with the increasing number of recording and post facilities taking on premastering responsibilities.

Along with audio (*Red Book*) CDs, the *d2d* will duplicate CD-ROM mode 1 and mode 2 (to the *Yellow Book*) and mixed-mode CD-ROM/CD-DA or single-session CD-Rs with finalised TOC (to *Orange Book Pt II*) and also Sonic Solutions PM-CDs. Full subcode information for P-channel and all three Q-channel modes are supported to the glass master.

QC checking is incorporated into the recording process and a report giving BLER, E22 and uncorrectable C2 (E32) errors is automatically generated. For audio CDs, further E32 details are included.

The application of the *d2d* is to be extended with support for CD+G, CD-ROM XA, CDi, Video-CD and Photo-CD currently under development.

Also from StageTech comes the *EC2* CD error checker—an affordable, 3U-high, stand-alone checker and analyser. Designed with mastering houses, CD-ROM houses and users in mind, the *EC2* allows audio CDs and CD-ROMs to be checked to Red, Orange and Yellow Book standards. The disc under test is scanned for BURST, BLER, E11, E21, E31, E22 and E32 (broken down into A, H and AH categories) errors are identified and output to a parallel printer port. Functions are compatible with *Windows 3.1* software control.
StageTech AB, Sweden.
Tel: +46 40 150018. ■

StageTech *d2d* CD mastering system

TOWNHOUSE POSTPRODUCTION

Bill Foster visits the recently-opened mastering facility at London's Townhouse Studios and discovers a facility ready to meet American mastering rooms on their own terms

Townhouse Studios in west London has been one of the UK's premier recording facilities since it was opened in 1978 as part of Richard Branson's expanding Virgin empire.

The recording studios were designed by the then 'flavour of the month' studio designer, Tom Hidley, during his Eastlake incarnation. In 1980 an Eastlake disc cutting room was added, and equipped with a state-of-the-art Neumann *VMS80* cutting lathe. This was mainly in response to demands from the studio's prestige clientele for a disc cutting room that would match the standard of the studios, although it was also intended that the facility should service the needs of the rapidly growing Virgin Records catalogue.

Townhouse's first disc cutting engineer was Ian Cooper. Ian trained at Pye Studios, and immediately prior to Townhouse had been at Utopia. In 1981, Cooper was joined by his former Pye and Utopia colleague Gordon Vicary, sharing the one room by working on a day on-day off basis (a system they had begun at Utopia and which continues to this day).

When Neumann introduced Direct Metal Mastering (DMM) in 1983, Townhouse was one of the first studios to adopt this technology and purchase a *VMS82* lathe. This was installed in a side room and linked to the cutting room by tie lines; allowing both conventional lacquer and copper discs to be cut—simultaneously if required.

As Townhouse's reputation grew, so did the business, and in 1983 a second, smaller disc cutting room was added and fitted with another *VMS80*. Gordon Vicary moved into this room, where he was joined by the studio's copy engineer, Tony Cousins, who has expressed an interest in joining the cutting department.

Ian Cooper, therefore, needed a new 'cell mate'. Kevin Metcalf from Utopia—and previously with CTS Studios in north London—was recruited to make up the quartet, and this team worked together for almost ten years before Cooper and Cousins left to jointly set up Metropolis Mastering in early 1983.

In addition to the cutting engineers, there are five other postproduction staff working at Townhouse. Bunt Stafford-Clark and Dave Bernez handle CD premastering, Robert Frake is responsible for cassette copying, while Barry Woodward and Frank Arkwright look after a Sonic Solutions editing room.

The departure of Cooper and Cousins to Metropolis coincided with the arrival of a new owner for Townhouse—Thorn EMI. When Richard Branson sold Virgin Records to EMI in 1992 the Virgin studios had also been included in the package and Townhouse now came under the control of EMI's Director of UK Studio Operations and Manager of Abbey Road Studios, Ken Townsend.

Townsend installed Martin Benge—the former manager of EMI 301 Studios in Sydney and Ken Townsend's successor-designate-to oversee the integration of Townhouse into EMI. This somewhat naturally caused some concern amongst the staff there, but these concerns were very quickly dispelled when it was realised that not only did EMI intend to retain Townhouse; they also planned to inject some much-needed investment into what had by then become a rather jaded-looking facility.

When Benge arrived to take up office, one replacement for the two departing cutting engineers had already been found. Jack Adams—a cutting engineer since the mid-1970s—had built a reputation as one of the UK's foremost mastering engineers, particularly in the dance music field.

Martin Benge set about finding the fourth cutting engineer and it was not long before he alighted upon Geoff Pesche. Following ten years at Tape One Studios and a brief spell at Utopia, Pesche was working at Copymasters. Over the years he had also developed a reputation worthy of the Townhouse name.

Adams and Pesche had worked together at Tape One for ten years, and so their pairing at Townhouse was, according to Adams, a happy if unexpected reunion. It is probably fair to say that their personalities and style of working are somewhat different from their predecessors, but the fact that the disc cutting fraternity in London

Entrance to The Townhouse cutting area

No1. Cutting/mastering room

is relatively small and everyone knows everyone else, their arrival was hopefully not too much of a 'culture shock' for the existing Townhouse team.

The new facility

According to Gay Marshall, who has managed the postproduction facility at Townhouse since the studios opened, the new mastering rooms have been a long time coming; 'I've been fighting to get new rooms for at least six years. Eventually we got plans put together, but then there was the EMI takeover and I was really worried that everything might get shelved.'

EMI's decision to put Martin Benge in charge of Townhouse to oversee the transition was a lucky break for Marshall and her team. The studio he had managed in Australia—301 in Sydney—had a small but highly successful disc cutting and CD pre-mastering business, and Benge fully appreciated the benefit in both commercial and financial terms of having such a facility as part of a studio complex.

To everyone's delight (and relief, no doubt),the go-ahead was given for the construction of a totally new postproduction area—to be built on pillars above the existing Studio 2. This new area would comprise two rooms fully equipped for CD pre-mastering and disc cutting, one CD premastering-editing room with additional facilities for audio-for-video work, and a machine room containing the DMM lathe and other ancillary equipment.

There is also a cassette copying room in another part of the building with 60 Aiwa machines and another editing room downstairs containing a Sonic Solutions system. This mainly handles session editing work. As part of the plan one of the old disc cutting rooms is to be refurbished and the editing suite relocated there.

Unfortunately, before the postproduction department was to get their new facility there was to be another setback. Mid-way through 1993 the building company working on the project went bankrupt. Most of the shell work had already been completed, but when a new builder was brought in it was discovered that (no doubt due to their financial problems) the previous company had cut corners and used inferior materials, effectively making the area unsafe. As a result, the whole lot was taken down, new footings dug and the shell rebuilt. By this time almost a year had been lost.

The job of acoustic design was given to Sam Toyashima. The engineers were canvassed on their preferences as to the shape of the rooms, client placement and other ideas based on their experience working in other rooms. The result is three comfortable, fairly spacious rooms decorated in fabric and wood, with a combination of direct and concealed lighting. Two of the rooms also have the benefit of natural light through large windows at one end—the third, as Jack Adams is quick to point out, does not.

'It was actually very difficult for them to better the rooms downstairs,' he says. 'Sonically these new rooms are totally different from the old ones. They were very live—they had a "ping" to them. It's a more dead setup here, which is why we have a 4K monitoring rig against 1K downstairs. But this is what people like now, and that's what we've got.'

The monitoring system Adams refers to is the *BB5* from the Professional Monitor Company, driven by Bryston amps; a system that is becoming increasingly popular among mastering facilities.

Kevin Metcalf had reservations about leaving his old room, mainly because of concerns over monitoring. 'I'd worked in there for 12 years and it had a great vibe to it. I could do everything blindfold. It was a shock coming in here, especially choosing the monitoring. We went round other studios and I didn't like anything as much as what I had already.

'When the rooms were built we tried a few different monitors, but I didn't like any of them. At this point I was getting desperate; I thought, I'm not moving. And then we put the PMCs in and everything was wonderful. They show up everything—which is actually what you want. They're also more accurate on the bottom end than the old ones.

'What I find frightening now is that when I add 1dB at 10kHz, it sounds like 5dBs. I've still got the NS10s of course. They sound horrible but most engineers and producers use them as a reference. I think I might get a sub woofer for them.'

Equipment

The installation of the equipment was carried out by Townhouse's own technical staff; a team headed by the studio's chief engineer, Martin Bastin.

Even though a great deal of the existing equipment was simply moved up from the old rooms, the entire signal path in the cutting rooms has been redesigned. The old Neumann ▶
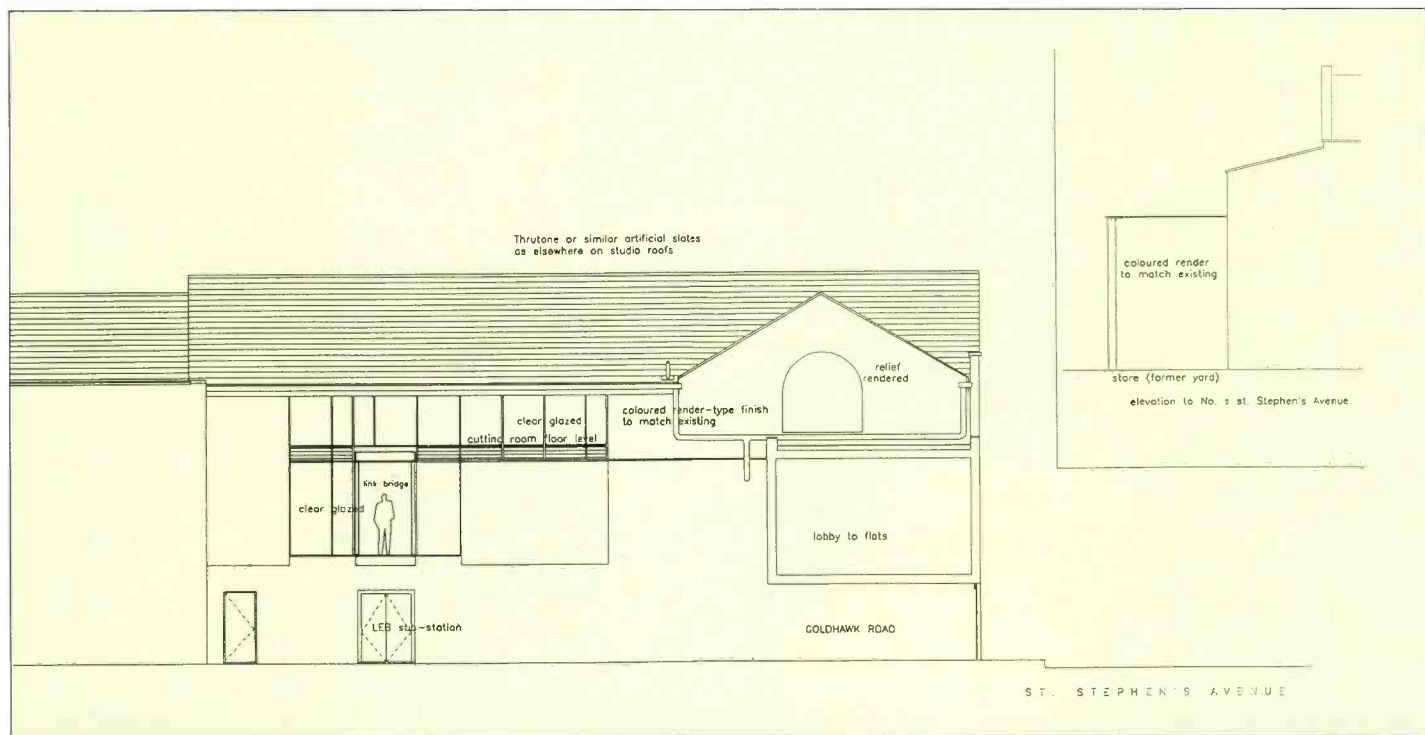
South elevation of The Townhouse

consoles—with their multitude of op amps—were tossed on the skip. The modules, however, were retained at the request of the engineers. These have been modified with newer components and, together with all the lathe controls, metering, analogue equalisers and some of the other outboard equipment, are now fitted into the new consoles.

The analogue output of each piece of equipment comes up on the jackfield, and an in-house designed monitor selector enables the engineers to listen to any these outputs without loading the signal. Bastin points out that in the old Neumann desks many of the modules were in circuit all the time. The new consoles are effectively just routing devices. 'We can patch everything so that we keep the noise to a minimum,'comments Geoff Pesche.

Another advantage of having totally new consoles was the speed of changeover it allowed between old rooms and new. According to Metcalf this was achieved with only a one week shutdown per room.

Apart from the *PCM-1630* systems—which are linked via ADT interfaces—the entire digital signal path is AES-EBU. But the fact that hardly any equipment— even the so-called high end professional kit—provides a separate word clock facility caused a major design headache for Bastin—until he discovered the NTP *575-100* asynchronous

AES-EBU switcher.

This device accepts up to 16 separate AES-EBU format inputs and, using a simple front panel menu, can route any of these inputs to any one or more outputs. Depending on the configuration, all 16 inputs could accept signals simultaneously and be routed to 16 different outputs. Input signals are re-clocked and re-shaped, and all inputs and outputs are transformer balanced.

The engineers are unanimous in their praise of the NTP. 'We had arguments for ages over what do to about digital routing and we finally got that box, which is absolutely heroic,' says Adams, pointing to the NTP.

'I can't believe how we managed without it,' adds Metcalf. 'It's solved all our problems and just made life so simple. Whatever you're playing back clocks the output, and you can go to more than one ▶

No 3. Digital/editing/postproduction room

Detailed floor plan showing cutting and machine rooms.
Room 1: Kevin Metcalf/Jack Adams. Room 2: Bunt Stafford-Clark/Dave Bernez.
Room 3: Gordon Vicary/Geoff Pesche

destination at once.'

All three postproduction rooms have a broadly similar inventory of equalisers and other outboard gear, although there are minor differences—some based on preference, others probably determined by what was available.

Analogue EQs are a mixture of Summit, Klein & Hummell and GML, with the latter being found in all areas. Adams says other EQs are being evaluated: 'We've been assured that as new kit becomes available, if we need it we'll get it. They are totally committed to being the top facility. We recently had the newer Summits in to try. They're gorgeous, very passive; you had to do an awful lot before you could hear it. And you have to wait for them to warm up!'

Metcalf likes his Klein & Hummell *UE 400*s; 'I've grown up with these—used them for the last 15 years. They're very accurate. You can attenuate each band and I like the shelf EQs as well. But I think the combination of the three works very well. The Neumann EQs are broad based, the GMLs are very warm and the K&H are very accurate.'

Townhouse currently have one of the legendary Sontec *MES 432C* stereo equalisers on loan for evaluation. Despite the fact that almost every cutting room in the US has these EQs—and has had since the late 1970s—there are no more than a handful to be found in Europe. However, Sontec are now in the process of organising a distributor in the UK and from the engineers' initial reaction

it would seem that the studio's General Manager, Ian Davidson, may be digging deep into his pockets very soon. After all, it would be a bit unfair if only one room had a Sontec, wouldn't it?

Working practice

Analogue-to-digital conversion is a subject which many engineers could write a book about—and arguably some come close to doing just that. It's therefore quite refreshing to find that the Townhouse cutting engineers have a slightly more relaxed approach to the subject.

Each room is equipped with one A–D convertor; a Prism *AD-1*. Are they therefore the convertor of choice? 'It depends,' says Pesche. 'I won't necessarily use the Prism for a CD master.'

Gordon Vicary puts the Prism on the front end of the *PCM-7030* but prefers the sound of the Apogee-modified A–Ds in the *PCM-1630* for CD mastering. Kevin Metcalf agrees: 'If I go to *1630* I use the *1630*s A–Ds. It's the nearest thing to what I set up.'

Very few projects come to Townhouse on *1630* these days. There are some analogue tapes, but most material arrives on DAT.

'Eighty percent of what comes to me is on DAT' says Adams. 'Sometimes I get 30ips ¹/₂-inch *SR*, which is daft because it's not what the system is optimised for. When I'm working from analogue tapes everything gets EQ'd, levelled and transferred via the Prism *AD-1* onto U-matic. Then

it's edited together to make the CD, album and cassette masters. I get into the digital domain as soon as possible.

'If it's left to me I'll do the *Red Book* style of digital black between tracks. But I've been doing a lot of Japanese work lately and there's a vibe there that if they're doing a 1970s style rock album they want it to sound '70s style; not only the EQ but also things like the noise on the tape. They don't want digital silence between tracks, they want the noise between tracks. I think both approaches are correct, it's just what the individual wants from their own CD.'

Are digital tapes kept in the digital domain?

For some of the engineers this depends on the programme material, but Metcalf is emphatic: 'I always go analogue, I don't EQ anything digitally. If it comes off DAT I go through the Apogee D–A and then EQ in analogue. I think everything should go through the analogue stage at least once just to warm it up. But I only do it the once —never twice.'

'If it's something that's taken six months to record and it's cost £250,000 to make you'll want to keep the signal as clean as possible,' says Pesche. 'If I'm just adding a bit of top it'll stay digital, but the Effector is limited in what it can do, so if you want to do lots of work it has to go back to analogue.'

An unusual feature in the Townhouse rooms is the provision of Switchcraft *Soft Limiter Barrels*. These were originally used on the input of the Prism *AD-1* to emulate the effect than can be obtained using an Apogee A–D. However they are now permanently wired into the jackfield.

'A lot of people are coming to the conclusion that soft limiting is better done just as the signal leaves analogue into digital rather than in the digital domain,' says Vicary. 'Using the soft limiters I reckon I can get 5dBs more level on a rock album,' adds Pesche.

But on dance music Adams works a different way: 'I'll limit digitally using my *DAL-1000*, driving it as hard as I can until I hear it working; then I'll back it off a fraction. But what an awful lot of the record companies want is an American sound, and on the stuff I'm getting from the States they seem so intent on keeping the meters on the end stops from the first breath to the fade that they're losing the plot; they're compressing for the sake of it. They don't seem to care what it sounds like—it's just got to be loud. You find yourself doing the same thing, but you've got to be careful.'

Many of the leading American mastering facilities are now using the Apogee *UV-1000* encoder, not only for its UV22 dynamic range enhancement, but also because it can increase the level on a digital master by removing digital 'overs'. Geoff Pesche says that Townhouse have tried the system but were not overly impressed; 'We had it on test for a while, but if you look at it on a 'scope it's distorting the signal.'

There is talk of getting Sonic Solutions systems for the two cutting rooms, but at present digital editing is handled by *DAE-3000*s connected to a pair of *DMR-2000* U-matics and a *PCM-7030*. Each room also has a second DAT machine and a Sony *CDP-2700* CD player. ▶
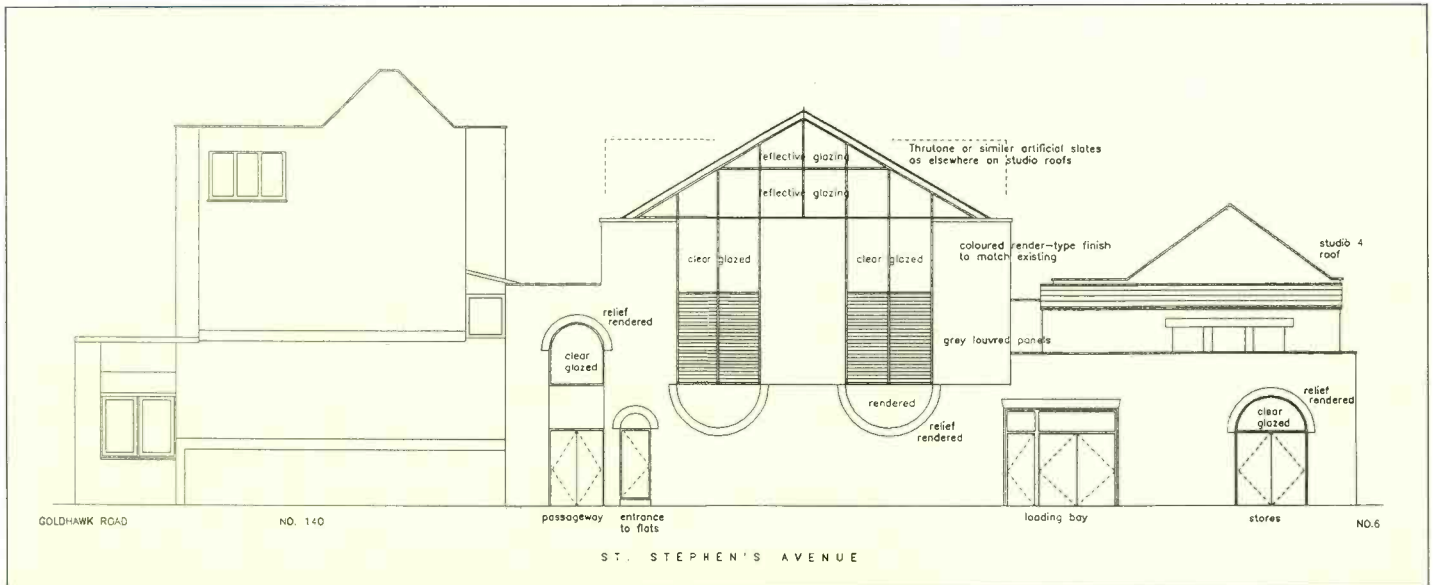
East elevation of The Townhouse

'The only thing we haven't got in the cutting rooms is hard disk editing,' says Metcalf. 'Everybody says 'where's your computer?' I've got a fairly open mind on it, but sonically I haven't got on with them at all; even the Sonic Solutions. I just don't like what comes out of it—to me it's not the same as what goes in. And when you go down to some of the cheaper systems it gets worse.'

If a client brings in an album mixed on, say, an AMS Neve *Capricorn* digital desk, will it go into a cutting room at all? Geoff Pesche thinks it probably will. 'We're still trusted to push up the fader. Clients still want a mastering engineer. We're not just cutting engineers any more.'

In Gay Marshall's experience; 'Clients are still spending as much time and money in the studio and they still want it sound good, so they will come to people like us. Just because they're not necessarily going to put it out on vinyl doesn't mean they're going to get it done on the cheap somewhere else.'

It is interesting to note that, despite the declining sales of vinyl—and the fact that only two rooms are equipped with lathes —all three new rooms are referred to as Cutting Rooms. 'What we've done is change from disc-orientated rooms to CD pre-mastering rooms that cut vinyl as well,' says Metcalf.

But according to Marshall, Townhouse—like most of the other disc cutting facilities in London —is still turning out a lot of lacquers. 'It's amazing that everyone says vinyl is out the window, but we're still churning it out. DMM is also as strong as

ever. I was talking to PR [the pressing plant who make Townhouse's DMM coppers] the other day and they turned over as many units in 1994 as they did in 1993. But it's only the UK, I think. All the clients we get from places like Japan only CD want and cassette. I don't think it'll ever completely die out here—people will still want their 12-inch discs.'

Metcalf adds: 'People who are still releasing on vinyl are looking to make good quality vinyl now. I think that'll come back more and more. What's happening is that a 60-minute CD is coming out as a double vinyl—splitting it to get a good level.'

If a project is to be released on both CD and vinyl, Geoff Pesche reckons it is nearly always the CD that is done first. 'We'll do the CD master and then cut the vinyl from that. If it's a different running order we'll clone the *1630* production master. We all do that.'

A lot of rock albums are still mixed to ½-inch and sometimes an album will come in that has all been mixed at the same studio. 'Then if I'm cutting a vinyl as well as making a CD I'll tend to do it as a vinyl album,' says Metcalf. 'If I can get away without using filters and the elliptical EQ,

No1. Cutting/mastering room

I'll do it in the traditional method; cut the side and run a production master at the same time. Straight from ½-inch onto the disc. The best way to do it is to use an analogue tape machine with a preview head. We've kept a Studer *A80* preview machine to do this for clients who want to release audiophile discs.'

Gordon Vicary works in a similar way to Metcalf: 'If it all comes leadered up ready to go I'll also do it in the old fashioned way, ie. switching from A to B. I'll cut a lacquer, make a production master at the same time and make the CD from that, making sure that I've got the best levels for the CD.

'But if it's all separate tracks on DAT or analogue, I would EQ one track at a time and put it on to *1630*, then compile that—probably to make the CD master first. Then if lacquers are needed, I'd cut them and make a production master at the same time. But this copy would remain digital via the editor, just taking an analogue feed for the lathe.'

Vicary likes the Sony *DAE-3000* for compilations, but wishes that it had a random access editing facility as well. 'It's very good, but it needs a hard disk. The Sonic is very complicated; I wish they would come up with a simplified version that just does what we need.'

The CD premastering-editing room is already equipped with a stereo in-stereo out Sonic Solutions system, although it also has a *DAE-3000* which is primarily used to drive the U-matics when preparing CD masters. 'The Sonic doesn't yet have a PQ module so we use a Philips PQ editor,' says Dave Bernez. 'All our CD masters are going out on *1630* at the moment; that's down to the factory.'

There is an increasing amount of audio-for-video work being generated by the VHS market and the advent of Video CD, and Bunt Stafford-Clark believes that this work should be carried out by audio experts rather than the video people. 'Things are moving much more towards picture with sound rather than sound only. People whose main thrust is music are going to want to make sure that the music on their videos is as good as it possibly can be, and they're going to feel more confident coming to a place where the people are specifically involved with audio.'

To this end an AMS Neve *Logic 3* has recently been in on evaluation, and a Digital Betacam machine for laybacks is also under consideration.

Clients

So, with three rooms all more or less similarly equipped, what is the criteria for deciding which room is used for a particular job?

According to Stafford-Clark, it comes down to a number of factors. 'It can depend on the client. Sometimes they're going to want to work with a particular engineer. It may come down to the music. Both Dave and I have experience as balance engineers and we have a particular feel for some types of music. It might even come down to one room being full and one not. It's rarely down to the equipment, unless someone specifically wants to work with the Sonic when they would use this room. Nobody's really

bothered whether there's a lathe in the room. A disc can always be cut afterwards.'

'Everybody works with everyone here,' Pesche says. 'If Gordon is on holiday and there's a single to do from an album he's cut it'll be done by whoever is free. The clients know that whoever they work with here, it's going to be good.'

Although agreeing that all the engineers are equally capable of tackling any job, Gay Marshall finds that clients often check out the credits of their favourite albums. 'They'll say "he mastered so and so, I want him to do my album". I would say 60% of the time the client will ask to use a particular engineer, but if they don't mind I'll put the job into whichever room is free. 40% of the time it's the studio they want to use because we've got a good reputation—I'm finding that increasingly. We do a lot of European work and they are quite happy

to send their tapes over and let us take care of it.'

'We definitely do more dance music than the other two,' Adams considers. 'They're much more indie and album orientated. But it's very much Townhouse, not the engineer. Anyone of us can turn out a good job.'

And turn it out they do. With six engineers staffing the three new rooms there are a lot of available hours to fill, but so far this does not appear to be a problem. In fact, Geoff Pesche estimates that most weeks 20% of the British chart has been mastered at Townhouse.

It would seem that EMI's faith in the Townhouse postproduction facility is being well rewarded. ■

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CUTTING ROOM EQUIPMENT

CUTTING ROOM NO.1
- Sony *DAE-3000* Digital Editor
- Sony *PCM-1630*
- Sony *DMR-2000* U-matic (x2)
- Sony *DTA-2000* Verifier
- ADT SDIF-2—AES-EBU Format convertor
- Sony *PCM-7030* DAT
- Sony *PCM-7010* DAT
- Totalsystems *DBM-1* Digital Meter
- Sony *DAL-1000* Digital Limiter
- NTP *575-100A* 16x16 AES-EBU Router
- Sony *CDP-2700* CD Player
- Marantz *CDR-1* CD Recorder
- Prism *AD-1* Convertor
- Apogee *DA 1000E-20* Convertor
- Ampex *ATR-100*
- Dolby *361* (x2)
- Aiwa Cassette Recorder
- Summit Audio *EQP200* (x2)
- K&H *UE400* EQ (x2)
- EMT *156* Limiter
- Switchcraft *Soft Limiters*

- Neumann *VMS 80* disc cutting system

- PMC *BB5*/Bryston monitoring
- Yamaha *NS10*
- Auratone (x1)
- Sony Monitor TV

CUTTING ROOM NO.2 (CD PREP.)
- Sonic Solutions
- Philips PQ Editor
- Sony *DAE-3000* Digital Editor
- Sony *PCM-1630*
- Sony *DMR-4000*
- Sony *DMR-2000* U-matic (x2)
- Sony *DTA-2000* Verifier
- ADT SDIF-2—AES-EBU Format convertor
- Sony *PCM-7030* DAT
- Sony *PCM-2500* DAT
- Totalsystems *DBM-1* Digital Meter
- Sony *DAL-1000* Digital Limiter
- NTP *575-100A* 16x16 AES-EBU Router
- Sony *CDP-2700* CD Player
- Marantz *CDR-1* CD Recorder
- Sony *R7* Digital Reverb

- Prism *AD-1* convertor
- Apogee *DA 1000E-20* convertor

- Ampex *ATR-100*
- Dolby *361* (x2)
- Aiwa Cassette Recorder
- Summit Audio *EQP200* (x2)
- GML *Model 8200* EQ (x2)
- K&H *UE400* EQ (x2)
- Switchcraft *Soft Limiters*

- PMC *BB5*/Bryston monitoring
- Genelec *S30* Self-powered Monitors
- Yamaha *NS10*
- Sony Monitor TV

CUTTING ROOM NO.3
- Sony *DAE-3000* Digital Editor
- Sony *PCM-1630*
- Sony *DMR-2000* U-matic (x2)
- Sony *DTA-2000* Verifier
- ADT SDIF-2—AES-EBU Format convertor
- Sony *PCM-7030* DAT
- Sony *PCM-2500* DAT
- Totalsystems *DBM-1* Digital Meter
- NTP *575-100A* 16x16 AES-EBU Router
- Sony *SDP-1000* Digital Effector
- Sony *CDP-2700* CD Player
- Marantz *CDR-1* CD Recorder
- Prism *AD-1* convertor
- Apogee *DA 1000E-20* convertor
- Ampex *ATR-100*
- Dolby *361* (x2)
- Aiwa Cassette Recorder
- Summit Audio *EQP200* (x2)
- GML *Model 8200* EQ (x2)
- EMT *156* Limiter
- Switchcraft *Soft Limiters*

- Neumann *VMS 80* disc cutting system

- PMC *BB5*/Bryston monitoring
- Yamaha *NS10*
- Auratone (x1)
- Sony Monitor TV

MACHINE ROOM:
- Neumann *VMS82* DMM disc cutting system
- Studer *A-80* Preview Machine

FOCUSRITE 315 ISOMORPHIC EQ

The Blue 315 brings Focusrite's prestigious technical standards to the mastering suite for the first time. Review by Patrick Stapley

Before you reach for your dictionary, an Isomorph is something that shares an identical form with something else. In the case of the Focusrite *315* mastering equaliser, this has two connotations: firstly that the unit has the same circuitry as previous Focusrite equalisers, and secondly that because the unit employs high precision stepped controls, its two channels can be matched identically—a facility that is obviously extremely important for the mastering engineer.

The *315* represents Focusrite's first dedicated foray into the mastering suite, and brings with it all the expertise and sonic integrity that the company have become renowned for in the studio. The unit is the first of a new Focusrite *Blue* Range, and features the incredibly sturdy build quality and solid engineering found in the company's stunning *Red* Range. Focusrite's Technical Director Richard Salter explains further.

'The reason we've departed from the plated steel assembly used in the original *Blue* Range and adopted a similar construction to the *Red* Range, is to meet the future EMC (Electro Magnetic Compliance—see *Studio Sound*, November 1994) regulations being imposed by the EU. We've been aware of these regulations for some time now, and they were one of the reasons we initially embarked on the *Red* Range. However, rather than produce another *Red* unit, we wanted to retain the *Blue* identity because the *315* is essentially a re-run of the old style units, plus it's aimed at a different marketplace to the *Red*s.'

Although the *315* shares the same circuitry as the *ISA 215* equaliser, which in turn was based on the Focusrite *Studio Console* equaliser, there are certain areas where the electronic design has been changed to make it more suitable for mastering.

The main differences tend to be with the resolution and range of controls which have been

modified to fit in with mastering engineers' requirements. For example, rather than providing 16dB of boost and cut, the unit offers ±10dB in 23 steps—the assumption being that the *315* will be used for very precise corrective work and general enhancement, rather than being a tool for salvage or effects.

Focusrite's research showed that most mastering engineers rarely applied more than 4dB to any one frequency band, and needed to be able to make adjustments using very small and very accurate increments. In fact the gain structure is arranged so that cut/boost is in 0.33dB steps to ±1dB, and from there to ±10 dB in 0.5dB steps. The thinking behind this being that most of the use is likely to be in the range between +2.5dB and -2.5dB; however, the company also realised there would inevitably be times where larger amounts of gain would be required.

'There are obviously going to be occasions where engineers will want to use more and that's why we went to 10dB,' says Salter. 'We had a lot of feedback from people who were using the Sontec equaliser, which is the only other dedicated, all-switched outboard mastering EQ on the market, and generally we found that people who were using Sontecs ±6dB version (a ±12dB version is also available) felt it didn't provide them with quite enough control.'

Obviously a fundamental consideration with a mastering equaliser is that settings should be easy to recreate as well as duplicate between channels. This requires precisely stepped controls, rather than continuously variable ones, and clear, sensibly spaced graphics. The *315* scores well on both points, providing good, solid controls that click into place positively, while the broad spacing between controls allows plenty of room for the very up-front yellow against blue graphics.

Functionality

The front panel of this 3U-high unit has been laid out into two full-width channels, one placed above the other. Each is divided into seven distinct sections providing four bands of EQ, low and high-pass filters, an input section with three separate level controls operating at different resolutions, and a PHASE REVERSE switch and overload indicator. Additionally to the left of the unit is a large EQ IN-OUT button which switches both channels simultaneously, and a power switch – all switches on the unit are illuminating. At the rear of the unit are XLR connectors for the transformer coupled inputs and outputs.

As with its studio twin, the *315* has high and low shelves, and two peak characteristic mid bands. The frequency range of the four bands also remain identical to the *ISA 215* although of course not swept—instead each band has been arranged into 11 evenly spaced musical intervals: quarter-octave steps for HF and LF, and third-octave for the two

mids. Additionally, each mid band includes High Range switching enabling an alternative range of frequencies to be assigned which is approximately 4.5 times the value of the Low Range. The Q control for the mids has an extended range compared to the *ISA 215*, but has been 'flattened' so that at high settings it's effect is less sharp, producing a broader more gentle curve better suited for mastering.

The high and low pass-filters, on the other hand, have been reduced in range. Here again the argument is that because the equaliser is designed to deal with processed rather than raw audio, wide band-pass filtering is not something that should be necessary. Instead, having a more contained range which divides into closer steps, provides a more useful facility. The slope for the filters is 18dB/octave, but although not widely publicised, this can be changed by Focusrite.

'Provision has been made internally to enable us to easily change the filters to suit the client,' says Salter, 'and so far we've supplied units with 12dB and 6dB per octave filters. The requirements for mastering often tend to be quite specific and very personal, so it really is impossible to build a single unit that will please everyone. With that in mind, we've allowed for customisation, and will happily tailor the unit to meet the client's requirements—how would you like it sir!?'

An area where Focusrite have attempted to please everyone is with the functionality of the EQ IN-OUT button. This operates in two ways: firstly with a stabbing action it performs as a latching switch (tap it once it goes on, tap it again it goes off), and secondly with a push and hold action it acts as a momentary switch (turning on for the duration of the press). However, irrespective of whether you're a 'stabber' or a 'holder', the switch performs totally silently.

As mentioned the unit incorporates three input gain pots per channel operating at different resolutions. First impressions could be that this arrangement is a little
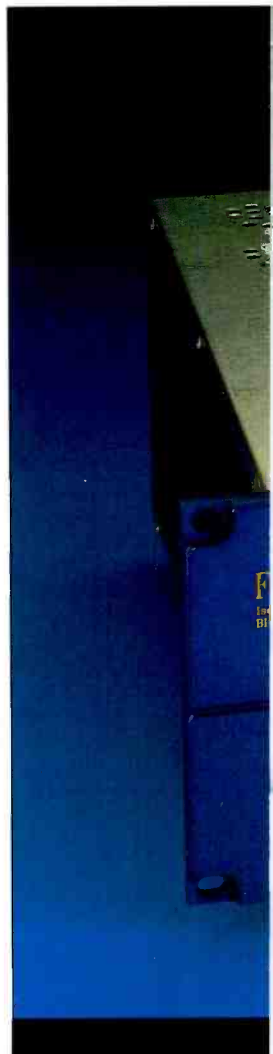
over elaborate and that two controls would have sufficed. However, this does appear to be the most effective method of control, bearing in mind the use of stepped controls and the fact that Focusrite wanted to offer control resolution down to 0.1dB. The three controls provide; coarse switching in 5dB steps, fine switching in 0.5dB steps, and a centre detented extra-fine trim that sweeps between +1dB to -1dB—this extra-fine control is the only non-stepped pot in the unit, and as an extra precaution, a bypass switch has been included.

As would be expected with a unit in this class, headroom is generous with the onset of clipping occurring at +26dB. Overload indication becomes active at +20dB and is measured post the EQ processing. The *315* also excels with low noise figures, which are kept well below -90dB with a +4dBu output level, making the unit ideally suited for digital remastering.

The kind of technology and performance offered by the *315* does not come cheaply—high-quality switched components and hand wiring, for example, add significantly to the cost. However, if you're looking for a dedicated mastering equaliser, that offers the very best in British designed EQ,

with the accuracy, sonic quality and build that Focusrite have justly become famous then the *Blue 315 Isomorphic Equaliser* is most certainly worth investigating.

The *315* is now accompanied by Focusrite's second dedicated mastering processor and further addition to the *Blue* Range, the *330 Stereo Mastering Compressor & Limiter*. This unit is derived from the *Red 3* studio unit, but again includes a number of small detailed changes that make it specifically suited to mastering applications. ∎

BLUE 315 EQ AND FILTER RANGES

HF Shelf:	3.3kHz–22kHz In 11 steps.
HMF Peak:	560Hz–3.9kHz and 2.7kHz–18kHz (High Range) both in 11 steps. Q from 0.4–2.4 in 11 steps.
LMF Peak:	39Hz to 270Hz and 180Hz to 1.2kHz (High Range) both in 11 steps. Q from 0.4–2.4 in 11 steps.
LF Shelf:	33Hz–560z in 11 steps.
HF Filter:	OFF, 33Hz, 47Hz, 68Hz, 100Hz and 150Hz at 18dB per octave.
LF Filter:	OFF, 22kHz, 18kHz, 15kHz, 12kHz and 10kHz at 18dB per octave
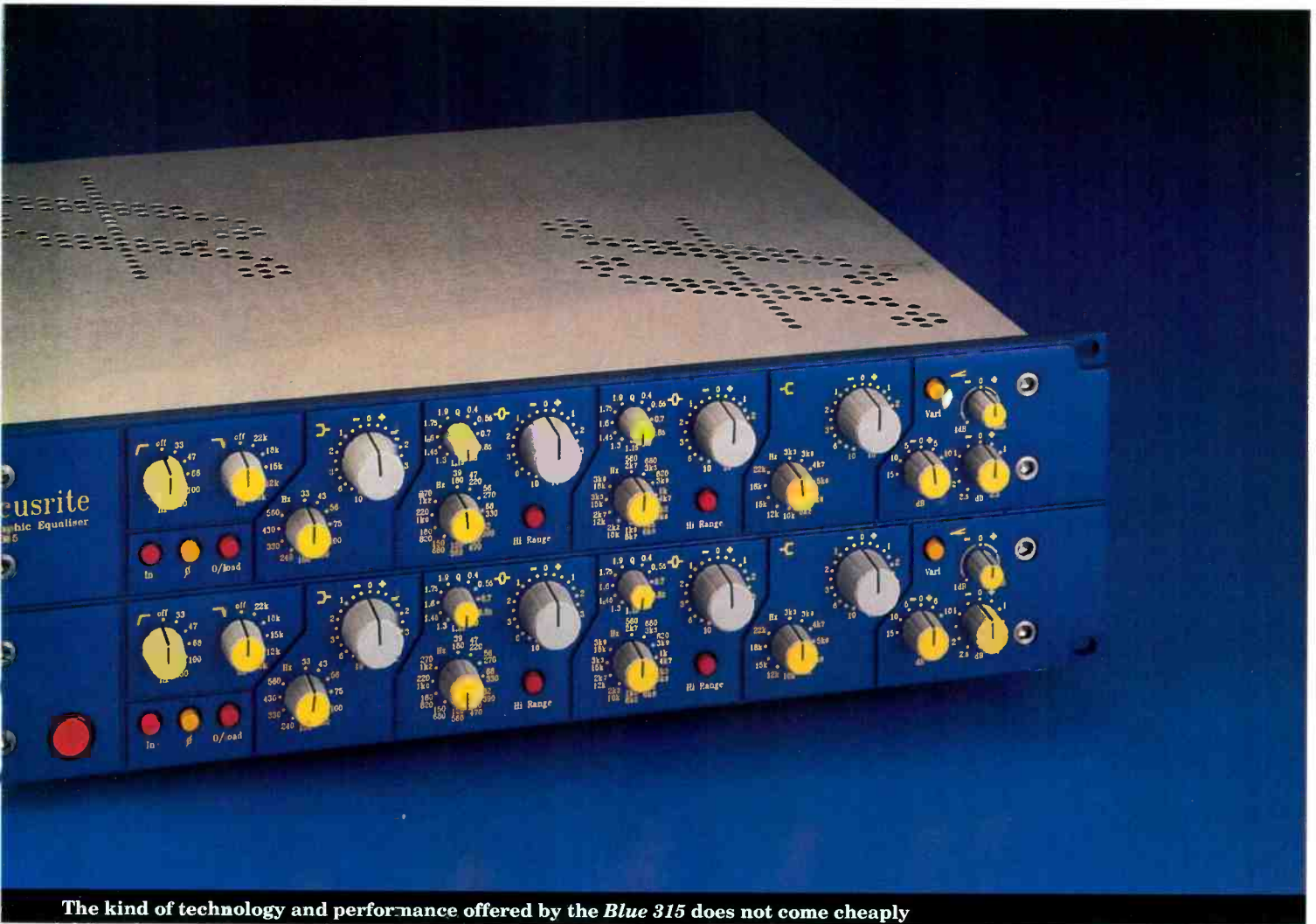
The kind of technology and performance offered by the *Blue 315* does not come cheaply

DIGIDESIGN MASTERLIST CD

Creating PQ codes is no longer the exclusive domain of expensive editors. Dave Foister assesses the Digidesign option

Those familiar with the various Digidesign editing packages will probably already have come across *Masterlist*—a simple bolt-on software package, allowing material edited on one of the main systems to be stitched together to form a finished master. Perhaps most commonly used with *Sound Designer II*, it can import material in the form of complete Soundfiles, edited Playlists, or individual Regions, and allows the various elements to be assembled into a final running order. It gives control over spacing between items and level matching (providing individual attenuation for each item) and when assembly is

complete will play the whole thing out for recording on *1630*, DAT, or any suitable mastering medium.

For those unfamiliar with Digidesign terminology, a word about the procedures involved in editing using *Sound Designer II*. A Soundfile is a recording on hard disk of all the raw audio required for a project, a Region is a selected portion of that audio, and a Playlist is a sequence of those Regions linked together to form the finished piece. Editing normally takes the following form: the raw material is recorded, with all the relevant takes, on to the hard disk; the required sections are selected to form a set of Regions; and the Regions are then assembled into a Playlist, with trimming, crossfading, level adjustments and optional fades at the start and end of the whole thing. The separate pieces of music or other material comprising a project will probably therefore take the form of a series of Playlists, each coming from a separate Soundfile. *Masterlist* provides a convenient way of bringing them all together for mastering.

If the project is a CD, this still leaves the PQ editing to be done. The finished tape will still have to be sent elsewhere to have its PQ subcodes added, although *Masterlist* can help by producing detailed timing information about track start and end points. Digidesign have produced *Masterlist CD* to cut out this further stage and allow this editing to take place alongside the preparation of the audio material; glass master ready output can be produced direct from the *Mac*.

Mastering the list

The main window of *Masterlist CD* is very similar to the original Masterlist window, but with a few additions. The gain of each item is now adjustable upwards as well as downwards, and is independent for the two channels—each can be adjusted from -96 to +12dB in 0.1dB increments. Crossfades can be introduced between items using exactly the same options as in the *Sound Designer II* Playlist—crossfades have a choice of six shapes, all of variable length, and can take place before, across, or after the join between two items. They are executed in RAM and are nondestructive, but unfortunately they can only be used between Regions or Soundfiles. Playlists, probably the most likely source material, cannot be crossfaded, but this is not really a problem since the most common use of the facility will be to fade in and out of the digital silence between tracks, and the Playlist should already have these fades in place.

All these features greatly enhance the potential usefulness of the basic package. For instance, it is now possible to do the stitching together and reordering of the Regions in a piece in the Masterlist window, with virtually all of the facilities found in *SDII*'s Playlist window where

this work would normally be done. But the most important addition is of course the icon for opening up the PQ subcode editing window.

This window shows the assembled information as it will appear on the final CD, complete with its track positions, index points, status flags and ISRC (International Standard Recording Code) data. (Detailed information about the function, format and limits of these codes can be found in Bill Foster's article on PQ encoding in the second issue of *Mastering, Duplication and Replication*), and it seems that Masterlist CD supports, and allows editing of, all the available codes and parameters.) The only obvious exception is the flag to differentiate between audio and non-audio data (CD-ROM, CD-I and so on, which is always set to audio since *Masterlist CD* only deals in audio data—it cannot handle any of the other formats or mixed-mode discs.

In many cases the PQ window will only need to be opened as a check that everything is in order, because for a basic straightforward CD the system uses sensible default values for all the required parameters. If a CD is compiled from a spaced series of imported items, each of which constitutes one track on the CD, if the tracks all start at the beginning of those items, and if no further index points are required, then the result is what Digidesign call a Simple List. A further proviso for not requiring PQ editing is that no ISRC codes are to be added; apparently most CDs still go out without this information, although the constraints of DCC and MiniDisc (if either ever becomes more firmly established as a consumer medium) might eventually make ISRC more universal. With a Simple List any adjustments that need to be made to inter-track spacing and levels can be done from the main window, with no alterations to the derived PQ data required.

Control

A set of tape transport buttons at the top of the main window allow auditioning of any of the material, complete with a user-selectable pre-roll, so each transition from one track to the next can be checked for timing and level matching. The PQ window will then simply confirm that the software has inserted the default initial pause and the pre-gaps before tracks, deriving all its track numbers and timings from the main list. Note that these pre-gaps are purely for the benefit of the CD player finding programmed tracks and counting down to their starts—they are not related in any way to the timing of the spaces between tracks.

All this information is updated automatically if the running order of the tracks is changed in the main list. Global offsets for the Begin and End Access Points—required for correct operation of CD player muting circuits—are set by default at the generally-agreed values but may be altered

Hard work - the *Mac*-based hardware necessary to dupport Digidesign's soft option

if required.

It is when the requirements of the CD are more detailed than the situation outlined above that the PQ window comes into its own. This is where index points within tracks are added, status flags set, ISRC codes entered and so on. Index points. despite their usefulness, are not used as often as they might be as many CD players are unable to access them. They seem to be most commonly used in long classical pieces, sampling CDs and sound effects CDs, and can be entered in several ways using Masterlist CD. An index can be defined manually as a time position, related either to the beginning of the CD or to the start of the track in which it appears. Note at this point that time can be displayed in four formats within *Masterlist CD*: 'standard' time at 100 frames per second (fps), SMPTE at 30fps, CD time at 75fps and sample time, shown at 44100 or 48000fps depending on the sample rate of the relevant list item.

Manual entry would probably be a last resort as placing it exactly where it is wanted can be a little fiddly and hit-and-miss. The package offers two other methods of creating an index, based in different ways on the structure of the source material. The first relies on points identified during the original editing session in *Sound Designer II*. If the item in question is a Soundfile or a Region, a pop-up menu shows all the text

and numeric markers placed in the item in *SDII*, and allows any of them to be chosen as the place to put an Index point. This means that points can be marked with sample-accurate precision in the *SDII* waveform display prior to assembly in *Masterlist CD*, or even afterwards; the package allows you to update its lists automatically to take into account further changes which may be made to the original Soundfile and its related data. This has all kinds of helpful ramifications, since no matter how many decisions are made in *Masterlist*, nothing is set in concrete and radical re-editing of the source material remains possible without having to re-do the entire mastering process.

If the item is a Playlist, a pop-up menu shows the starting points of all the Regions within the Playlist (complete with their names) and allows you to choose any of them as the location of an index. Since it is highly likely that the kind of musically important moments—such as divisions between movements—that would require an index will coincide with edits and therefore fall at the start of *SDII* Regions, this strikes me as potentially the most useful indexing option.

The final method uses a similar pop-up menu procedure but offers the starting points of individual *Masterlist* items as possible indices. If a list has been compiled using multiple imported Regions within a CD track, this in effect

Index points are commonly used in classical pieces and sound fx CDs, and can be entered in several ways

provides the same possibilities as the Playlist method. All the indexing procedures are invoked using a single Index icon in conjunction with various combinations of the *Mac*'s Command and Option keys; this is one of the few instances where *Masterlist CD* requires you to remember a keystroke sequence, and I wonder whether it might have been better to use separate icons or a dialogue box to choose between the options—it's not as if the screen is cluttered as it is. It might also have been useful to have a way of capturing index points on the fly, following which they could be fine-tuned in the PQ window. ▶

File   Edit   Setup   5:16:22 pm ?

MDR Reveiw - 16 bit

0:00:03:27   L 50 30 15 8 5 3 1 +
             R

No.	Start Time	Name	Length	Stop Time	L Gain dB R		Xfade	Length	#Trks
1	0:00:02:00	4.45 Alone	0:00:01:27	0:00:03:27	0.0	0.0	I	0 ms	1
2	0:00:05:27	Sea of Love	0:00:02:27	0:00:07:54	0.0	0.0	⋏	500 ms	1
3	0:00:09:54	Saturday Night	0:00:01:12	0:00:10:66	0.0	0.0	I	0 ms	1

PQ Subcode in MDR Reveiw

Disc Catalog Code:
Begin Access Offset: 15 CD Frames
End Access Offset: 15 CD Frames

Trk	Index	Time	Name	Length	Emph	Prot	SCMS	ISRC Code
1	▽	0:00:00:00	4.45 Alone	0:00:03:12				
	0	0:00:00:00	pre-gap start					
	1	0:00:02:00	audio start					
2	▽	0:00:03:27	Sea of Love	0:00:04:27				
	0	0:00:03:27	pre-gap start					
	1	0:00:05:27	audio start					
	2	0:00:06:27	Choir in					
	3	0:00:07:22	strings					
3	▽	0:00:07:54	Saturday Night	0:00:01:27				
	0	0:00:07:54	pre-gap start					
	1	0:00:09:54	audio start					
AA	1	0:00:10:67	Start of Lead Out					

Typical working screens - PQ subcode details to the fore

The display gives the option of showing or hiding the index points within each track depending on how streamlined you want the window (or its printout) to appear; but even when hidden the indices will be written to the final master. The manual warns that hiding may sometimes become necessary as the window cannot scroll through more than 2047 total lines of information; this doesn't sound like a problem that would arise very often, but the warning says something about Digidesign's thoroughness.

Subcodes

There are five further fields shown for each track in the Subcode window. The first is the length of the track, which is not editable but calculated from the start and end times including the Access Point Offsets. The next three are simple toggles for various flags. The Emphasis field shows whether pre-emphasis has been applied to the track and therefore whether it needs de-emphasis on replay. It has no effect on the audio but must be set correctly for the source material, and this

has to be done manually as the software cannot detect the presence or absence of pre-emphasis for itself. As expected, a CD can contain a mixture of tracks with and without pre-emphasis, although this entails some restriction—the Index 0 (the pre-gap) between tracks with different emphasis settings cannot be less than four seconds in order to allow the CD player to switch itself over. This in turn will cause problems with some CD recorders, which will only allow two seconds of Index 0 per track.

Two further fields set protection flags, the first being a complete Copy Prohibit flag which it seems few digital recorders take any notice of and the second being the more familiar SCMS flag. Finally for each track comes a field where its ISRC code can be entered if required; as already noted, many producers have been slow to take the opportunity to encode this information on to the CD itself, despite its obvious uses for radio play logging, royalty collection and so on. Up at the top of the window with the Access Offset values is a space for the Catalogue number, which allows the writing of the CD's UPC-EAN barcode number on to the disc.

It should be clear by now that the *Masterlist CD* package is pretty comprehensive, giving ready access to all the data CD mastering requires. It is also remarkably simple in layout and easy to use; assembling the tracks is ludicrously straightforward, and assuming you know what the various PQ subcodes are and how they work, adding and editing those is quite intuitive, requiring little recourse to the manual. Indeed, the manual contains at least as much information about PQ itself and the workings of *Red Book* CDs as it does about *Masterlist CD*; as such it makes a useful reference, besides being a very well-thought out guide through the software. The audio quality is of course no more or less than that provided by Digidesign's audio interface, although the convertors will, naturally, not be used for the writing of the master. It is worth noting that just as Digidesign's editing software is capable of working with up to 24-bit audio, *Masterlist CD* can handle 24 bits as well; it has its own dither algorithms for reduction to 16 bits, which I was unable to test, having no access at the time to any high-bit sources.

Like the original *Masterlist*, the *CD* version can deliver its finished audio product to any digital recorder, including CD-R, and provide complete PQ printouts, but will only write the PQ information to two media: SCSI CD writers (as distinct from stand-alone CD recorders) and Exabyte 8mm tape using Digital Data Protocol (DDP). SCSI CD machines are now little more expensive than the more familiar CD recorders, but different models have idiosyncrasies in their operation and capabilities which may mean some of *Masterlist CD*'s facilities will not work or have additional constraints placed upon them, such as the emphasis switching considerations mentioned earlier. Despite this, the format has obvious appeal; it produces a finished article that can be played on a variety of real CD players to check its encoding, and many models will write at double speed (although some have reservations about the merits of non-real-time writing—see, again, Issue 2 of *MDR*). The number of CD plants that will accept such a CD-R as a source for the glass master is growing all the time, although by and large the first thing that will happen is that it will be transferred, PQ intact, to Exabyte, since it is the Exabyte format that directly drives the glass master cutter. For this reason alone it makes sense to consider Exabyte as the final medium for *Masterlist CD*, especially as the price of these

Masterlist CD effectively allows a studio to bypass the specialist mastering house altogether

drives too has fallen; a suitable off-the-shelf drive with a chip set for DDP can now be bought for less even than a 'domestic' CD recorder.

It is easy to imagine many mastering engineers, already unhappy about the number of non-specialists who think they can do their job, shaking in their shoes at the prospect of any Tom, Dick or Harry with a *Mac* being presented with such an easy way to perform yet another stage of the process. Having *Masterlist CD* effectively allows a studio to bypass the specialist mastering house altogether, although to be fair many CD plants have been making that possible

by offering PQ facilities for some time. Digidesign are clearly aware of the situation, since the manual contains a touching few paragraphs pointing out that mastering is the final stage of the creative process of making a recording and entreating the user not to overlook the value of experienced mastering engineers. This is a bit like asking the purchaser of a shotgun not to shoot anything with it, and may offer little comfort to the mastering business; one would like to think nevertheless that the current raised profile of the mastering process will lead users to realise that there are many mastering jobs which require a little more input than simply sticking the bits together in the right order and making sure the mechanics work properly. For those that do not, *Masterlist CD* offers a comprehensive, foolproof method of producing complete CD masters using little more than a set of equipment many studios already have, and consequently will undoubtedly become as familiar a sight as the *Macintosh* it lives in. ■

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REMASTERING THE ART OF GENESIS

GENESIS DEFINITIVE EDITION REMASTER GEN 1

A fter 25 years in the business and album sales topping the 100 million mark, Genesis celebrate an extraordinary quarter century with a new edition of 20-bit remasters. The *Genesis Definitive Edition Remasters* comprises 13 albums recorded by the band between 1970 and 1981—to be more precise *Trespass* to *Three Sides Live*.

Ever since Genesis realised that their first CD release, *Abacab*, had been mastered from the wrong tape, they have become increasingly wary of record company control of CD production. Phil Collins recalls that, 'This was only the start because other CDs had already been produced using production masters that had been optimised for vinyl'.

As a result, the band have now taken greater control over remastering favouring an in-house approach rather than leaving things to the discretion of the record company. Responsibility for this project fell to two individuals—Geoff Callingham, Studio Manager at the band's private studio The Farm, and Nick Davis who engineered and produced the last three Genesis albums. Although neither had a first-hand experience of remastering, their combined talents as engineers

GENESIS

SELLING ENGLAND BY THE POUND

1973's *Selling England by the Pound*

Thirteen albums and a significant piece of progressive rock history make a daunting remastering prospect. Patrick Stapley learns the tricks of the tale

and their familiarity with Genesis' music and knowledge of the back catalogue, put them in good stead to do the job sensitively and scrupulously —something that had not always been the case in the past as Nick Davis points out.

'When the 1974 album *The Lamb Lies Down On Broadway* was first mastered, the cutting engineer somehow managed to introduce a mains hum all the way through it. We know this because the hum only appears on the production master and not on the original master. Because the record company made the CD from the vinyl production masters, rather than referring back to the true master, the hum has appeared on all subsequent CD releases, that is up until now of course.'

In fact, it transpires that quite a lot of the original CD remastering had suffered from being rushed out, and according to Nick Davis, Genesis were fully aware of the improvements that could be made. Another issue—bearing in mind the age of some of the tapes—was restoration and this was also high on the band's list of priorities.

'It was only quite recently that the band felt content that restoration could be properly achieved

without damaging the original sound,' says Davis. 'A big concern was that the remasters should keep their original character, and nothing should be done that would interfere or change that. The band are very quality conscious, and that's another reason they waited up until now to do the remastering so they could take full advantage of 20-bit and noise shaping techniques.'

Having decided on what had to be done, it was then a matter of equipping the studio, and after very careful consideration, Genesis invested in the largest Sonic Solutions system sold so far in the UK.

'There were a number of reasons for choosing Sonic Solutions,' recalls Geoff Callingham. 'Apart from being widely used in top mastering facilities worldwide, it's a fully integrated system that offered us all the features we were looking for in a single package. Also, being *Macintosh* based it appealed to us as we are heavily *Macintosh* orientated here.'

The Sonic Solutions system was installed into the original control room at The Farm (a much larger control room was added to the building nine ►

Nick Davis, Genesis Engineer and Producer, and Geoff Callingham, The Farm's Studio Manager

years ago), which already houses a full Sony *PCM 1630/DMR-4000* editing system using the *DAE-3000* editor, Digital Systems metering, and two Sony *7030* DAT machines. Added at the same time as Sonic Solutions was a Prism *AD-1* convertor-noise shaper, Sony *CDW-900E CD Writer*, Exabyte drive, and a TyreStor removable hard disk system.

With the equipment in place, the next job was to locate the material. Most of the tapes were found quite easily, but two masters eluded the remastering team, as Geoff Callingham explains.

'All Genesis tapes are stored at our archive at Heathrow Airport, but at some point during the Charisma days, somebody had decided to remake two of the albums—*Trespass* and *Foxtrot*—and they were missing. Unfortunately we weren't able to find them, but we did manage to turn up safety copies for both albums from Virgin's archives, and these second generation tapes were used for the remastering.'

Once all the tapes had been gathered together, time was booked at Abbey Road Studios with mastering engineer Chris Blair, who appropriately also celebrates his 25th year in the business. Blair was responsible for the 20-bit transfers into Sonic Solutions, and for EQing the albums using vintage EMI equalisers.

'We wanted to add analogue EQ rather than digital because we thought it would suit the material better,' comments Davis. 'Also, it was important at this stage to have someone like Chris Blair who's got great ears and knows exactly how to get the best out of the material without over doing it.

'Some of the albums sounded quite thick, and we could easily have EQd them to sound like a modern record by making them very bright and ultra hi-fi, but it would have been completely out of character

About two thirds of the way through there's this awful detune as the track suddenly changes speed

with what the band were trying to do at the time. We were also careful to keep the dynamics between tracks as originally intended—we avoided the temptation to make every track peak at maximum level for instance, or adding any dynamic processing.'

However, one of the albums did require more than just 'sympathetic' treatment as Davis explains.

'The *Duke* album was mixed at Maison Rouge around 1980, and there'd been a problem with the monitoring which made the sound in the control room extremely bass heavy. This, of course, meant that all the mixes ended up being incredibly bass light, and Chris had to compensate by adding masses of low end as well as elevating the bass response of the tape machine to get it to sound right.'

The transfers were done at a rate of about two per day allowing time to check and deal with 'sticky tape' syndrome—three masters from the period between 1976 to 1980 required baking in Abbey Road's tape oven. Each album was then

down-loaded from Sonic Solutions, without any further processing, to 20-bit Exabyte ready to take back to The Farm.

It was then a matter of cleaning up the sound using Sonic's *NoNoise* system, and making any repairs that were necessary.

'The first thing we did was to de-click and this was mainly over edits where there were clicks and bangs and things,' says Davis. 'Then we'd take noise samples and de-hiss; usually after hiss removal we'd add a little bit of Sonic high and EQ to compensate for the inevitable loss in top that the process causes. We were always very careful, though, not to over process because you can start closing down on the atmosphere. There's a very fine division between removing noise and losing the space around instruments, and on a number of occasions we'd leave noise rather than risk eating into the music.

Extraneous noises including hums and buzzes, mainly from instruments, were also removed, and as would be expected the earlier tapes require more work than the later ones—the first album, *Trespass*, from 1970 needing the most attention. There were also occasional tape drop-out problems, and a section at the beginning of one of the live albums had to be patched where oxide had shed badly. However, the only instance where the original programme was radically changed was for part of a track on *Foxtrot*.

Nick Davis: 'On *Foxtrot* there's a 20-minute track called 'Supper's Ready' which was originally mixed in sections over two days. What happened was that somebody changed ¼-inch machines overnight, and when the band came to edit the track together, they discovered that the two machines had been running at slightly different speeds. They had no time to remix the ▶

WHERE YOU GO - WE GO

1972's classic *Foxtrot*

track again, so about two thirds of the way through there's this awful detune as the track suddenly changes speed. Now with Sonic Solutions it was very easy to retune it and restore the track to the way it should have sounded back in 1972—all the same, I expect someone will write in and ask what's happened to that "great effect"?'

During the remastering process, the removable media were used quite extensively.

'Having removable hard disks has been very useful for this project', remarks Callingham. 'It meant that we could leave things in memory rather than having to back-up to Exabyte all the time. There was also a Mike & the Mechanics album being mixed at the same time and they wanted to use the room for some editing, so all we had to do was swap drives—it couldn't have been easier.'

According to Callingham, another useful piece of equipment built specifically for the project by The Farm's Mike Bowan, was a switching box that allowed simple selection between eight stereo sources.

'Because we were continually referring to various sources—the original masters, original CD, 20-bit Sonic output, 16-bit dithered Sonic output, and so on—there was a need for a box that could instantly switch monitoring between sources rather than relying on mute buttons on a console. Also built into the box are trims for each stereo input, and a main output fader.'

Once remastered the tracks were PQd and CD-Rs were made for each of the band members to approve. Generally speaking there were few

comments apart from small concerns about whether something was over bright or a gap between joined sides was too short. A-B comparisons were also made at this stage between the new remasters and the previously available CDs.

'The new versions all sounded better,' smiles Davis, 'and with some, like *The Lamb Lies Down On Broadway*, the difference was like night and day. They all benefited from an openness to the sound that was missing on the original CDs and generally sounded much cleaner, so we were all very pleased about that.'

Having been approved, the albums were again transferred to Exabyte in 20-bit form, and to 1630 U-matic via Prism noise shaping. The PQd U-matics were then sent off for glass mastering.
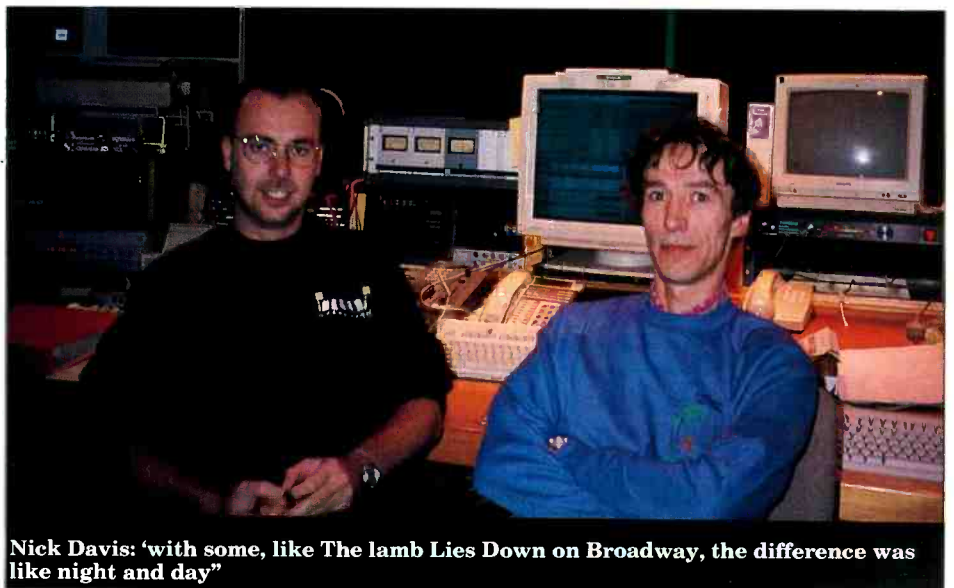
The whole project took over three months to complete, working out at roughly an album per week. The CDs were released in two batches: the first six during August 1994, the next seven following a couple of months later. Apart from the audio quality, improvements were also made to the artwork with better quality printing and full cover reproductions rather than the cropped versions that appeared on the previous CDs.

The next Genesis remastering project will involve two sets of four CDs provisionally called *The Peter Gabriel Years*, and *After Peter Gabriel*. These will contain key track, out-takes, unreleased live material, single B-sides, 12-inch versions, and rehearsal recordings. Release date is scheduled for the early half of 1995. ∎

DISCOGRAPHY

A total of 13 albums were remastered spanning from 1970 to 1981. The subsequent albums had been mixed digitally and so did not warrant remastering. Genesis' first album, *From Genesis To Revelation* 1969, was not included in the new edition for copyright reasons.

Trespass	1970
Nursery Cryme	1971
Foxtrot	1972
Genesis Live	1973
Selling England By The Pound	1973
The Lamb Lies Down On Broadway	1974
Wind & Wuthering	1976
A Trick Of The Tail	1976
Seconds Out	1977
And Then There Were Three	1978
Duke	1980
Abacab	1981
Three Sides Live	1981

Nick Davis: 'with some, like The lamb Lies Down on Broadway, the difference was like night and day"

REPLITECH REVIEW

Bill Foster reports on conferences, equipment and trends from the crowded floor of the European REPLItech show

The REPLItech shows—now held three times a year in Europe, North American and Asia—are principally designed as showcases for the equipment used by the manufacturers of CDs, audio cassettes and video cassettes. There is, however, quite a lot to interest those involved with the programme content.

The most recent REPLItech was held at the beginning of April in Vienna, Austria. While only in its second year, and therefore not as big as the now firmly established event in Santa Clara, California (held in June), this year's REPLItech Europe attracted nearly 100 exhibitors and 1,800 delegates, many of whom also registered for the accompanying conference.

REPLItech is unique in that the conference and exhibition are separated, taking place in the morning and afternoon respectively. This gives exhibitors an opportunity to attend the conference and hear what their prospective customers—and their competitors—are thinking. The three day conference is divided into three tracks: Optical Disc, Tape Duplication and Computer Media.

While the show did not have a specific theme, the overriding message was that the replicators and duplicators are being squeezed from all sides by rising labour costs, more expensive raw materials and lower selling prices; their only solution is to raise productivity. The hardware manufacturers are doing everything they can to address this with faster cycle times, increased yields and time savings in areas as diverse as mastering and printing.

And then of course, there's the HD-CD format debate.

Mastering for video

'Track hopping' delegates who attended Day Two's Tape Duplication session entitled *Mastering for Better Quality Video Duplication* may have been slightly confused when they realised that the content was virtually identical to that given under the title *Changing Replication Markets in a Multimedia Revolution* on Day One of the Optical Disc track.

Despite this, the highly informative and entertaining presentation by Paramount Pictures' Executive Director of TV Operations, Garrett Smith, covered many of the problems the movie houses face when mastering feature films for video-based formats.

'The true importance of technology is as a tool to preserve the artistic intent of the film maker,' Smith said, and then proceeded to show a number of examples to illustrate this point.

The obvious difficulty when preparing a major movie for showing on television is the different aspect ratio. Most features today are shot in wide-screen 1.85:1 format, against a standard television screen ratio of 4:3 (1.33:1). The problem is further compounded by HDTV, which has a ratio of 16:9; similar, but not identical to wide-screen.

Currently, Paramount produce up to six video versions of each film—three PAL and three NTSC. A wide-screen 'letterbox' transfer is used for LaserDisc and some VHS releases, a 'pan-and-scan' version for general VHS use, plus where necessary an edited version for airlines and television release.

Digital D1 has been used for mastering since *Fatal Attraction* and this is considered to produce the best results. Experiments have also been made using HDTV, where the picture is transferred using an HDTV telecine and then down-converted to make both the NTSC 525 and PAL 625 versions. According to Smith, this technique has not proved very satisfactory and for the time being it has been dropped. *'Forest Gump* was the first movie to use HDTV. The transfer process to produce the NTSC version took three weeks; the PAL version took six months! Down-conversion is still an emerging technology,' he said.

Smith is less than enamoured by a proposal to make just one HDTV version from the original film print and use this for all subsequent video versions. This would entail the picture being cropped for 16x9, and then being cropped again for 4:3. By then a substantial portion of the picture would have been lost.

Smith claims that using technology for technology's sake can be counterproductive: 'I believe the film industry will ultimately reject any system that gives you less than we have today. It is worth remembering that VHS today is better than some of the proposals for tomorrow's distribution media.'

Hours are often spent deciding on the best 'compromise' when panning-and-scanning wide-screen for TV and video release, and Smith showed some examples of how a poorly thought out transfer can completely change the sense of a film. He also explained the various techniques that are used to improve the resolution of nighttime shots and how, sometimes, modern technology can actually produce results that are closer to the director's original intent than were hitherto possible. This was particularly evident in a clip from the remastered version of the classic western, *Shane*.

During his Optical Disc session, Smith touched on the requirements for Video CD and DVD. 'Paramount was the first CD-i signatory,' he said. 'One of the problems we don't have in PAL is 3:2 pull down. When you encode to MPEG-1 or variable rate MPEG-2, 3:2 can cause artifacts.' This will inevitably mean re-transferring for CD release.

On the subject of which HD-CD format Paramount would support, Smith commented: 'Paramount Pictures is hardware neutral and intends to stay that way. Both systems have their good points, and their potential drawbacks.'

High density CDs

Unfortunately, in the case of Toshiba-Time Warner's HD-CD proposal, the industry will have to wait until the Santa Clara show to find out what these are. In announcing a change to Day One's Optical Track programme, Dr. JA Verhoeven, strategic program manager for ODME, told the audience that at the last minute Toshiba-Time Warner had decided not to participate in a discussion on the two proposals entitled Industrial Positioning of a New High Density CD Format.

Their absence gave an opportunity for the 'rival' camp to explain their technology in more detail. Dr. Verhoeven believes that the time is now right to introduce a replacement for the *Red Book*, and it was to this end that Philips and Sony have jointly developed the HD-CD.

Earlier this year ODME organised a seminar in Eindhoven, Holland to explain the Philips-Sony format in detail. The event took place one day before Toshiba-Time Warner announced their double sided Super Density (SD) format.

Jacques Heemskerk, program manager of Philips Key Modules, outlined the physical specification of their HD-CD proposal—during which he made a number of pointed references to the backwards compatibility offered by a single-sided disc. As well as expressing the view that it was important 'not to push optical and mechanical disc technology to its limits at the cost of reliability and interchangeability'. Heemskerk said that it was important for the physical dimensions of HD-CD to be the same as its predecessor. Signal processing and file formats should also be similar so that only minimal modification to the electronics would be required to replicate these new discs.

The amended programme also afforded Jeff

Floor Wars - exhibitors vie for visitors' attention in Vienna

Uitenbroek, European business development manager for 3M, an opportunity to outline their 2P (photo polymer) dual layer replication process. By employing a patented alloy to create a second semi-reflective layer—which can be read by a differential laser focusing lens—the capacity of the Philips-Sony high density disc is increased to 7.4Gb. In the case of long feature films this offers a continuous programme without the need to change sides.

Uitenbroek explained that by coating the second information layer on a parallel sub-system, standard discs can still be produced when required by the main production line. There are also no special labelling and handling equipment requirements.

However, the chief engineer of one major CD replicator pointed to Uitenbroek's admission that so far 3M have only experimented with this process under laboratory conditions. He expressed concern that applying the second layer before the first moulding had been allowed to cool could cause optical distortions in the final product.

Concluding this section on HD-CD, Dieter Daum, the executive vice president of Sony DADC Austria, presented the findings of research into the practical aspects of manufacturing high density discs that has been carried out by his company in Japan. The conclusion they have reached is that producing single-sided, single-layer high-density CDs will not require any significant changes to either mastering or moulding equipment, although tighter tolerances will inevitably be required.

Producing single-sided, single-layer high-density CDs will not require any significant changes to either mastering or moulding equipment, although tighter tolerances will inevitably be required

CD-ROM

During the Trends in Software Manufacturing and Duplication presentation (part of the Computer Media track), John L Sands of IPC Software Services highlighted Video CD as a major growth area for CD replicators. He said that the video hire industry is eagerly awaiting the introduction of CD-based video media, because currently a VHS tape lasts an average of only 21 hires before it is unusable.

Sands believes that although a major proportion of the replication business will go to the software owners' own facilities, around 30% will be available to independents. 'Thirty per cent of this market is going to be a lot of business and we expect those who get this business with be the ones who are equipped to press high density discs and have already started working with the film studios,' he said.

In response to those who believe that CD will be quickly replaced by the Internet or other means of electronic distribution, Sands commented; 'In the early days of CD there were reports that it was already being scrapped in favour of DAT. Now everyone says that no one is publishing on CD-ROM any more as they are all going on-line. But, although the Internet is growing by leaps and bounds, it is still tiny compared to CD distribution'.

Sands pointed to the growth of Multimedia PCs, which he believes will soon result in an 'explosion' in the number of retail outlets selling CD-ROM. This will in turn put more pressure on the ▶

Alea Systems' *CD-Maker* desktop CD copying system

Exhibition highlights

While Olsson restricted his talk to a 'generic' look at the market, once back on the **StageTech** stand in the exhibition hall he explained how his company's *d2d* system has been designed specifically as a mastering input device. It not only transfers all data and subcodes to the glass master but also produces a complete mastering history of the CD-R by printing a detailed error log.

The standard *d2d* system connects between a *PCM-1630* and the LBR. A changeover switch then selects the required input device. The *d2d*'s functions mimic those of the *1630* and so it can be controlled without modification to the LBR's software. However, Olsson stresses that this approach does not limit *d2d* to single-speed CD-DA and CD-ROM; the unit can also be configured to accommodate other CD formats.

It is not only the CD replicators that have a need for higher speed mastering. The cassette duplicators are also going down this route in an attempt to increase their output by achieving a faster turnaround between jobs. This is especially important now that customers are adopting 'just in time' methods and the trend moves towards smaller, more frequent runs.

One of the first to address this problem has been **Concept Design**. They have developed the ROM-LOAD system to work with their *DAAD* digital bins, and the *MAX* bins they manufacture for **Gauss**.

Until now digital bins have been loaded from DAT masters running at real time, which has meant an average loading time of 20–25 minutes per album title. (The two sides are loaded simultaneously from different DATs.) ROM-LOAD allows this process to be speeded up by a factor of four—reducing load time for an album to around 5–6 minutes.

According to Robert Farrow, president of Concept Design, the hardware modification required to the digital bin is minimal. The essence of ROM-LOAD is the offline PC-based workstation.

Senior project engineer, Andrew Isakson, explains: 'ROM-LOAD's Master Maker employs a 486DX-66 containing a 3.6Gb SCSI hard drive buffer onto which masters can be assembled from R-DAT or other input media. The CD-Rs are then written as full 16-bit 44.1kHz files, but recorded as .WAV files in the more robust error corrected CD-ROM *Yellow Book* format. The audio can also be Dolby encoded if required.'

Farrow agreed with Krister Olsson about the problem of using standard audio CDs as input media: 'While an audio CD is easier to produce,' he says, 'the problem is that uncorrected errors from the disc are passed through into the digital memory and duplicated. That's why we elected to use CD-ROM; there's an additional level of error correction, it's a whole lot more robust, and if we do get an error the system will shut down.'

(**Tapematic** also previewed a CD system for loading their SAM memory, but at present this is a prototype and no detailed technical data was ▶

software industry to produce more titles, and in larger quantities. 'Where initial orders are now between 15,000 and 50,000, that should grow to an average of 75,000 to 120,000,' he told delegates.

Sands is convinced that most new formats will be CD based for the foreseeable future, anyway. 'The replacement technology for CD is not at hand yet; we can't even guess what it will be.'

Staying with CD-ROM, a Status Report on the European Replication Market presented by Sairoze Hemani, senior consultant at BIS Strategic Decisions, focused on the rapidly changing European market for CD-ROM.

Although the wealth of facts and figures were difficult to absorb in the time allotted, the underlying trend appears to be a shift away from the entertainment titles which dominate CD-ROM sales at present. As the market matures it is moving more towards multimedia applications.

According to Hemani, it is still a little early to accurately predict what effect Video CD will have on CD replication numbers. The European video cassette market is similar in size to that for audio CD, and so widespread acceptance of this new format could dramatically affect current predictions.

'The goal posts are moving all the time,' she said. 'Sales patterns are changing, with some video companies possibly looking at CD-ROM as their main platform rather than Video CD.'

Another speaker to reinforce the CD message was Krister Olsson, managing director of Swedish mastering specialists StageTech, whose presentation *Mastering: Double Speed* looked at the various media that are now challenging U-matic as the standard for the interchange of premasters.

Olsson pointed out that one of the most commonly used formats at CD plants today is 8mm Exabyte, which is capable of running at double speed, or higher. Most audio studios are probably not aware that the U-matics they send in to the plants are frequently transferred to Exabyte before glass mastering in order to gain maximum output from their expensive laser beam recorders.

'There are some reservations about this in the audio industry, although whether it can really have any effect on the programme is another matter,' Olsson said. Other input media options available include recordable CD and a direct download via SCSI from hard disk; the latter being in the experimental stage at present.

One of the problems when using recordable CD is that most CD-R machines record only to the *Orange Book* standard, and this format cannot be used as a premaster for audio or CD-ROM without an interim transfer stage. CD-R machines were also unsuitable for use as the front end in a mastering system because they are unable to monitor the various levels of error correction.

available at the time of the Vienna show.)

There was one device at the show that can only be described at ubiquitous. The *CD-Maker* is a desktop CD copying system, but what made it slightly unusual was the fact that it was being displayed by three or four companies under different brand names. After some investigation it was found to originate on the stand of **Alea Systems**.

The *CD-Maker* is, in fact, a family of copiers, with a combination of options so varied it would require several pages to detail them all. The basic unit makes a 'mirror' copy of a CD-DA, CD-ROM, CD-i or a variety of other CD formats, but with no modification to the data being possible. The range goes up to systems producing multiple high-speed copies by employing four CD-R 6x drives. There is also a CD jukebox which enables up to 500 copies to be generated automatically.

Labelling CD-Rs has always been a problem. Stick on labels can disturb a disc's balance and the ink from some marker pens has been know to eat into the protective coating. **Rimage Europe** showed one solution at REPLItech with what they claim to be the world's first CD-R printer. The label is 'designed' on a PC system and the CD is then fed through a modified ink jet printer —apparently without any detrimental effect on the disc.

The imminent arrival of HD-CD, in whatever form, means that almost every equipment manufacturer is branding their equipment 'high

It is not only the CD replicators that have a need for higher speed mastering. The cassette duplicators are also going down this route in an attempt to increase their output by achieving a faster turnaround between jobs

StageTech's *EC2* CD error checker – CD-R testing on site

density ready'—and in many cases claiming that their competitors are not!

The injection moulding companies are now incorporating easily variable cycle times into their systems to allow for rapid changeover between standard and HD discs, and a couple of the manufacturers have recently introduced smaller and lighter moulding machines specifically designed for the purpose of producing 120mm CDs. These smaller machines can achieve cycle times of around four seconds, a vast improvement when compared with the 18 seconds that it took to mould a CD back in the mid 1980s.

But probably one of the biggest battles—of words, anyway—is the one being waged between the proponents of photoresist mastering and the alternative dye polymer (non-photoresist) technique. Each claim that their system is best suited for HD-CD, and have demo discs to prove it. Unfortunately, because there are currently no players available, there is as yet no easy way for the prospective buyer to check out their claims.

Birefringence is a word that does not exactly trip off the tongue. It is, however, a crucial factor in the process of manufacturing optical discs and refers to the amount of light absorbed by a CD's polycarbonate substrate. This can be affected by a number of factors, including the optical distortion caused by stresses induced when there is uneven pressure or cooling in the mould. Reduced pressing cycle times increase the risk of higher birefringence and this is likely to become even more of a crucial factor when manufacturing HD-CDs.

QC specialists, **Automatic Inspection Devices**—who recently acquired the UK company **Integral Vision**—produce a birefringence tester that shows the operator a topographical map of the disc, making it quick

and easy to identify any problems.

Aerosonic, better known for their video test equipment, have recently entered the CD market with a number of products including their own birefringence tester and a bit-for-bit verifier. Where a CD-R has been used as the mastering input medium, the latter allows a direct comparison to be made between a finished pressing and the master. On screen displays show precise error counts together with a quick visual indication of bad blocks, making the system ideal for use by unskilled operators.

Another recently launched CD tester which will be of specific interest to premastering and mastering facilities—as well as anyone building an archive using CD-Rs—is **StageTech's** *EC2* CD Error Checker. The unit has principally been designed for those wishing to use a CD-R in place of the *PCM-1630* for the CD master. It identifies any disc errors and provides a *DTA-2000* style printout. In addition, the *EC2* will read and print out the PQ code from a disc, including catalogue and ISRC numbers. Support is currently provided for *Red*, *Orange* and *Yellow Book* discs; others will follow.
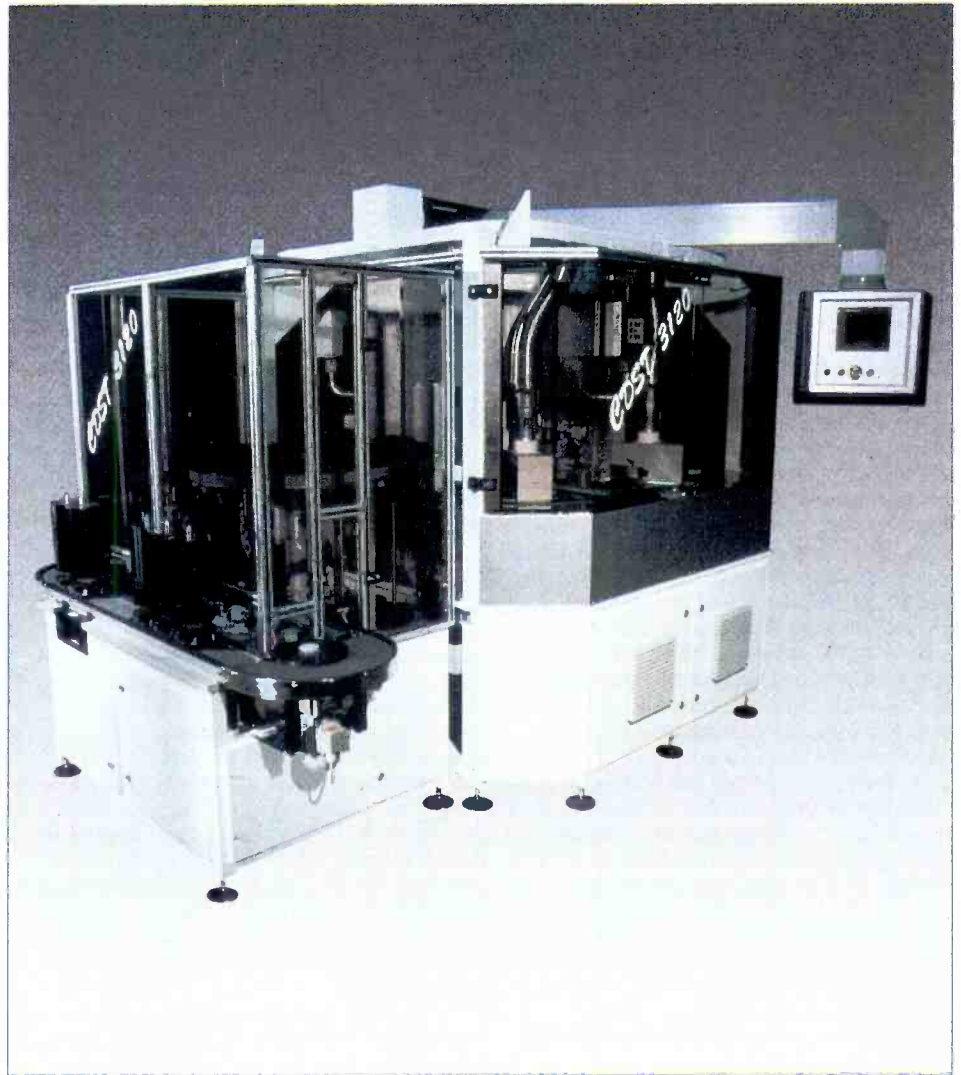
REPLItech Santa Clara

The forthcoming REPLItech International in Santa Clara promises to be an event of major importance. With a packed conference schedule which should include more details about their HD-CD format from Toshiba-Time Warner, and over 200 exhibitors lined up to show their latest products, attendees are promised a busy three days.

We will be there to cover the event. Look out for a full report in *MDR 6*. ∎

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Format for success

Dear sir, over the last few months the opinion seems to be gaining momentum, like a snowball rolling down a hill, that CD Video is going to be the 'next big thing'. People are actually opening new CD plants on the strength of this belief. Do these guys know something I don't, because from where I am standing CD Video, in its present form, doesn't seem to be the foregone conclusion that everyone else seems to think it is?

Has everyone got such a short memory that they've forgotten the dreaded DCC-MiniDisc debacle? Hyped up a couple of years ago, where are they now? At the Paris AES Convention, MiniDisc was virtually invisible, except for a few professional machines aimed squarely at the cart-replacement market. The only DCC on the Philips stand was a bare transport reinvented as a data-logging device. Surely this episode was a clear demonstration that the consumer will not fall over himself to adopt a new format, despite its supposed benefits, and despite the marketing muscle of the likes of Sony, Philips, Matsushita and so on. The worldwide installed base of VHS is massive—are all these users going to junk their machines in favour of something that (a) looks crap and (b) does not record ?

VHS might not be perfect but, personally, I would rather consume my video on a system where the picture does not go fuzzy when there is a panning sequence or a large amount of movement on the screen, and any moving background detail isn't pixellated out of recognition. Has everyone forgotten that is was the time-shift viewing capability that got video off the ground in the first place? Also, since a feature film is essentially a linear viewing experience, what's the advantage of putting it on a random access medium?

It seems to me that the optical disc industry is still wallowing around, looking for that 'killer application' (in the same way that *VisiCalc*, the first spreadsheet, was largely responsible for the success of the Apple 2 in the USA, and *PageMaker* virtually saved the Macintosh from obscurity). CD Video, in my humble opinion, is not it. By way of illustration, last Autumn I attended a CD-i presentation by Philips to an invited audience of APRS members. I went there expecting Philips to say, 'Hey, look what we're doing with this amazing technology—you too can join us and be a part of this' Instead of which, the message they gave out was, 'Well, we've got this technology, it does all these things, but we don't know what to do with it. Please help us find a use for it.'

What the industry needs is this 'must-have' application that somehow utilises the full potential for audio, video, interactivity and so on, and captures the imagination of the public. Until then, CD Audio will be the only mass market CD format, and a lot of people who have opened CD plants on the strength of CD Video are going to be decidedly red-faced.

But still, what do I know? I wouldn't know an MPEG from a clothes peg, so will someone who does please give me a convincing argument as to why the CD Video format will be the miracle cure for overcapacity in the optical disc manufacturing industry.
Henry Smithson, Sounds Good Studios, Berkshire, UK

Case study

Dear Sir, in his piece on the threat to the cassette (*MDR* April 94) Martin Polon points out that the demise of the LP was attended by cost-cutting and consequent poor quality, and suggests that the same might happen to the cassette. I am here to tell him that it is already happening.

As far as I can see, one of the best ways to invite mechanical damage to the tape in a cassette is to leave it rattling around out of its box so that its hubs are not locked against rotation. If the hubs are free to turn, normal vibration in a car, a pocket or a carrying case will cause loops of slack tape to develop inside the shell. If this slack is not taken up before the cassette is played, all kinds of damage can result. The tape can fail to thread correctly across the guides and rollers of the shell and transport, causing creasing and edge damage, and in extreme cases the snatching caused by putting such a cassette into fast wind can snap the tape. I should have thought this was obvious, and is the reason why library cases were designed with the two spikes or lugs to hold the hubs during transit; even when unorthodox designs have been tried (remember Memorex' original case?) it has still been necessary to provide a way of locking the hubs. So why are we now seeing cases without the lugs?

One project I was recently involved in came back from the duplicators in lugless library cases. Within days of beginning distribution we had a returns rate of more than 10%, all with the type of problem I have described. Random inspection of the remaining stock showed then all to have come severely unwound inside the shell, inviting trouble.

The supplier's response to a complaint was to provide 100 further free copies—20% of the original order!—to replace damaged ones, and to tell us that these cases are now in widespread use, a fact confirmed by a visit to a local record shop. By this time word had got around the potential customers that there was "a problem with the copies" and sales and reputations were damaged as a result.

I would be interested to know how much cheaper these cases are to make—I cannot believe the saving is significant. I can see no benefit from the change; the only motivation which makes sense is the desire to undermine consumer confidence in the medium by making it appear unreliable and prone to damage, unless of course the duplicators just don't care what happens to the cassettes after they have been shipped. Whichever it is, these cases are unacceptable and I would suggest that the lugs should go back immediately.
Dave Foister, London ∎

master *pieces*

In an era of mixed analogue and digital audio technology, the requirements of mastering engineers have never been more precise. It is in response to growing demand that Focusrite has developed two new products, designed to address the key processing functions of equalisation and dynamic control.

The Blue 315 Mastering EQ and the Blue 330 Mastering Compression Limiter both make use of the highest quality switches for all rotary functions. These provide precise and repeatable settings in units of unequalled build quality, ensuring long-term reliability and performance.

Blue 315

It was the widespread desire to see the legendary ISA 110 Equaliser available for mastering which led to the creation of the Blue 315. The simple request was for rotary switches on all functions, but of course there is a great deal more to mastering than recall-

ability of rotary switches alone.

Mastering is the process by which a mixed product is refined – the fine-tuning and assembly for particular medi. Private discussions with individual mastering engineers, coupled with careful research, revealed many small differences between a programme equaliser and a product designed for top-quality mastering. These differences were the starting point in the design of the impressive 315.

The frequency ranges have been gently expanded to allow for finer resolution and the Q controls boast higher resolution and wider low-end range. In addition, the boost and cuts are designed with small increments close to the null point and larger steps at the extremities. The filters have minimum ripple roll-off and the extra-fine
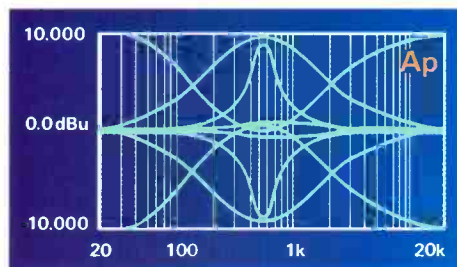
variables of the input gain controls allow for absolute precision.

Mastering will always be a very personal skill, and it is with this in mind that the 315 has been constructed to allow simple adjustments according to individual preference.

This technological 'masterpiece' has been achieved without any sacrifice of Focusrite's traditional standards. You are assured of the best performance parameters (often superior to digital), the highest quality components and construction, along with both transparency of sound and ease of use.

> "The Blue EQ is a superb sound sculpting tool. It allows me to develope textures no other equaliser enables you to achieve"
> – George Marino, Sterling Sound, New York.

> "In almost a year I've used my three old EQ's three times. Any other questions?"
> – John Matousek, Masterworks, Los Angeles.

Blue 330

Also the product of customer demand and extensive research, the Blue 330 represents the transformation of the Focusrite Red 3 Compressor and Limiter into a Mastering format. Unique and unrivalled in all its attributes, we feel it genuinely deserves masterpiece status alongside the 315.

The structure of the circuits is very different to that of other compressors/limiters. The 330 separates the compressing and limiting processes, which are then implemented by one signal path VCA through combined controls signals. You are able to compress and limit in turn, meaning that the limiter only compresses the peaks that remain after the completion of the compression process. The overall result is cleaner and less intrusive than that which can be achieved

Blue 330 Block Diagram (single channel)
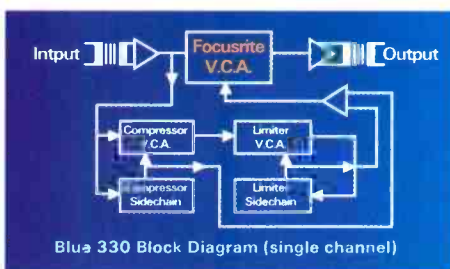
with a compressor that rolls over into limiting.

Our diagram shows that the main signal path has only the Focusrite proprietary VCA between input and output. Its feed is from two separate sidechain circuits – compressor and limiter – each with their own VCA.

Just like the 315, the 330's control ranges and sensitivities have been suitably adjusted to meet the needs of fine-resolution mastering. The input gain and make-up gain controls are of the same sensitivity, allowing tandem contra operation, so that all other settings can therefore be raised or lowered without re-adjusting each control.

Both the Blue 315 and the Blue 330 are now available for evaluation, either direct through Focusrite in the UK, or via our appointed distributors elsewhere in the world. To find out more, please contact us today.

PROJECT DIGITIZE

Project Digitize is the evocative title the British National Sound Archive have dubbed their efforts initiative to preserve their library of diverse audio material. Dave Foister investigates the Archive, the Project and the technology

The one thing we learn from history, we are told, is that we never learn anything from history. Organisations like the British Library exist in the hope that this is not true, and to make history of various kinds available for research.

In a bold effort to make sure that material of all kinds remains available in this way far into the future, the British Library has launched research projects to investigate methods of digital preservation of its contents. Twenty such projects include research into digitised images, documents and whole books, digitising microfilm, and the use of optical character recognition for text. Since the British Library now incorporates the former British Institute of Recorded Sound, now known as the National Sound Archive, one of the projects is concerned with the preservation of the vast diversity of sound records held in the archive, and this is known as Project Digitize. When one considers the huge resource the archive represents, with its collections of music, spoken word, oral history, drama, wildlife sounds and so on, the importance of its preservation becomes clear, as

does the scale of the project.

There are three main goals, or 'deliverables', of Project Digitize. One is to research the best ways of retrieving the sound accurately from vulnerable analogue carriers; since the various collections include virtually every analogue medium ever used, this in itself requires a combination of historical research and technical innovation. The second is to find a way of combining the transferred result with relevant digitised images, which could include record sleeves, documentation of recordings, pictures of the participants and other background information in text or picture form. The current conclusion on this aspect is that no practical solution exists at present; multimedia work of course abounds but there is no way of making the audio and the pictures independently browsable, which would be a prerequisite for research. It is felt that the user of the finished product should be able to listen to the recording continuously while choosing which images to look at, rather than being forced to associate the one with the other, and as things stand this is not possible.

The third deliverable is to make the collection more accessible, and this accessibility takes several forms. In the context of the library itself, many items in the collections are simply not available for listening by anyone. The NSA operates a public listening service, allowing access to material on tape, disc or CD via special listening rooms operated by NSA staff, but many items cannot be made available in this way as they only exist on their original fragile carriers which would unavoidably suffer damage at each playing. On a global scale, there is of course a wish to make material available via the various international data networks to researchers elsewhere, which will only be possible when the collections exist in digital form. This in itself is the subject of another research project, Project Jukebox, and although the two are independent the one will inevitably feed the other.

One important aspect to bear in mind is that the specific concern of Project Digitize is the storage in digital form of the actual sounds in the archive, not the preservation of the various artifacts on which the sounds exist. The NSA as a whole of course is committed to the physical preservation of the material, and indeed a further consequence of the project is the fact that if it succeeds it should never be necessary to play the fragile originals again.

Digitize

Project Digitize is a 15-month initial research project, already more or less at its end, investigating the central aspects of the problems. It was decided early on that rather than take bits from all the collections to work on, it would be better to identify a whole swathe of work and try to deal with it all, in the expectation that if

appropriate material was chosen most of the likely stumbling blocks would crop up along the way. The material selected included the Werner Collection of wax cylinders made by Alice Werner in Kenya in the early part of this century. These cylinders, originally deposited at Cambridge University, form part of the largest accumulation of such material in the UK, and the Werner Collection in particular has never before been copied. Also included in the project, and presenting a wholly different set of problems, is the collection of tapes made by AL Lloyd, regarded during his lifetime as the leading authority on English folk song but also a keen collector of such material from other cultures. Digitizing these collections will fulfil all the achievable goals of Project Digitize, including the practical one of making material available to the public; since this material has never been dealt with before, it does not even appear on the NSA's cataloguing system yet, which means that many of those who might want access to it are not even aware of its existence.

The project involves three key personnel: the Project Manager, Peter Copeland, who is also Technical Manager of the National Sound Archive itself; a Transfer Operator, Serena Lovelace, responsible for the actual transcription of the material; and a Discographer, Jonathan Summers, whose job it is to research the origins, sources and nature of the material and to document it in such a way as to make the Transfer Operator's job as smooth as possible.

For instance, the AL Lloyd collection is on various formats of tape; even within a reel, track configurations, speeds and levels can change from one item to the next, and it is the Discographer's task to log all the changes against real time so that the Transfer Operator can set the replay equipment up quickly and easily for each section. With cylinders and discs he has to identify chronology, sort out the hierarchy of various copies which might exist, and again establish correct playing speeds where possible, all jobs made more difficult by the fact that the original documentation is often vague, sketchy or even wrong. This is work which should never have to be repeated, as whatever developments take place in audio the documentation of the collections and the sorting out of initial transfer requirements is a one-off job and the information will remain available to later researchers. The audio material will inevitably be the subject of further work in the future; whatever archiving medium is chosen, it will not last indefinitely and must at some stage be copied on to either a fresh version of the same medium or some new medium altogether, and if techniques become available for retrieving the information from the old recordings more effectively than current technology allows then, no doubt, that will be applied as well. The donkey work (no disrespect intended) of identification, cataloguing and transferring the old artefacts will have been done,

Mixed media - the Pelec cylinder player alongside SADiE

so future revisiting of digitised material will be a much faster process than the current project.

Some of the challenges faced in this work make the odd problems faced by most of us—unlabelled or misaligned tapes, for instance—pale into insignificance. Typical are those presented by the Werner Collection, which consists of recordings of ethnographic material—local musical traditions and so on—made in 1912 and 1913 during Alice Werner's Kenyan expedition. As an anthropologist, her intention was simply to make notebooks in sound of what she was hearing on the expedition, and consequently she paid scant attention to some of the considerations which would be considered important by musicologists, such as the original pitch of the music. It seems that she altered the recording speed of her machine more or less arbitrarily simply in order to fit a given item on to a cylinder, so that speeds can vary by as much as 50% with no record of the actual deviation or any pitch reference.

The variety of sources and formats means that the various rooms in the labyrinthine National Sound Archive contain an extraordinary selection of replay equipment, some carefully preserved originals and some specially made modern replacements. In use on the Lloyd and Werner collections respectively are a Studer Revox ¼-inch 4-track recorder (now discontinued and by no means a familiar machine) and a custom-built cylinder player, manufactured by Peter Posthumus at Pelec Systems based on earlier work by Lloyd

Experience shows that any tampering with the original now can hamper future attempts at restoration

Stickells and Bob Walters before him. This is a remarkable machine, with a moveable pickup bridge to accommodate different diameters of cylinder and the incongruous sight (to those not familiar with modern cylinder players) of a Shure *M44* cartridge where the old phonograph's pickup would have been. A wide selection of styli are available, and the NSA has access to an expert stylus manufacturer who can produce special styli to the NSA's own specifications.

Having obtained suitable replay equipment and established the most authentic way of retrieving the sound from the carrier, the next stage introduces the first of many philosophical arguments. If one is to preserve a collection of this kind, how should one define preservation? Should one attempt to produce the most palatable,

listenable end result achievable with current techniques; should one attempt to reproduce what one believes the original sound to have been before the medium got in the way; or should one simply preserve as exact a replica as possible of the sound present on the original artefact? Some approaches inevitably introduce subjective judgments, which immediately means there is no one correct version but many shades of opinion.

The approach adopted by the NSA is to define three categories of transfer. First, anyone using the archive now should have access to the most intelligible transfer of the original, using whatever restoration techniques are available, and a subjectively processed copy for public use can be made. Second, there is a place for careful restoration using demonstrably objective processes, as long as any alterations are fully documented. Finally, experience shows that any tampering with the original now can hamper future attempts at restoration when more powerful techniques become available, so the actual archive copy should be as accurate and complete a replica as possible of the sound on the original medium. It is well known that current restoration processes such as *CEDAR* work best with flat transfers of old material, and that any attempt to remove unwanted noise and crackles by means of filtering and so on beforehand just makes *CEDAR*'s job more difficult by, for instance, blurring the distinctions between the hard leading edge of a click and the less violent transients of music. ▶

Peter Posthumus' custom cylinder player incorporates a Shure *M44* cartridge

Acknowledging this leads to considerations of which processes can legitimately be used to make archive transfers, if any, and a phrase central to the NSA's vocabulary is archivally sound. If it can be demonstrated that a particular process loses nothing of the original intended signal, then it can be considered archivally sound and its benefits used to advantage. Any process which does more than this must be reserved for the production of listening copies. The consequence of this is that the transfer suite possesses surprisingly little equipment for actual restoration, the only item in regular use being a little-known device called the *Packburn Switcher*. This incorporates several processes, but only one is considered archivally sound; this is the main function of switching between two reproduced channels of what is originally a mono signal, as produced by a stereo cartridge playing back a mono record, be it LP, 78 or cylinder. It is well established that on a conventional laterally-modulated record each imperfection—a scratch or a worn groove—will probably be worse on one wall of the groove than the other, while the wanted signal will be effectively identical on both. The *Packburn* monitors both groove walls continuously, and switches between them so that at any moment it is playing the quieter wall. This means that some of the raw contamination has been removed without detriment to the wanted signal, which fulfils the criteria. Many source s—cylinders and some 78s—are of course vertically modulated (what is often called hill-and-dale modulation) and since the same stereo cartridge reproduces both the hills and dales and the defects in the side walls of such a source as well, simply by inverting the phase of one of its channels, the *Packburn* can be set to do the same job on these. Although the other processes are not considered archivally sound, the *Packburn* also includes a click removal system and a dynamic filter or single-ended noise reduction system, both

of which are occasionally used on public listening copies. So useful is the *Packburn* considered that it is even sometimes used on mono LPs. For those wondering where they might be able to obtain such a beast, the good news is that an updated version may be on the way.

Transfers

Transfers are made either to DAT or to the NSA's SA&V *SADiE* editing system, which is normally only used for compilation purposes and to edit out occasions when the stylus sticks and repeats a section. Its processing is occasionally used for difficult cases; an example played to me was a cylinder recorded by an old man as a message to his grandchildren on 26 January 1894 at the London Phonograph Company, of which two copies exist. Transcription was a problem as the cylinders were both in fairly poor condition so that even the NSA's wonderful player could not track either of them properly. Eventually they were played at sufficiently low speed to be tracked, copied into *SADiE*, the best bits selected from the two versions, the editing done and the finished product shifted back up to original speed. The results were perfectly intelligible and useable, although needless to say no longer considered archivally sound.

The DAT machine is a Sony *PCM-2700*, fitted with the Audio & Design modification allowing verification of the data on the tape. Asked whether they had considered outboard converters of any kind, the NSA replied that this is one of the more clear-cut areas which needs little research as such at this stage, and that Project Digitize's funds were better spent elsewhere initially. The same applies to the Spendor-NAD monitoring, which no-one would pretend is state-of-the-art, but the requirements in this application are perhaps different from those obtaining in a typical studio environment. Most monitoring is in fact done on

headphones so as to eliminate spurious background noises and clicks which might mask a problem during the transfer. This need for quiet, however, has persuaded the operators to site the *SADiE* computer remotely from the keyboard and screen so that its fan noise is less of a problem, although not so far away that its occasional helpful bleeps cannot be heard.

It is no surprise to learn that the NSA do not regard DAT as a suitable medium for archiving, and as a rule of thumb they allow two years as the estimated life of a DAT recording. Much of the general logging and archiving work of the organisation as a whole is in fact done on Sony *PCMF1-701-601-501* systems, these days using VHS for storage although there are an astonishing number of old Betamax machines adorning most of the rooms. Even this, however, is not considered appropriate for real long-term archiving, and the decision as to which medium should be used became central to the Project's research at an early stage. Crucial to the considerations were obvious matters such as sound quality, reliability and cost effectiveness, but an aspect few of the rest of us have to consider is making an archive future-proof. Here a lesson has been learned from history; part of the reason some of the more obscure media held by the NSA—not, obviously, the media involved in the Werner and Lloyd collections—are so difficult to deal with today is the fact that there are so few players surviving, partly because there were never that many in the first place, and it could be a big mistake to archive now onto a medium which even today could be considered specialised. The ideal medium on which to leave an archive for future generations is one which is sufficiently popular and widespread now that it can be confidently expected that it will still be playable in a hundred years time, and the obvious medium is therefore CD. There are an estimated 40 million CD players in the world ►

Serena Lovelace loading the cylinder player

Serena Lovelace at the NSA's *SADiE* workstation

Jonathan Summers and Serena Lovelace

today, so the chances are good that there will still be plenty of working specimens available a century from now.

This assumes, of course, that in the first place the quality of sound on CD is adequate for preserving the nuances of the original, and whatever the pros and cons of high-bit media few would disagree that 16 bits at 44.1kHz are equal to the task of encoding a wax cylinder. In the second place, the chosen medium needs to have as long a shelf life as possible, so as to be in the best possible condition for future playback and even future restoration of the audio content. The longevity of the compact disc has been the subject of much debate since its introduction, but many of the early fears have been shown to be either groundless or easy to deal with. Nevertheless, recordable CD (CD-R) is newer still, and its life expectancy is in many cases an unknown quantity. In the early days of Project Digitize, Peter Copeland organised, in conjunction with the BBC, some tests on a British make of magneto-optical blanks which, although designed for computer data archiving, would have been suitable for this application. So robust were the discs that it was difficult to achieve meaningful results from any of the ageing tests, the best figure being in the order of hundreds of billions of years. Unfortunately, production of these blanks ceased in favour of higher density carriers which were not CD compatible, rendering the whole testing procedure rather pointless.

More recently, tests have been conducted on CD-R blanks using a Koch CD tester, but since audibly acceptable discs are being rejected as complete failures by the machine it is felt there may be some problem with the procedure as applied to CD-R. The cumulative effect of all this inconclusive testing is to make the NSA reluctant to embark on any more, preferring instead to look very carefully at the results and specifications published by the manufacturers themselves.

The problem is that few of the blank disc manufacturers publish sufficiently detailed figures. The first exception was Kodak, who claim a life

expectancy of a hundred years, backing it up with detailed maths which Peter Copeland, after detailed analysis, has professed himself convinced by. This is not to say that Kodak are necessarily the best—the NSA are keen not to be seen to endorse any particular product, partly because their own requirements and criteria may not be those of the world at large—but that so far Kodak are the only ones prepared to stick their heads above the parapet with hard data. More recently, HHB have launched a range of CD-R blanks with the same hundred-year life expectancy quoted in their literature; it will be interesting to see whether they too can satisfy Peter Copeland's probing of their figures.

Longevity

The point about the NSA's priorities being perhaps different from those of the rest of the industry raises further interesting issues. For their purposes, the primary consideration, given reasonable data accuracy to begin with, is longevity. A few errors here and there will not concern them greatly, as long as they do not proliferate too much with age. Clusters of small errors close together have been identified as a potential problem, because a small deterioration may cause them to merge into larger irrecoverable

It is felt that compression is neither necessary nor desirable for the long-term archive

errors, but apart from that reasonable occurrences of errors will be acceptable.

The other current area of growth is of course the recorders themselves, but the main consideration with these is convenience of operation, it being assumed that once the signal is in the digital domain there will be little to choose between them in terms of audio quality. The machine in use at present is a Meridian, one of the original badged Philips units, and it is at the stage of the transfer on to this machine that the verification facility on the DAT machine is used. Logging the results and storing them with the tape allows the tape to be verified periodically so that this too can be assessed for ageing. The presence of *SADiE* would of course allow the use of a SCSI CD writer for the final transfer, but the added convenience of a conventional stand-alone recorder has many uses. The new generation of CD recorder, represented so far by the Apex *2000*, will allow both modes of operation, but at this stage this type of machine is not supported by *SADiE*.

Some work has been done looking at data compression, but it is felt that compression is neither necessary nor desirable for the long-term archive. There is an obvious application, however, in the context of Project Jukebox, and an interesting sideline is that such freely available material may have to be compressed in order to introduce an element of deliberate degradation to satisfy copyright holders that their property cannot be too easily pirated.

The NSA seem reasonably satisfied with the results of Project Digitize, although as ever they would like to have had more time and more money. It seems clear that many lessons have been learnt about procedures, attitudes and techniques which should see the archive well into the next century and beyond, and which have clear applications for the rest of us in audio. ∎

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DNA DICTATOR

Forget flash, forget fancy. If you are concerned with signal limiting for mastering, think workman-like. Dave Foister dons overalls and reports on a Dutch limiter

The limiter must be pretty much the least glamorous audio signal processor, yet at the same time the one most likely to be indispensable in certain applications. It's a bit like an audio condom; no matter how carried away we get, how adventurous and creative we might feel, the limiter is designed to make sure there are no mishaps, no accidents, no unwanted consequences and no ailments induced in the surrounding equipment. No matter what colour, size, shape or even flavour a condom may be, it could never be described as glamorous, and the same is true of the limiter.

So dull is the limiter, in fact, that dedicated standalone limiters are a comparative rarity. Most of those we encounter are stuck on the end of a compressor, which can be as sexy as anything with soft knees, pumping, breathing, warm tubes and input-dependent release times. But the limiter is almost an apologetic afterthought for those who want to practise safe sound. Something for the weak links, sir?

Limiting has little to offer in terms of creative effect, being there simply to do its job of protection, and I would be surprised if many people outside broadcast engineering make routine use of it, perhaps regarding it as a necessary evil on those sessions which are such a roast we haven't got time for mundane jobs like watching the levels reaching the tape machine. For those who do need limiting as a matter of course in their work, a good limiter may make the difference between staying on air or losing the transmitter, or between clear PA sound and crunching overdriven loudspeakers, or between a clean master and a couple of tell-tale overs. It is tempting to wonder how many of the simple limiter circuits fitted to the average compressor would really do the job cleanly under such circumstances.

It is to make sure that such critical jobs are handled properly that the DNA *Dictator* exists. It does nothing whatsoever apart from limiting, but it has an unusual number of features for making sure that the limiting is done as accurately, cleanly, controllably and repeatably as possible. It still is not sexy, even with its macho name; never would a straightforward clinical unmemorable model number have been more appropriate.

Dictation time

The Dutch company of DNA have made quite an impression over the past few years, particularly with their consoles, and their recent introduction of a few outboard processors aroused a good deal of interest (see Patrick Stapley's review of the *Dymand* compressor, *Studio Sound* January 1995.) They rarely do things in the obvious way, but manage to be different without being too off the wall.

Many of the design features of the *Dictator* are put there to help those who will have the unit in circuit more or less all the time, who will have a standard calibrated setting to protect following equipment, and who want the settings to be both tamper-resistant and over-rideable. Thus although it has very little in the way of facilities apart from the obvious ones of level and threshold controls, it has a surprising number of knobs and switches to set them, and more importantly even more adjustable controls inside. This explains the presence of CAL switches on each section of the front panel, which offer more than simply a default factory setting.

Very sensibly, the *Dictator* is configured purely and simply as a stereo processor; with the exception of the input gain adjustment, all the other parameters are set with a single stereo control—vital for critical applications, provided of course that the controls track accurately, which these certainly seem to do. The input level controls have a centre zero, corresponding to a nominal operating level set internally on jumpers. This can be 0, +4dBm or +6dBm (the studio version comes set at +4dBm, broadcast at +6dBm) or variable on two of the many internal multiturn pots. The front panel level controls then add or subtract gain from this reference, but they themselves can be over-ridden with the associated calibration switch, which hands control to more internal presets. Like all the other functions, the unit can be permanently set to its internal level settings, disabling the front panel controls, by means of more jumpers. Whichever level adjustment is in use, input levels are shown on 10-segment all-green LED bargraphs. These can also be switched to show output levels—although given the avowed purpose of the unit it would perhaps have been useful to have both simultaneously—and cover the relatively small but crucial range of -15 to +12dB. The choice of upper limit is oddly low to my mind, all the more so as it runs right through the *Dictator*. The

Threshold, for instance, has a maximum setting of +12dB, which is 6dB below full scale on a normally calibrated DAT machine (and most other digital formats) where I come from. The only other metering is a red 10-segment bargraph showing gain reduction which, of course, does not need to show two channels as the same reduction will always be applied to both.

Threshold adjustment is unusually precise, as befits the requirements of the *Dictator*'s specialised job, having both a coarse control running from -12 to +12dB and a fine adjustment for the final 1dB either way. Again, these can be over-ridden with the CAL switch in favour of internal presets (-13dB to +13dB) and even disabled altogether on jumpers. Even more jumpers and presets on the PCBs set nominal output levels (with the same options as the inputs).

The attack time of the limiter is fixed at 100µs, chosen by DNA as being fast enough to ensure effective limiting without audibly squashing the signal. This does, of course, mean that there is a danger of the signal overshooting during those 100µs, and for applications where even this is unacceptable—FM transmitter protection or before an A–D convertor for instance—a Clipper circuit allows the output to be strictly clamped to the chosen threshold. When the clipper is selected, the limiter's threshold is automatically lowered by 2dB or 3dB to avoid the clipper introducing the very problems the attack time was chosen to eliminate.

Although the attack time is fixed, the release time is fully variable over a range of 50–500ms so as to tailor the behaviour to different source material. In addition, there is an AUTO switch, which unlike many such switches does not take over complete control of the release time depending on programme content. Instead it makes modifications to the user's chosen release setting depending on various factors which DNA have taken the trouble to explain in the manual. The system monitors both the gain reduction of the limiter and the crest factor (peak to RMS ratio) of the incoming signal, and shortens the release time as these increase, lengthening it again as the gain reduction and crest factor reduce.

The *Dictator* incorporates various ideas intended to make the operation of the limiter as inaudible and unobtrusive as possible, one of these being a soft knee, making the transition from linear gain to limiting more gentle. This even has two settings, spreading the soft knee over either 3dB or 6dB.

The most unusual feature of the *Dictator* is an idea of DNA's own which they call Interactive Low Processing (ILP). Conscious of the fact that a heavy low frequency content in a signal can make a limiter appear to overwork and introduce pumping into the rest of the signal, the manufacturers have split the low frequencies —below about 150Hz—out into a separate VCA and sidechain. These low frequencies will always be subject to at least as much gain reduction as the main signal path, but when there is a particularly high level at the bottom end the separate LF path is attenuated by an appropriate additional amount, leaving the mids and highs unaffected. Note that this is not an adjustable parameter—just a switch to turn the ILP circuit on or off.

All the back panel has to offer is inputs and outputs on gold-plated XLRs; everything is balanced, and although the balancing as standard is electronic, DNA describe the output circuit as 'transformer-like'. Real transformers are available both ends as an option.

It seems curious to consider the 'sound' of a limiter such as this; it would obviously be a decided disadvantage if it was anything other than flat and transparent, and indeed the *Dictator* probably makes as little difference to the sound of the incoming signal as it is possible to make. So smooth is it capable of being that usually the only way of knowing whether or not it is doing anything is to watch the gain reduction meter. It is very difficult to make its effects obtrusive, and when one considers that in an ideal, properly engineered world it would rarely be called upon to work very hard, it is probably safe to say that the *Dictator* offers everything a limiter should offer—complete control with negligible side effects.

I cannot help feeling its appearance counts against it slightly; it can hardly help being bland and anonymous, but the knobs chosen for the controls let it down by looking a little cheap. It is nonetheless logically laid out, clearly labelled and very easy to use, although to be honest it would be hard to make a limiter much of an operational challenge.

The unit I looked at was the studio version, and a broadcast model, specifically for protecting FM transmitters, is also available, with the addition of switchable pre- and de-emphasis. The emphasis curves are selectable on internal jumpers to be either 50µs or 75µs, and a separate detection and VCA circuit is used for the pre-emphasis signal. DNA recommend using the *Dictator*'s internal pre-emphasis rather than that in the transmitter if possible.

The *Dictator* has all the solid reassurance of being designed from the ground up as a precision device to do a simple job as well as it can be done. Everything is there to allow all the finesse of control for the most critical of applications, with detailed consideration of the likely operational requirements and calibration needs. Sexy it will never be, but for the many people who need real accurate limiting as a tool of the trade, the *Dictator* fills the bill.
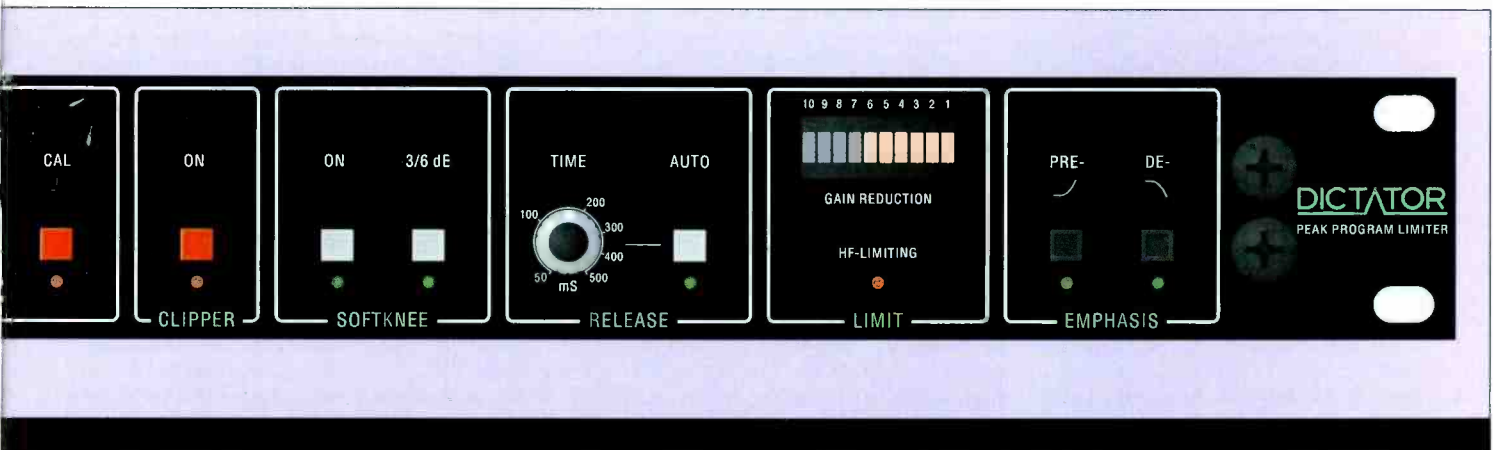
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MARTIN POLON

Despite recent reports to the contrary, MiniDisc is not dead. In spite of what could best be described as a lacklustre introduction, Sony have shown remarkable ingenuity in mustering the MD family for a further assault on the electronics industry—at home, in the recording studio, in radio and in the television station.

MiniDisc, along with its equally ill received and inadvertent stable mate DCC, was savaged by the audio critics. In the case of the MD, the flaw was perceived as sonic—based on the ATRAC digital compression scheme needed to fit 660Mb of digital stereo into a 130Mb disc. But unlike DCC, which was savaged more for physical shortcomings based on 30-year old mechanical technology, MD has a robust mechanical design which can be used in a number of different ways. And Sony have gone back to the drawing board on ATRAC encoding scheme in order to use it for their SDDS digital sound system for theatrical motion pictures.

Yet both MD and DCC floundered due to factors beyond the control of either Sony or Philips; two of the largest consumer electronic giants in the world today. Consumer interest in home entertainment products and consumer discretionary spending patterns have changed significantly since the 1980s when CD made its mark. Consumers in the US are spending $30bn a year on gambling schemes that virtually did not exist five years ago; consumer music and audio equipment purchases come from the same pool and cannot compete. These factors —and many others—have discouraged consumers from testing uncharted waters for relatively expensive new technologies that emulate rather than replace existing ones. The supposed target of the MiniDisc, the 18–29 age group, is also known as part of the 'X' generation. Instead of buying consumer audio, records and MD, the 'Xers' are dining and entertaining out. This at a pace that is more than 50% greater than the baby boomers who preceded them.

The other major issue that impacted the MD so negatively, was the inability of the music retailers to accommodate yet another music format. There are record retailers who have totally dropped cassettes and many others who have decided to phase downwards their commitment to that format to gain space. The space yielded is used to concentrate on higher profit SKUs (stock control units) such as CDs, blank media, laser discs, video games, music videos, AHS theatrical movies and boxed 'CD' record sets as well as tape recording supplies, accessories and so on.

One successful music vendor with several stores in the US mid-west reluctantly offered his view several years ago upon the introduction of the MD. 'I carry about 4500 CDs in each store I own. I also stock approximately 2200 analogue cassettes and about 80 music videos. There are also 100 or so

Is there life after death for the MiniDisc?

video game cartridges and several hundred pieces of blank media and recording accessories. Space is the issue and I try to maximise what we have. If you add one new medium, I will have to cut my CD collection by one quarter. I have already cut my cassette stock to make space. With two new recorded music formats, I will have to cut by half. That means I cannot carry decent stock in any one particular format. All I will be able to do is to use a computer readout of what is selling well and skim the top. You can forget any concept of selling back catalogues or accommodating music browsing —which is what my older customers do.'

Now, this combination of factors that worked against MD and DCC should not come as a surprise. Even the Sony ad campaign for MiniDisc was somewhat off the mark. Remember the 16 year-old-white male high-jumping hip-hopper screaming out through his captioning balloon in his ad in numerous different magazines, that he could 'record on a disk'?

How many parents of 16-year-old male teenagers find this plausible? What a 16-year-old might leap up to celebrate is scoring the family car for a weekend or landing a date with Joanna. Can a teenager afford a $700 audio player, let alone software—regardless of socioeconomic status? In any case, any youth likely to take to the air over being able to 'record on a disk,' is unlikely to be a handsome fellow attractive to all the girls but rather some teenage computer nerd with terminal acne from whom all the girls flee in abject horror.

On the other hand, the over-40s who have the money and time to devote to new technologies are likely to be deterred by such an advertising campaign. Regardless, initial release titles all pointed to 16-year-olds who couldn't and wouldn't spend that kind of money on MD or prerecorded discs.

Conventional wisdom in advertising, generational demographics and record retail problems aside, there two factors well within Sony's grasp that have also served to restrict MD's success: high retail prices and the perceived quality gap between the system's low-bit-rate coding scheme and CD.

The real target for MD and other emerging formats, is the aging analogue cassette. That was the thinking that drove Philips to create DCC, and unfortunately to retain most of the 25-year-old mechanical flaws in the existing system. The natural transition should be from the cassette to MiniDisc, not to CD. The CD is not dead and as they say in the mortuary business, 'if it isn't dead, don't bury it'.

Yet that was exactly the impression that Sony gave concerning the relationship between the CD and the MD. Sony had their hired guns travelling the US to apologise to audiophile consumer groups for the difference in sound quality between CD and MD. That was not necessary. Compare MD to the cassette; MiniDisc needs no apology as an adjunct to the analogue cassette.
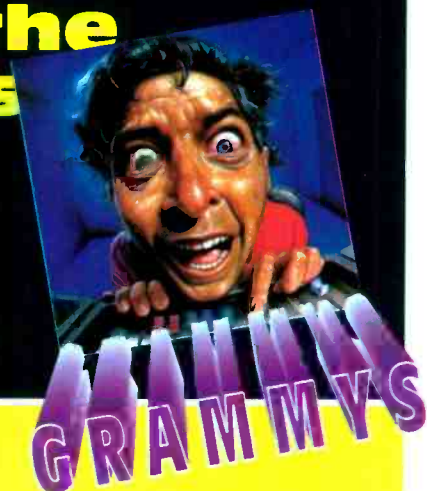
But now MD gets a second chance outside of the consumer arena. The data drive MD product is now being 'talked up' to computer makers such as Apple for use in portable computers and as an external drive for desktops. There is even some likelihood of MD units being configured to fit the spare drive bay on new desktops as an option. The external portable drive shown by Sony at the Boston MacWorld show was a hand-sized powerhouse capable of storing 130Mb of data on an inexpensive magneto-optical MiniDisc. The product could be a breakthrough computer storage technology providing removable drive capacity at floppy disk prices. If success is the outcome for the MD computer drive, a lower-priced audio MD resurgence could follow.

The computer storage mode of MD has another side that will help to provide the computer road warrior with entertainment and relaxation and which could also propel the MD system back into audio prominence. On portable computers that MD would be best suited to, stereo sound systems and speakers have become standard as they seek to be labelled and sold as 'multimedia'. This would allow the on-board MD unit with audio playback capability for prerecorded MDs to turn the computer into a high class 'boom box' for prerecorded music.

For radio and TV broadcast storage of recordings, effects and sound bites; and as a similar tool for the postproduction studio, Sony and Denon have created MD-based single and multi-player retrieval and production automation systems. The units provide the superb mechanical reliability and operational robustness that is the mark of MiniDisc. It may well be that this second life could expand again the audio horizons for the product and with it—the marketplace for duplicators and replicators. ■

Illustration: Clive Goodyer