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PROFESSIONAL RECORDING • SOUND AND MUSIC PRODUCTION

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Cover: This photo-collage is of Pajama Studios, Oakland's newest major recording studio. Well-equipped with a large array of audio processing gear, Pajama Studios features an Otari Series 54 console, Alesis ADAT 24-track with BRC remote and a Studer Dyaxis digital audio workstation. The studio design is by Dennis Rice, construction by Steve Backes and finished carpentry by Sonny Johnson.
Photo: Chloe Atkins



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8 Tracks

RECORD
INPUT

1 2 3 4 5 6 7 8



*The Choice of Professionals
Winner of Two 1992 TEC Awards
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Here's some features. ADAT uses the familiar tape recorder controls that you already know how to use so

recording is fast, intuitive, effortless. Connections are provided for balanced +4dBu levels on a single 56 pin ELCO** connector and unbalanced -10dBV signals on 1/4" jacks. And ADAT uses S-VHS tape because it's a proven, robust recording medium with wide 1/2" tape to solidly support ADAT's 8 recording tracks while delivering 40 minutes of recording time.

The best part. ADAT's Proprietary Synchronization Interface (Patent Pending) locks multiple ADATs, independent of the audio tracks, to single sample accuracy $\pm 5\%$ of 1/48,000th of a second! In other sciences this is referred to as 'air tight' So multiple ADATs function in perfect mechanical and electronic unison: up to 16 ADATs without an external controller. That's 128 tracks!

More best part. ADAT's Proprietary MultiChannel Optical Digital Interface (Patent Pending) simultaneously sends all 8 tracks of recorded information out the Digital I/O for perfect safety tapes and perfect track bounces.

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In time we'll all start taking these little miracles for granted. Before that inevitable event, unpack your first ADAT and track a minute of single notes and chords on your favorite instrument. Play loud, play soft. Play it back and listen really close. It's always a good feeling to have your mind completely blown.

See your Alesis ADAT Dealer today and start Megatracking on ADAT.

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FROM THE EDITOR

It's becoming a regular event! Each year, the editors of *Mix* magazine turn their collective attention to the expanding influence of digital recording and production technologies. And, as was the case last year, I'm responsible for coordinating the editorial efforts of regular *Mix* contributing editors, plus some specialist writers.

This year's special issue focuses on current developments in digital techniques and technology: hardware, operations and interconnections. Our feature material spotlights the various operational and technical parameters of emergent workstations, editors, recorders and processing systems that are having an enormous impact on the pro audio industry. In contrast to last year, however, the 1993 "Digital Issue" aims to provide more of a hands-on overview of what's happening in digital facilities, told through practical experience, plus several tutorial-style articles.

In addition to answering the information needs of established recording and production facilities, this time around we have also broadened the focus to include project studio owners and operators, as well as users who are looking for cost-effective digital solutions. As always, we've tried to provide relevant, up-to-date information that will make your studio operation more successful and ease the introduction or incorporation of more digital components into your facility.

The editorial material is divided into three parts: The first section comprises a series of profile articles detailing applications of digital technology, spotlighting the operational choices and in-use functionality. The second section comprises a series of operational articles covering important "how-to" and system-related topics. In addition, a series of mini-features and sidebars have been sprinkled throughout the magazine. These items spotlight important digital topics and should help the less-informed reader come to grips with some of the more fundamental aspects of digital recording and production technologies. And our regular features appear as well—with a digital twist, of course.

Welcome to the future: the cost-effective applications of high-quality digital recording and production for the music recording, broadcast, live-sound and post-production industries. Enjoy!



Mel Lambert
Senior Editor



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And by open, we actually believe that your professional digital studio

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With our TDM Digital Audio Bus, Pro Tools offers your studio an open door to the future.

should allow you to integrate hardware and software from a variety of manufacturers, and not just us. Which is why, in 1993, we'll be releasing the rather remarkable Digidesign

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For more information about Pro Tools, or about upgrading to Pro Tools 2.0, you can reach us at (800) 333-2137, ext. 100 (USA & Canada), or internationally at +1-415-688-0600. Call today, and we'll get you the information you need right away. We can also provide you with information about DINR and other Digidesign products, as well as Pro School (the ultimate digital training ground). And if you like, we'll be happy to schedule you for a free, no-obligations Digidesign Professional Audio Seminar, or provide you with the name of your Digidesign Professional Products Dealer.



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CURRENT

HARMAN TO ACQUIRE AKG

The rumors circulated throughout the pro audio community, but at press time it seemed all but certain that Harman International (Northridge, Calif.) was set to acquire AKG (Akustische & Kinogerate GmbH), a leading manufacturer of microphones, headphones and audio electronics based in Vienna, Austria. According to industry sources, Siemens was interested in acquiring AKG prior to the successful Harman bid. Harman is the parent company of JBL, UREI, Soundcraft, Audio Digital, DOD/DigiTech/Audio-Logic, Lexicon and other high-profile businesses. AKG Acoustics Inc. (AKG's U.S. division) also owns dbx, BSS, Orban, Turbosound and other companies. Reps of both Harman and AKG had no comment at press time.

AMPEX TO SELL MAG. MEDIA SUBSIDIARIES

Ampex Incorporated (Redwood City, CA) is seeking to sell a majority interest in its magnetic recording media subsidiaries (Media). The company will consider a possible public offering of the majority of Media or a spin-off of Media to the stockholders of Ampex Incorporated. With the sale, the company is looking to remove approximately \$160 million of Media's indebtedness from Ampex's consolidated financial statements. Following any divestiture, Media plans to continue marketing tape using the Ampex brand name. Existing customer relations won't be affected.

SPARS' FIFTH DAW SHOOTOUT HEAVY ON THE NUMBERS

At the fifth SPARS Digital Audio Workstation conference, held in New York on May 15-16, economics outweighed ergonomics by a

considerable margin. Most of the 14 manufacturers addressed the economics of workstations, from Otari's presentation of an onscreen spreadsheet analysis of workstation amortization by hourly rates to AMS/Siemens, which spent much of its allotted half hour on the topic. "We want to take price out of the purchasing decision," Jon Gluck stressed, recapitulating AMS' price reduction on the AudioFile system announced at NAB.

Economic issues, along with added features and system differentiation, seemed a logical focus at this stage of DAW evolution. The trend toward consolidation of various systems by the same manufacturer was clear. For instance, Lexicon announced and showed the Opus 3, which combines full editing, signal processing and routing, synchronization, and CMX and autoconform capabilities in a single unit. AMS stressed its forthcoming cable networking enhancements—with file server—via SCSI port, with Beta testing commencing in July.

Interconnectivity was also on SSL's mind, as it demoed—using a Batman cartoon—simultaneous ADR, dialog manipulation, Foley, sound effects, and sound design and mixing, using ScreenSound and Scenaria systems linked via SoundNet. The Scenaria also utilized the newly released OmniMix system, which adds surround sound capabilities to the unit, providing dynamic pan automation of up to 32 sources or submixes and spatial audio processing.

Fairlight's Digital F/X system was demoed by John Lancken, highlighting its Freeze-Frame audio feature, which maintains a sample's pitch at any scroll rate in Job/Shuttle mode.

Speed (as a function of economics) and ease of operation were also main themes at the conference. Otari touted ProDisk's multiple processors to produce faster information manipulation and the system's ability to do multitrack gross edits and still slip tracks individually. Otari also introduced its new CB-58 hardware controller, a \$3,500 ADB device developed specifically for the ProDisk system.

Sonic Solutions debuted its SonicNet system, as well as its MediaNet Partners Program, a fiber-optic network system for transmission of digital audio and compressed digital video, as well as Macintosh graphics. MediaNet is OMF-compatible with any SCSI-based workstation. Sonic Solutions also emphasized how its No Noise feature's intuitive algorithm, incorporated into its workstation, can clean up dialog and help avoid ADR sessions, as well as new looping features in its recently released V.2.1 software. A reverb DSP function has also been added.

New features for Avid's workstations included a Loop/Record mode for nonlinear dialog replacement, new picture editing capabilities, and an auto-save background function. Forthcoming upgrades will include additional I/O channels, cooperation with Digidesign on the TDM bus, support for Lexicon, Digidesign, Apogee and other systems, a licensing agreement on the No-Noise technology, software support for the Yamaha DMC 1000 digital console, and removable 14GB storage media.

Roland's Bob Todrank said that the DM-80's new Track manager will eventually support up to four

—CONTINUED ON PAGE 16

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INDUSTRY NOTES

Edward M. Esber Jr. was named president and chief operating officer of Creative Labs Inc. (Milpitas, CA). In other Creative news, the company recently inked an agreement with Archer Communications to use Archer's QSound technology in Creative's chip sets and sound boards... E-mu Systems Inc. (Scotts Valley, CA) hired Tom McLoughlin as its new general manager. E-mu also hired Scott Emmerman as its new Western U.S. regional sales manager... Robert Veri was elected to the board of directors of Fostex Corporation of America. Veri was also named executive vice president of the company... Sony Sales and Marketing of America (Park Ridge, NJ), a recently established division of Sony Corporation of America, made several management appointments: Ken Iwaki and John Briesch were named acting president and deputy president, respectively. Wataru Ogawa was named president of the recording media products group; Ogawa previously served as the company's senior vice president of logistics, a position that has been filled by Bill Midgley. In SSMA's Business and Professional Products Group, Mike Vitelli was named senior vice president of sales and marketing. Also in the BPPG, Andrew Mougis was appointed senior vice president of sales. In the Consumer Products Group, Yuki Nozoe was named senior vice president of marketing... TGI North America (Kitchener, Ont.) appointed Bob Prideaux its new president. Prideaux will assume all responsibilities of TGI's former managing director, Wib Heuckroth; Heuckroth will now serve as the company's chairman of the board. Also promoted was Bill Calma to vice president of sales and marketing for all product lines... Aware Inc. (Cambridge, MA) named David B. Hartley its

new vice president of sales and marketing... Joe Wisler was named Crown International Inc.'s (Elkhart, IN) new professional audio liaison... Celestion Industries (Holliston, MA) appointed Jesse Walsh Communications as the public relations agency for its pro products division. Celestion also appointed new product reps: Pearson and Pearson will represent the company in Colorado, New Mexico, Utah, Wyoming, Eastern Montana, Eastern Idaho, and El Paso, Texas; the Pacific Audio Group, the company's Southern California rep, is now also responsible for Arizona and Southern Nevada... Eventide (Little Ferry, NJ) appointed DB Productions to represent the company's audio and broadcast product lines in California, Nevada, and Arizona... Studio Technologies (Skokie, IL) appointed QMI as its U.S. and international agent... New York pro audio dealer AudioTechniques appointed Danny White head of its parts and accessory division... Switchcraft (Chicago, IL) news: William B. Coulter Jr. was named director of marketing, William M. Pagett became director of sales and Diane Lazaar was appointed East Coast regional sales manager... Tim Darland is Associates Creative's (Southfield, MI) new account supervisor... BEC Technologies (Orlando, FL) hired Tom Makofske and Herb Clann as, respectively, chief financial officer and production manager... Mackie Designs Inc. moved to a new location last month. The new address is 20205 144th Ave. NE, Woodinville, WA 98072. Phone numbers remain the same... Apogee Electronics Corp. has expanded its sales and marketing staff and moved it to a new location. The new sales address is 3435 Ocean Park Blvd. #211, Santa Monica, CA 90405; phone (310) 314-1700, fax (310) 452-4343. ■

—FROM PAGE 12, CURRENT

systems simultaneously on a single screen, and that MMC is being considered for the DM-80's MIDI implementation, although he stressed it was purely speculative at this point. Version 2.0 software was to be available in June, with more than 50 new features added.

Studer V.1.2 was also expected in June, adding a multiple machine control interface, as well as a Plug & Play interface for the unit's multipin port. Spectral Synthesis' new V.2.0, ready sometime this summer, will add real-time M/O support, varispeed, autoconform functions (called Auto tracks), and graphical transitional editing.

The bottom line? Word on the floor was that the screens were looking more similar than ever, and the same for basic functionality. Several manufacturers agreed that the market is now segmenting along price and reliability lines, as well as brand loyalty, which may bode well for companies with a wide array of related products—particularly Avid, SSL, AMS and Lexicon—which are increasingly being linked to form modular digital product lines. The OMF initiative, when refined and if adopted widely enough, would do much to keep the field as wide open in the future as it is now.

SAMSON TO DISTRIBUTE ZOOM IN THE U.S.

In an aggressive marketing change, Zoom Corporation of Japan recently finalized a distribution agreement with Samson Technologies Corporation (Hicksville, NY), whereby Samson will handle distribution and marketing of Zoom products in the U.S. Despite rumors of an acquisition, the deal involved no ownership or licensing agreement. Zoom struck the deal because the company wanted to devote itself mainly to product development, although its San Francisco office will continue to handle global marketing. ■

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USE READER SERVICE CARD FOR MORE INFO

by Ken C. Pohlmann

THE NEW PERCEPTUAL STANDARD



There are literally dozens of different perceptual coding systems (sometimes called data-reduction or data-compression systems) now available from a variety of manufacturers. They range from simple, fairly generic models to highly sophisticated proprietary types with a wide range of bit rates, audio transparency and price. Together, they confirm that perceptual coding is moving rapidly to the fore of professional and consumer digital audio technology on a broad front of applications.

If digital audio has a fault, it is its gargantuan appetite for bits. Whether you are storing linearly represented digital audio information or transmitting it, the need for large storage capacity or wide bandwidth limits the fidelity and usefulness of digital audio. Clearly the desire to achieve lower bit rates has been intense, because it would open many new applications for digital audio (and video) with little or no signal degradation.

With the recent advent of inexpensive and fast digital signal processing systems, it has become possi-

ble to employ psychoacoustic models to reduce the number of bits needed to represent an audio signal. Applications of compression ratios of 4:1, 6:1 or even 12:1 are now common; in addition to traditional rates of 1.4 Mbits/second, reduced rates of 256 kbps and less are now common. Not only do perceptual coders clearly outperform traditional linear coders in terms of bit efficiency, they also compete with them in terms of fidelity. Designers of reduction systems have achieved remarkable transparency so that in many applications reduced data is audibly indistinguishable from linearly represented data, or is even better. For example, given a 20-bit master recording, a 4:1 PASC-encoded recording (with a bit rate of 384 kbits/second) may be judged by some to be superior to a dithered linear 16-bit recording (with a data rate of 1.4 Mbits/second).

The obstacle to perceptual coding has been lack of standards. Though everyone agrees that different applications require different coding methods, it is essential to have standard

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coding methods available to promote compatibility and reduce cost. The International Standards Organization and the Motion Pictures Expert Group have recently released the ISO/MPEG international standard 11172-3 for reduced data rate coding of digital video and digital audio signals and made it available to interested parties. The audio portion of the standard promises to define the future for many perceptual coding products.

The audio portion of the ISO/MPEG standard can trace its origins to tests conducted by Swedish Radio in July 1990. The MUSICAM coding achieved the highest overall scores. However, the ASPEC system was superior at very low data rates. The architectures of these two coding methods form the basis for the ISO/MPEG standard. The 11172-3 standard describes three layers of coding, each with different applications. Specifically, Layer I describes the least sophisticated method that requires relatively high data rates (approximately 192 kbits/second/channel). Layer II is based on Layer I but contains increased complexity and operates at somewhat lower data rates (approximately 128 kbits/second/channel). Layer III is somewhat conceptually different from I and II, is the most sophisticated and operates at the lowest data rate (approximately 64 kbits/second/channel). The increased complexity from Layer I to Layer III is reflected in the fact that at low data rates, Layer III will perform best in terms of audio fidelity.

In very general terms, the operation of all three coders is similar in that the audio signal passes through a filter bank and is mapped into the spectral domain. Data reduction is carried out through examination of redundancy and irrelevancy in the music signal. In each case, the encoders are not defined by the ISO/MPEG standard; only the decoders are specified. This permits improvements in encoding methods, particularly in the psychoacoustic modeling, provided the data output from the encoder can be properly decoded. This is an important element; for example, digital radio stations could improve a few encoders, and the benefits would be perceived by all listeners with an existing decoder. On the other hand, because encoders differ from one manufacturer to

another, it is incorrect to assume that two encoders using the same layer will sound the same. The following descriptions of the layers are generally correct; however, there may be differences in specific products.

Layer I is derived from the MUSICAM standard and is basically a simplified version of that codec; its aim is to provide high fidelity at low cost, at a somewhat higher data rate. In Layer I a sliding FIR filter is used to split the wideband signal into 32 sub-bands of equal width. Frames are created, each containing 12 sub-band samples; this represents 384 wideband samples. A fixed scale factor exponent is computed for each sub-band; it is based on the largest value of the samples in the sub-band. Using the scale factor information, and analysis from a 512-sample FFT wideband transform, a psychoacoustic model compares the data to the minimum threshold curve and applies a masking model to achieve data reduction. Dynamic bit allocation assigns mantissa bits to the samples in each coded sub-band, or omits coding for inaudible sub-bands.

As with any digital audio system, error correction and other information is added to the signal at the output of the coder. Decoding is performed easily by reformatting the data and applying it to an inverse synthesis filter. Because there is no perceptual model in the decoder, improvements in the encoding models will be accepted compatibly by the decoder. In addition, Layer I can be augmented with stereo intensity coding, which examines redundancy and irrelevancy between channels to optimize performance by increasing audio quality or decreasing bit rate. A version of Layer I is presently used in the DCC recording system.

Layer II is essentially identical to the original MUSICAM standard, and thus similar to Layer I, but more sophisticated in design; it strives to provide high fidelity at moderate data rates, with somewhat higher cost. Thirty-two equal-width sub-bands are created, but frame size is expanded to 36 samples, corresponding to 1,152 wideband samples. The FFT analysis block size is increased to 1,024; tonal and nontonal components are distinguished to better determine their effect on the masking threshold. Three scale factors are calculated for each sub-band, each corresponding to 12 sub-band samples.

Temporal masking is applied to these scale factors. Dynamic bit allocation is employed to maximize both the sub-band and frame signal-to-mask ratios; four bits are used for the more critical lower sub-bands, and two bits for higher sub-bands. As in Layer I, decoding is relatively simple (it contains only one third the complexity of the encoder); for example, a stereo decoder can run on a single DSP56001 chip (VLSI Layer I and II chips are also available from manufacturers). The decoder unpacks the data frames and applies appropriate data to the reconstruction filter. Layer II can employ stereo intensity coding; it will be used in the proposed Eureka 147 digital audio broadcasting system.

Layer III combines elements from MUSICAM and ASPEC and is more complex than Layers I and II; its forte is moderate fidelity even at very low data rates, at a somewhat higher cost (for example, the decoder performs a third more operations than a Layer II decoder and requires an extra 1K of RAM per channel). The wideband signal is split into 32 sub-bands, and each sub-band is further divided into 18 more sub-bands by an MDCT (Modified Discrete Cosine Transform) for a total of 576 sub-bands with a bandwidth of 41.67 Hz at a 48kHz sampling rate. The MDCT window size is variable to minimize temporal pre-echo artifacts. A short window uses six sub-band samples (292 wideband samples), and a long window uses 18 sub-band samples (576 wideband samples); combination windows switch between the two. Because of the overlap inherent in the MDCT, these sample sizes are doubled in each case. Bit allocation uses dynamic quantization as well as Huffman and run-length entropy encoding. These algorithms employ the power of statistics to achieve data compression. For example, values that occur more frequently are coded with shorter code words. Layer III can employ stereo intensity coding as well as MS (sum and difference) coding between channels.

Extensive tests have demonstrated that either Layer II or III at 256 kbits/second can convey a stereo audio program with no audible degradation, compared to a 16-bit linear system such as CD. If a higher data rate of 384 kbits/second is allowed, Layer I also achieves transparency compared to 16-bit linear PCM. At rates

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as low as 128 kbits/second, Layers II and III can convey stereo material that is subjectively very close to 16-bit fidelity.

Tests also have studied the effects of cascading perceptual codecs. In one experiment, critical audio material was passed through four codec stages at 192 kbits/second and two stages at 128 kbits/second, and they were found to be transparent. On the other hand, a cascade of five codec stages at 128 kbits/second was not transparent for all music programs. These tests did not enjoy the benefit of joint stereo coding, and as with any perceptual coder, overall performance can be improved by substituting new psychoacoustic models in the encoder.

It is also important to note that the similarity between the layers will promote tandem operation; for example, Layer III data can be transcoded to Layer II without returning to the analog domain (other digital processing is required, however). Specifically, a decoder must be able to decode its layer and all layers below it. Clearly, the menu of data rates, fidelity and layer compatibility provided by ISO/MPEG 11172-3 is useful in a wide variety of applications such as digital audio broadcasting, computer multimedia, home studio recording and editing, multichannel disk recording, ISDN transmission, and multichannel HDTV.

As with any new standard, the ISO/MPEG digital audio codec standard will encourage wider participation by manufacturers with greater product diversity and lower cost. In addition, and not inconsequentially, the growth of perceptual coding applications will challenge traditional PCM audio products in terms of cost, application and fidelity. This competition, in turn, will stimulate the development of lower-cost 20-bit PCM systems, as well as new advances in digital audio coding such as psychoacoustically optimized noise shaping and, possibly, 24-bit coding systems. In other words, the advent of perceptual coding standards both expands the horizons of the digital audio revolution and propels it forward. ■

Ken Pohlmann is a professor of music engineering at the University of Miami in Coral Gables, Florida, where staying cool is a full-time job.

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That's why TASCAM chose the newer 8mm tape format for digital multitrack recording. It's simply better than anything else. Why? The 8mm transport is the most compact and is designed to take the beatings of the start-stop-start-stop operations that characterize studio and post production environments. And we should know, because TEAC makes

transports for both VHS and 8mm. We tried them both. In fact, tests show 8mm to be superior for digital audio multitrack recording. That's just the start. The 8mm format is superior in many ways. Like "Auto Track Finding" (ATF)—an innovative technology that ensures consistent, error-free operation by imbedding important control information during the helical scan. This maintains a perfect relationship between the tracking and program signals on your tape. What does that mean? Precise editing for punching in and out as well as the ability to exchange tapes between musicians and studios without synchronization concerns.

There's more. The Hi-8mm

metal particle tape cassette is sturdier and protects the tape against dust and environmental hazards. The 8mm format takes advantage of technologically superior tape that characteristically has a higher coercivity and therefore higher retention than S-VHS tapes. That's why Hi-8 is a preferred format for backup of critical digital data by computer users worldwide. And that's why your recordings will last longer on Hi-8. Even more, with up to 100 minutes of recording time, Hi-8 offers longer recording length than any other format.

We could go on. But the point is that with over 20 years experience, TASCAM has quite an investment in multitrack recording. An investment that has paid off for

musicians, recording studios and post production houses worldwide. We've put this experience to work in defining the future of affordable studio quality digital multitrack recording. And you can take advantage of it now.



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by Stephen St.Croix

BAITING BUYERS WITH BITS FOR BUCKS

THIS ISN'T THE COLUMN YOU EXPECTED

Those of you with exceptional observational powers will notice that this month's column is in fact *not* the second half of last month's. It is instead a totally unrelated piece; a cohesive component of this month's *Mix*. Yes, as I do once a year, I have succumbed to Mel Lambert's relentless badgering and have written something that actually fits in with the theme of this July special issue. Sort of.

The missing second half should appear in the next issue. On with the show.

FINANCES FIZZLE, FRUGAL FEW FORESEE FUN FUTURE

Entertainment has been around since the very first time some guy put on a dress and danced for a cave full of other guys while waiting for some damned pterodactyl to leave. One of these dancing cave guys eventually asked all the other guys for sticks and berries for his services, and the entertainment *industry* was born. So was the saying "sticks and stones..." as hecklers were developed on the same day that admission was invented.

Well, a shortage of berries eventually forced the invention of money, and our industry has been somewhat shielded from negative economic fluctuations ever since (with a few exceptions like the great depression).

This stability was primarily due to the fact that when depression or recession is at hand, people's lives get more complicated, and great emotions like despair become a part of life. Escape becomes crucial. While jumping from the 23rd story window has been a standard Wall Street escape for some time now, it isn't the

only escape known to Man. Diversions in the form of movies, music and recreational pharmaceuticals have long been escapes for the masses, possibly because most of them don't live on the 23rd floor.

But this time, immunity to bad times has collapsed. Our



lives and our industry have permanently changed. Money is tight and will remain so forever. So what do *we*, the pro audio community, do now, so that we may live long and prosper? That's easy: don't smoke, be nice to animals and *streamline*.

You have some serious decisions ahead of you when it comes to survival and, hopefully, profit. Every purchase must be thought out carefully. You must plan ahead like never before. Luckily, technology that will help us is right around the corner.

Let's look at the overall picture. Take your entire audio recording facility. The very definition of the term "recording studio" is beginning to change from a room full of processing equipment patched to mixing

ILLUSTRATIONS: SUSAN GROSS

consoles and tape recorders, to a few select pieces of personal favorite processing gear interfaced to one central machine, the Digital Audio Workstation.

Soon it will be pitifully humorous to imagine that you can compete with well-planned DAW studios using older "conventional" analog studio technologies. And the DAWs themselves will soon face an even more imposing threat—true virtual studios—monstrously powerful machines that will do it all; and do it so well that the quality and quantity of the end audio product will increase so dramatically that no one without these machines can compete. I promise you this. True virtual studios will be as significant a change to the recording industry as multitrack recorders were, way back in the Homo Sapiens' piezo-electric period, when the machines were the size of small refrigerators, solely to make them too heavy for pterodactyls to carry them off.

At some point you must make the jump. You must go with *some* workstation, and as tight as money is, you had better choose the right one.

SMALLER STATIONS SEEM SEXY. STILL, SADLY SLOW, SORROWFULLY SHABBY SONICS SCARCELY SERVE SIMPLE SEMI-PRO SESSIONS.

There certainly are a lot of low-cost workstations out there, and there will soon be many more. These machines all have one thing in common that dominates their feature lists: They're cheap. Now, don't get me wrong, it's not that I don't like them...Wait a minute...That *is* it; I *don't* like them.

Now let me just say out front that a certain amount of my time goes into consulting with high-end workstation manufacturers, so if it sounds like I'm biased toward the more powerful (costly) systems, you're right. Just the same, I wouldn't be able to sleep at night (or at least nap during the day) if I didn't point out to you what I feel are the sacrifices made for cost in most small systems.

I have tried to work on the best-selling units, and my response, along with the response of my coworkers, has ranged from horribly disappointed to madly frustrated. I guess I was expecting these machines to work as their ads *implied* they would, not as they actually did. I guess I expected them to speed up my work and

make me more productive. I guess I was asking too much.

If they would just present and package these machines as simple stereo audio *editors*, each brand with a few additional "bonus" features, like additional editing beyond two tracks under certain conditions, or simple steady-state, *stereo-only* hiss and pop reduction, and so on, it would be fine. But too many of these guys fight this ridiculous low-cost feature war that ends up with ludicrous attempts at high-powered functions from low-powered machines.

Tiny Ford Fiestas are okay as bare-bones transportation, but you will go crazy if you try to use one to pull a 20-ton trailer up a hill. It takes real machines to do real work. Now, you might get away with pulling a 5-ton trailer up that hill *once* when you are moving your home, but if



you pull trailers up hills for a *living*, you have to get it done in an hour, several times a week, not in 250 hours, once a year.

Most of what are being called workstations are *not* workstations; they are simple editors, and many fail miserably at that. I must say that there are a couple of straightforward multitrack digital recorder/editors that work well. These units are great bargains and can cut editing times dramatically. These are brought to you by new fringe companies and are not the mainstream low-cost "bargain" units that are infesting our cities like a plague.

Sales figures for low-cost "workstations" are impressive. Everybody wants to get into the digital age, and if you only have a few thousand bucks these machines seem irresistible at first.

But then comes what I have written about before: the hidden negative surprises. Simple ripple edits that you used to do in 30 seconds with analog tape may now take 200 seconds, not the five seconds that you expected and hoped for. Do ten edits and you may unknowingly slip all the audio from that point on by more than a frame. This problem is in fact quite

common!

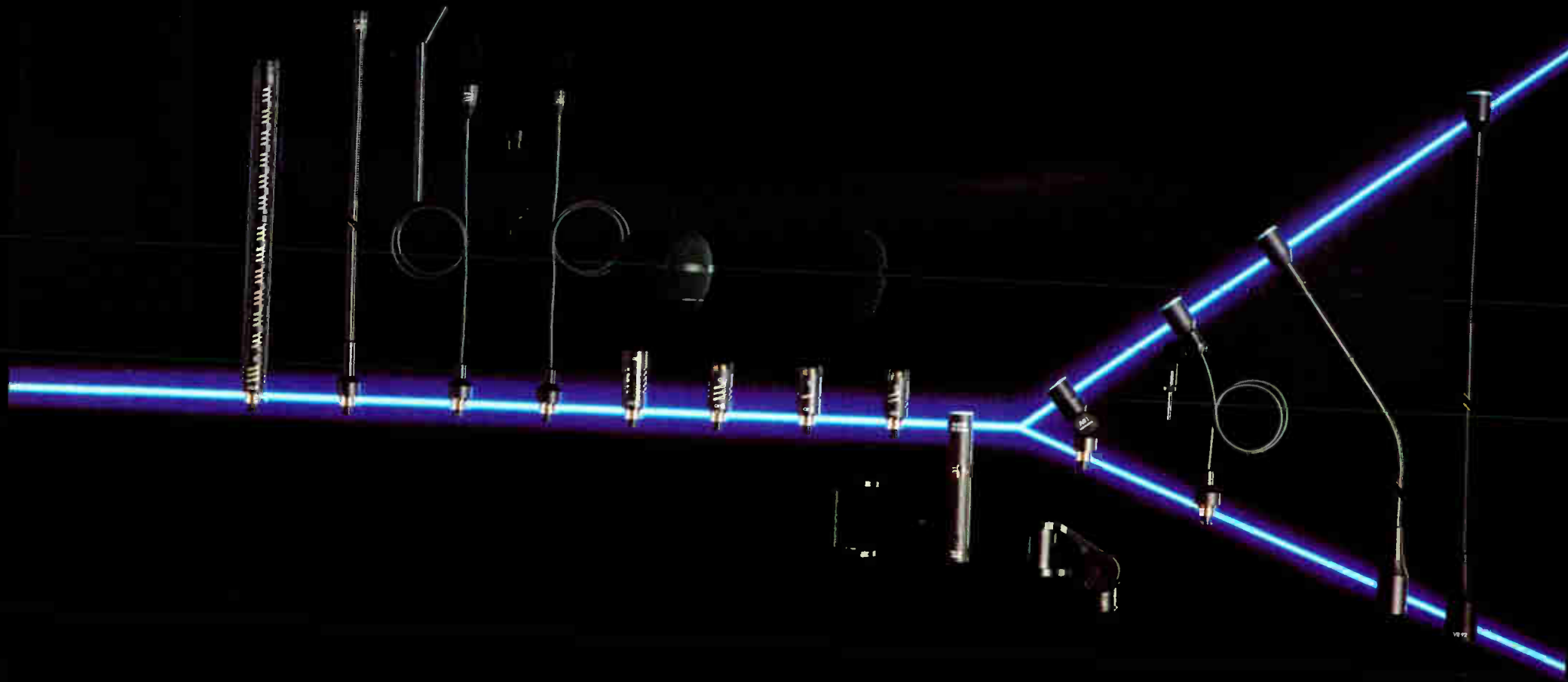
One of the most popular units offers EQ, but it is so incredibly horrible that nobody should ever actually *use* it. This same unit doesn't sound quite right even if you don't use any EQ and go in and out digitally to avoid its converters. The stereo image collapses, the high end loses definition and becomes strident, and the bottom end gets cloudy and thick. In the last few years, we have learned to associate this type of audio damage with inferior converters. What is going on to cause this when using D I/O? Who knows?

The operative term here is toy. Toys are great. You get something for close to nothing, and if you choose wisely it can serve as a basic entry-level educational sample of what the real thing can offer. However, one of the characteristics of toys is that they offer no actual growth path. This is necessary for low-cost manufacturing, but a lot of those who purchase these little "DAWs" don't quite realize that, and when the long list of limitations and dead ends is revealed, the customer often feels trapped and frustrated, because there is no way out other than eating the purchase and starting over.

There has been a lot of noise recently about new bus standards for these machines. This is pretty good, as it will allow different manufacturers to interface their gear directly. But this is by no means a true open-ended expandable architecture. Low data rates and lack of control along with the same old thing—lack of real *power*—severely limit these schemes. Also, don't confuse an expansion bus with a real upgrade path; they are *not* the same thing. None of these units has a rational upgrade path. That should scare you.

All of this bothers me for the obvious reasons, but it also troubles me because there is so much of it that DAWs are actually starting to get a bad name. This is unfortunate, since DAWs are the only future we have, the only path that exists for us if we want to become more productive and more creative, if we want a higher-quality end product in less time for less money. It simply won't be possible to compete without a good DAW by the end of next year. Face it.

It may appear that my attitude on the subject is elitist, but it is not. Blatantly put, many of these smaller low-cost toys are so severely limited in



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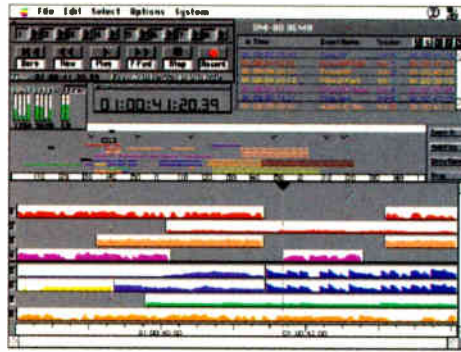
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the Word.

Problem is, many DAWs just can't give you all of these things.

Here's why:

Problem: Some systems use a single computer for graphic user interface *and* for audio information processing. This slows the whole system down, and makes you wait.

The Answer: A workstation that separates the hardware "engine" from the user interface computer. This way, audio information processing is not slowed down by the user interface, and the interface computer operates without the load of additional tasks. And you save time and money.

Problem: A system crash in the middle of a complicated project could cost you as much in time lost as some of the less professional DAWs are worth. You should expect reliability you can count on from your DAW, and get it.

The Answer: First, call around. Check the reputation of DAWs. We have DM-80s working every day all over the world in high volume production environments. Our customers will tell you they're reliable.

Problem: Some systems don't give you a user interface that's familiar and easy-to-use.

The Answer: Buy a DAW that lets you choose either a dedicated hardware remote that gives you familiar tape recorder controls, or computer software control that is simple to understand and easy to operate.

Problem: Some DAWs are the weakest link in the audio chain. The DAW you buy should deliver sonics as good or better than any piece of audio equipment you own.

The Answer: Choose a DAW from a company that knows professional audio, not just a company that knows computers. But most of all, ask audio professionals who own one.



We believe you'll find all these answers and more in the Roland DM-80 Digital Audio Workstation. Call us at (213) 685-5141, ext. 337, or FAX (213) 722-0911 for a brochure. Or better yet, schedule a demo. You're going to like what you hear.

"The thing is just impossible to screw up! The DM-80's non-destructive editing is the only way to go—revisions are extremely easy, and very quick."

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21ST CENTURY SOUND DESIGN, HOLLYWOOD
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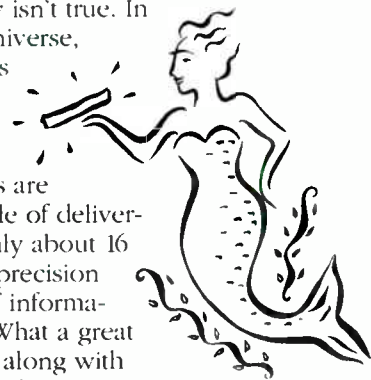
basic horsepower that real-world demands such as time stretch/squeeze and equalization (though theoretically offered) are of such horrendous quality that they produce end results far inferior to those of today's typical *semi-pro* studio toys. And high-speed multitrack editing is so slow and so ridiculously loose in timing accuracy that it is a bad joke. None of these machines actually *locks* to code—not with the resolution needed to fully realize the editing potential of DAWs.

DEALERS DISSEMINATE DECEPTIVE DATA, DISCOURAGING DIGITAL DISCIPLES. DISTORTED DETAILS DOMINATE DOCUMENTS.

The race to appear to have more to offer for less money is creating yet another problem: blatantly deceptive advertising. Don't believe the bullshit that certain manufacturers are telling you. Make them prove it. Kick them out when they can't.

My favorite outright lie is that 20-bit converters exist. *I love* that one! Just to make sure you catch my drift: *There are no 20-bit audio A/D converters on earth!* Nor is it possible to reach that by summing any combination of today's converters. Audio equipment manufacturers tell you that their gear has them, and even the companies that make the chips that all these manufacturers buy to put in their gear tell *them* that they are buying 20-bit converters, but it simply isn't true. In our universe,

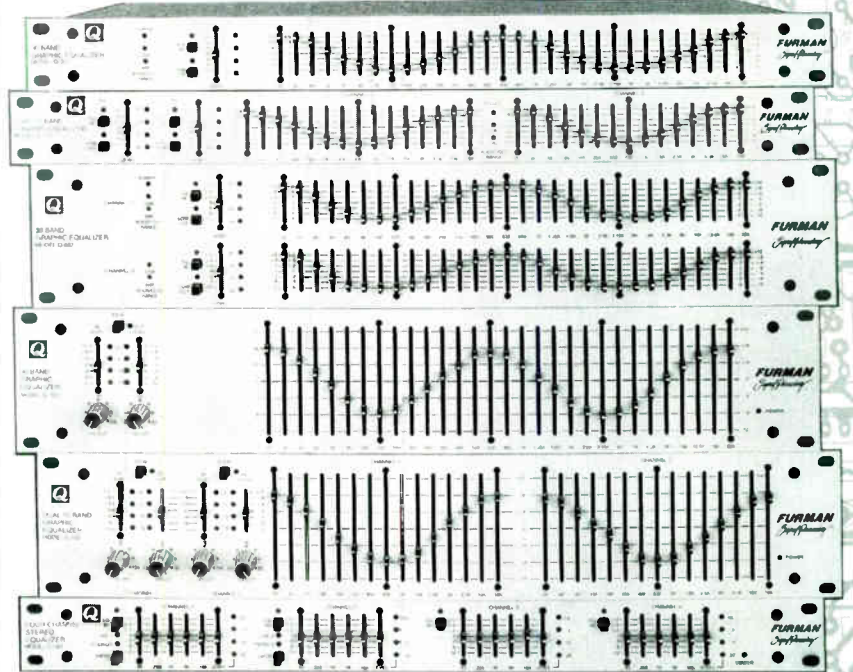
today's "20-bit" converters are capable of delivering only about 16 or 17 precision bits of information. What a great scam, along with 120dB dynamic ranges, flawless digital copies, noiseless digital EQ and mermaids. I've certainly seen more mermaids than 20-bit converters.



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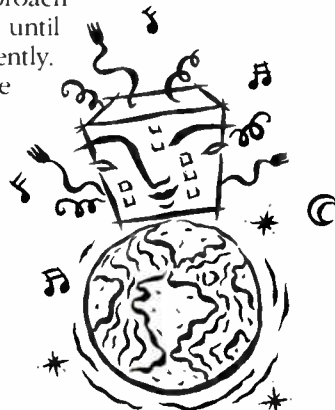
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ronments will be based on some evolution of today's DAWs and tomorrow's virtual studio systems within a few years, this level of sophistication must be achieved.

Old thinking says that this is a ridiculous goal—the "jack of all trades, master of none" model. That has been the primary type of thinking we have had until now, and the result has been what we now call the "conventional studio." Don't get me wrong, no other approach was possible until just very recently.

Truly massive computer power is needed to even entertain this concept, and that type of power is just becoming available to designers this year.

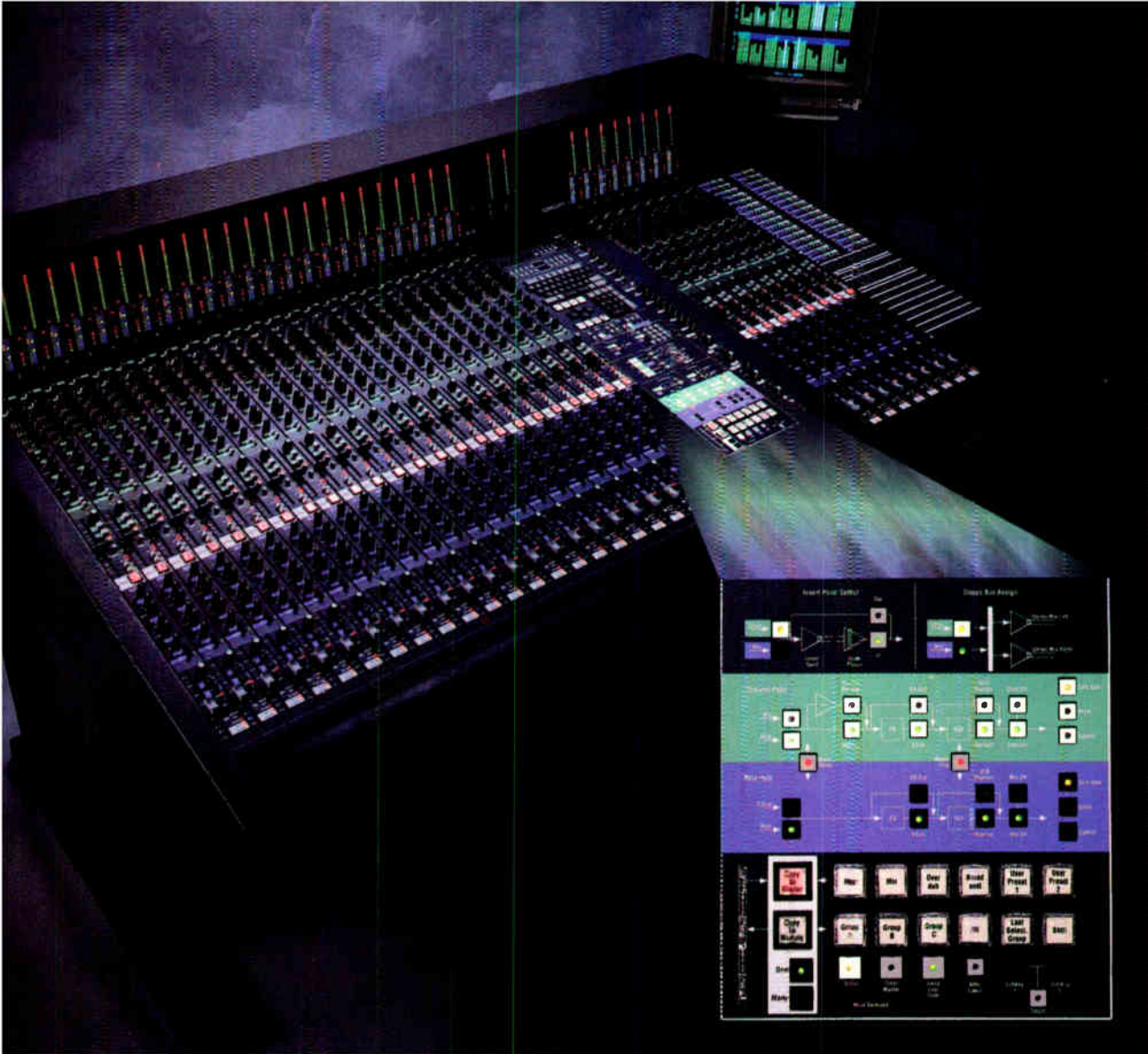


New designers, thinking in new ways, will be needed to translate the raw potential of modern high-horsepower architecture into the next generation of virtual studios that will rule the world. The proper mixture of fast, easy-to-see-and-compare combinations of assignable and dedicated hardware surface elements, and true virtual "glass" interactive surfaces can do a shockingly good job of realizing this lofty goal.

Wait and see. It's all in the human interface. Monster horsepower is meaningless if you can't get to it, just as beautiful interfaces are stupid if they don't control obscenely massive horsepower. Ideal interactive virtual studios, or "glass consoles" will be the path to the future. Be careful to put your money into something that will make you competitive as soon as you take delivery but can grow with you over the coming years. After all, it is just becoming possible to make good 18-bit A/D converters, and it is possible to manufacture a DAW that is better, faster, and more creative than any analog or digital alternative, with no penalties and no compromises. When you see that machine, it is time to buy. Don't blow your future on anything less. ■

Stephen St.Croix can take his nap now.

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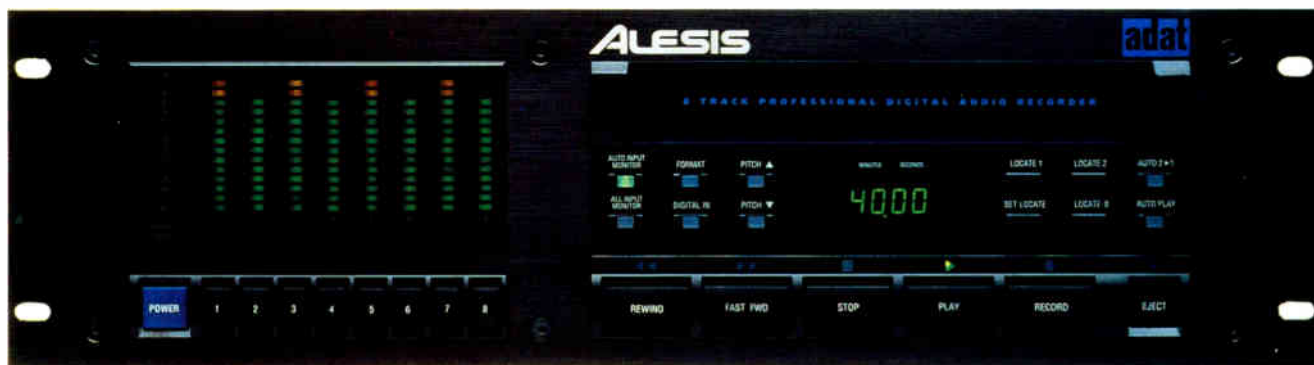
Everything You Ever Wanted to Know

.....

LP vs. CD; Beta vs. VHS; 8-track vs. cassette; Mac vs. DOS; DASII vs. ProDigi; MD vs. DCC. Format wars are nothing new. One merely has to look through the annals of audio history to discover that competition among incompatible formats has been with us since the great disk vs. cylinder debates of the 19th century. So what's this Alesis ADAT vs. Tascam

DA-88, June 1993—Eds.)

First, a few basics. Both the Alesis ADAT and the Tascam DA-88 offer a tremendous cost-to-performance ratio. And despite what anyone may tell you, 8-track analog is dead. The advantages of ADAT and the DA-88 (as well as Yamaha's DMR8/DRU8 and the Akai ADAM systems) are impressive. Want your



DA-88 brouhaha, anyway?

It all boils down to market-share economics—money. And it's a safe bet that the Tascam system—said to have been on the drawing board for more than four years—would never have seen the light of an audio showroom had Alesis never announced the ADAT system on January 18, 1991. Competition is a wonderful thing, especially to consumers who reap the benefits of a free-market economy. Three years ago, who would have thought that a digital 32-track could be purchased for less than a 2-inch analog 24-track?

by George Petersen

Unfortunately, along the way, both sides in the budget Modular Digital Multitrack controversy have been guilty of occasional lapses in truth. Let's take an objective look at the facts. (Note: The following *Mix* issues have reviews with detailed information on MDMs: Akai ADAM, February 1990; Yamaha DMR8, November 1991; Alesis ADAT, October 1992; Tascam

cousin Guido in Napoli to do an accordion overdub on your next speed metal hit? Just dub a scratch track on a digital multitrack cassette and, Federal Express willing, you'll have that hot performance you need in a couple of days. Very cool.

MDMs are, by nature, both upwardly and downwardly compatible. Way back in the Neolithic analog days, if you recorded on a 16-track deck, you had to mix on a 16-track deck. With four recorders in a Tascam or Alesis system, you can work on 8-, 16-, 24- or 32-track sessions. If you need more tracks, you can always borrow or rent a couple of extra modules. In the same manner, you can start out with a modest 8-track system and then purchase more modules as your needs—or cash reserves—grow. The old school of recording thought required purchasing a completely new recorder every time you wanted to upgrade, which made a lot of retailers happy.

Overburdened by high tape costs? With an

TASCAM

About Modular Digital Multitracks

MDM, forget about spending \$120 for a 2-inch, 24-track analog reel that runs a mere 17 minutes at 30 ips. At best, that's only four songs per tape. Tape costs can add up fast—I understand that the last Peter Gabriel album used over 100 reels of 2-inch! Storage space for masters is another concern, but fortunately, all the

type of modular digital tape recorder (A-DAM, Yamaha, ADAT, Tascam and a custom 4-track digital system I've used since 1984), I can say that recording on such devices uses up a lot more tape than you might initially think possible. For example, on a typical reel-to-reel 24-track music session, the band plays—and erases



tape for a complete album project recorded modular digital could fit in a shoe box (or two), including the 2-track DAT mixdowns.

However, having done sessions on every

es over—the basic tracks until a suitable take is recorded. Why? Tape costs money. A six-minute song on an analog 24-track consumes about \$40 in 2-inch tape, so people tend to be picky about what becomes a "keeper." When tape costs are cut to less than a twentieth of that amount (typical for an 8mm or S-VHS system) people keep a lot more takes.

Studio owners should be aware that, when using MDMs, bands tend to record *lots* of versions of basic tracks, which turns into *lots* of band-in-the-control-room listening time, which turns into higher revenues. Ditto for the pleasure of keeping *all* 64 guitar solo—or lead vocal—overdubs (filling eight 8-track tapes) and then listening to them *all* while the studio time meter is

**LP vs. CD; Beta vs. VHS;
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DOS; DASH vs. ProDigi;
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For starters, the DR4d is self-contained. This means no expensive add-on remote or computer is required to access the powerful editing features built-in to the DR4d. But those features would mean nothing without great sounding audio. So Akai has equipped the DR4d with 18 bit, 64-times oversampling A/D converters for sound quality equal to that of our DD1000, used for mastering many of the most popular albums on the charts. The output is just as clean, utilizing 18 bit, 8-times oversampling D/A converters.

The DR4d includes as standard features that are options on other digital machines. How about a digital interface in both professional and consumer

formats? Standard. How about a 108 memory autolocator? Standard. How about editing features like COPY, MOVE, INSERT, DELETE, and UNDO? Standard.

You'll feel comfortable with the DR4d right out of the box. It operates just like a conventional 4-track recorder with familiar tape transport controls. But your analog deck never gave you features like the DR4d's digital level meters, and a jog wheel which lets you scrub audio through the outputs to find precise edit points. And, you'll love moving instantly to more than 100 locations.

Connecting the DR4d to your existing system is just as easy. Four 1/4" TRS jacks on the back accept either balanced or unbalanced lines. A switch lets you choose between +4dBu or -10dBv operation. No expensive custom connectors are required.

The DR4d allows you room to expand as your needs grow. Up to

four units can be connected for 16-track recording, with sample accurate sync. For more recording time, the DR4d can accept up to seven SCSI hard drives. Optional SMPTE and MIDI interfaces allow the DR4d to control or be synchronized to external devices. A second digital interface is also available as an option if you need four discrete digital ins and outs.

The DR4d starts at \$1995.00 (less hard disk). A 200MB internal hard disk is optional, or you have your choice of using a wide variety of external drives. Whichever you choose, the DR4d is ready when you are. See your nearest Akai dealer soon for a demo.

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running. Add in another four or five hours patching together the "perfect" take—via assembly editing on the multitrack or SMPTE flown in/out to a workstation—and you've discovered the secret solution to the studio recession.

COMPARISON SHOPPING

Yet, with all of the advantages that low-cost MDM production offers, engineers are still faced with two opposing and incompatible formats (even more if you also count the Akai and Yamaha systems). Getting past the hype and determining the best system for your studio's needs is much easier when you compare the facts, so let's take an objective look at various aspects of the Alesis ADAT and Tascam DA-88 formats.

Maximum Tracks: Both ADAT and Tascam systems are based around 8-track modules that can be combined for up to 128 tracks. Call this category a tie.

Basic Features: Comparing the basic features of single machines, both systems offer seamless punch ins/outs, unbalanced -10dBV and balanced +4dBu operation, two locator points, pitch shift, looping points, 16-bit linear digital recording and a choice of several digital cross-fade times. The Alesis machine includes a compact remote control, but the more expensive Tascam machine provides word in/out ports, shuttle wheel, sync offset (allowing assembly editing using a second transport), individual track delays and programmable preroll. The latter three functions are also available with the Alesis, but only with the optional BRC autolocator. This one goes to Tascam.

Recording Time: The Tascam records a maximum of 108 minutes on a 120-minute tape; Alesis records just over 40 minutes on a 120-minute tape, while a recent software revision allows recording on T-160 videotapes for an increased running time of 54 minutes. Tascam gets the nod here.

Multitransport Sync: Both systems interlock multiple recorders via a simple connection of one sync cable between each transport. Alesis sells an \$11.95 9-pin cable required to interlock two ADATs, but it's a standard computer item—even at Radio Shack (part #26-116) for \$9.95. The special D15-sub Tascam sync cable is \$85. In our *Mix* tests, we

For Studio Owners Only

Everybody talks about the project-to-commercial studio connection, where people track at home and mix their digital tapes at a real facility. But here's how a typical scenario may play out:

1:00 p.m. Client shows up for two-hour booking to mix project that's "only four tunes." Needs DAT master.

1:30 p.m. Client, listening to tracks for the first time on *real* studio monitors, hears thin vocals with intonation problems recorded in basement using \$29.95 "pro" microphone. Multiple attempts (on each tune) at adding reverb, EQ and other "fix-in-the-mix" remedies don't help.

3:00 p.m. Engineer wisely blames the problem on client's low-quality vocal mic and suggests retracking vocals.

3:15 p.m. Engineer sets up *real* vocal mic (vintage tube preferred to impress client) and sets up monitor mix.

5:30 p.m. Four hundred punches later, "one-take" client finally completes vocals on four tunes. Says he "has a cold."

7:30 p.m. Ace quick-mix engineer completes mixing the four tunes, compliments the client for

great session that really only took two hours—for the mixing part, that is. Client realizes he needs *edited* DAT tape to send to tape duplication facility.

8:45 p.m. Fast-chops engineer finishes assembling mixes, after dumping tunes into workstation, editing tunes, adding tones and transferring 20-minute final product to second DAT tape. Client announces he needs six cassette tapes for band members.

10:00 p.m. Engineer completes six cassettes, in three passes of the control room DAT feeding two high-end cassette decks. While second group of tapes run, engineer compliments client on great tunes and adds that "while we're here we could also run a recordable-CD copy for only an extra \$200." Client agrees and leaves with "killer session mixes."

By now, you probably get the idea. A two-hour booking turns into nine hours, plus sales of two DAT tapes and a \$200 CD-R. Just one of many reasons a commercial facility should take a close look at a modular digital multitrack investment. There's gold in dem hills, pardner.

—George Petersen

recorded a mono tone burst on two synchronized decks; we examined the playback results on a Digidesign Sound Tools system and found both machines to be capable of sample-accurate synchronization.

Sound Quality: In our lab tests, both machines performed well, meeting or exceeding the factory specifications. The ADAT met its 0.009% THD+N (at 1 kHz) spec, while 20 to 20k Hz frequency response was flat to within ± 0.2 dB. The DA-88's THD+N (at 1 kHz) was slightly under 0.003%, with a 20 to 20k Hz frequency response flat to ± 0.2 dB—identical to the ADAT spec. In critical listening tests, there is a perceptible difference between the two recorders, but it would be foolish to try to say which sounded "better." Both systems sound very good—comparable to the audio quality of a decent studio DAT ma-

chine. Of course, once Tascam and Alesis deliver their digital interfaces, you could use outboard converters to create your own sound. But to be completely fair, the best-sounding digital cassette multitracks are Yamaha's DMR8 and DRU8, two 20-bit decks that put the high-falootin' notion of "ultimate CD-quality audio" into the garbage can where it belongs.

Tape Costs: Both Hi-8mm and S-VHS tapes are readily available from electronics stores, although finding a tape at an all-night drugstore can be a chancy proposition. As a price comparison, I checked a local discount shop that had TDK's XP SuperPro ST-120 (S-VHS) for \$7.95; TDK's ME-120, a similar-quality Hi-8 tape, was \$9.99. Not much of a price difference, but if you figure in the DA-88's increased running time, Tascam gets the price edge—about 1.25

cents per track-minute, vs. 2.37 cents per track-minute for the ADAT. Keep in mind that 2-inch analog tape at 30 ips is about \$7/minute (29 cents per track-minute).

User Base: At the time of this writing, Alesis has delivered more than 15,000 ADATs worldwide, which is more decks than all other digital multitrack tape formats—3M, DASH, ProDigi, A-DAM, Yamaha and Tascam—combined. To be fair, the number of Tascam decks should increase now that product is in the stores, but this existing multitude of ADAT users implies a wide acceptance of the format and a lot of potential clients for studios who cater to the “track-at-home/mix-at-a-commercial-facility” business. Chalk one up for Alesis.

Third-Party Support: A large user base also encourages third parties to develop accessories, custom modifications and peripherals to work with the ADAT system. Fostex plans to ship its ADAT format recorders in a couple of months (see sidebar). Meanwhile, Tascam is reportedly talking to other manufacturers about building DA-88-compatible decks. And with a one-year head-start, Alesis has announced numerous third-party alliances to develop other ADAT products. Among these are the \$349 DataSync from JL Cooper Electronics of Los Angeles, which creates a MIDI Time Code output from ADAT's control track for syncing to MIDI devices; and DataMaster, a \$749 rack-mount synchronizer that adds SMPTE chase, MIDI sync, MIDI Machine Control and optional (\$149) Sony 9-pin/ES bus sync. The AI-2 (\$995) synchronizer by TimeLine of Vista, Calif., offers SMPTE chase, Sony 9-pin interface, word clock in/out, video reference input and an interface for incorporating ADATs into a Lynx-2 and MicroLynx system. Steinberg's ACI (from Steinberg/Jones of Northridge, Calif.) is a \$399 device that adds MIDI sync and MIDI Machine Control to an ADAT system; designed for use with Steinberg's Cubase program, ACI works with any sequencer or computer platform that supports MMC. Digidesign (Menlo Park, Calif.) plans to build digital and sync interfaces for transferring eight tracks of audio directly to/from ADAT into Digi's Session 8 and Pro Tools disk-based workstations. Alesis is the clear winner in this category, but

more companies may support the Tascam format now that the DA-88 is in the stores.

Transport: When going into/out of typical transport operations (play/stop/rewind, etc.), both systems emit clunks and odd whirring noises that don't inspire confidence. However, the Tascam transport is noticeably faster than the ADAT, roughly comparable to the speed difference between DAT and an analog 2-track. When working on a 60-second spot or 3-minute song this isn't much of an issue, but if your work involves a lot of long-range shuffling between different sections of a tape you'll appreciate the faster operation. Tascam gets the edge here.

Analog Interfaces: Connections: Both systems offer analog -10dBV (Alesis 1/2-inch; Tascam RCA) and +4dBu inputs/outputs. However, to reduce manufacturing costs, the +4dBu I/O on both systems is provided on multipin connectors: Alesis uses a single 56-pin Elco; Tascam uses two 25-pin D-sub. Elcos tend to be hard-to-find and fairly expensive but are rugged with large, gold-plated contact pins. The smaller D-Subs are less expensive and readily available but harder to assemble, especially with larger-gauge cable. Alesis and Tascam interface cables in a variety of lengths and configurations are manufactured by Clark Wire & Cable ([708] 272-9889), Hosa ([714] 522-5675), Pro-Co ([616] 388-9675) and Whirlwind ([716] 663-8820). Another tie.

Digital Interfaces: Both companies use nonstandard, proprietary interfaces. Tascam's TDIF-1 is a bidirectional D-25 port; a cable for tape cloning (between two DA-88s) is \$100; the AES/EBU and S/PDIF interface is \$1,099, and an SDIF-2 interface is \$1,299. Alesis uses two (in and out) optical ports; a fiber-optic dubbing cable is included with each machine; and the optional interface with AES/EBU and S/PDIF ports is \$895. From a price standpoint, Alesis gets the nod here.

Documentation: Though both formats are being touted as the professional choice, the documentation shipped with both machines is a far cry from what should be offered with a pro-quality device. There are no schematics, flow charts, maintenance/troubleshooting procedures or even a cogent explanation of how the systems operate. Pretty lame on

both sides.

Construction Quality: Both machines are solidly built with quality parts, such as Crystal A/D converters. The transports appear rugged, though not invincible. With the covers removed, both decks offer adequate access for head and tape-path cleaning. The DA-88 electronics are mounted on slide-out cards, which should simplify servicing—or at least board-swap repairs. The ADAT has a switch-mode power supply, and there were reports of power supply failures on some early Alesis units, but these seem to be under control now. The Tascam power supply is linear, with a large power transformer (which contributes significantly to the DA-88's 33-pound heft); the design also creates a fair amount of heat, requiring a cooling fan that increases airflow (and dust movement) past the transport/head assembly. A toss-up, once again.

Reliability: I've heard a few reports of Alesis failures (see above), but when you contrast the number of problems with the 15,000+ machines delivered, reliability looks pretty good. In comparison, the first 3M digital 32-tracks were usually accompanied by a full-time maintenance tech—just to keep them running! Early Sony and Mitsubishi multitracks also had an affinity for downtime. The Tascam DA-88s haven't been on the market long enough to determine their reliability, so we'll have to wait before deciding this one. Another issue is the fact that rotary-head systems (such as DAT, VCRs, ADAT and DA-88) are complex mechanisms that are prone to breakdown and head wear. Rotating heads usually need replacing after about 2,000 hours of use (typically less than one year at a busy studio), so whether you choose ADAT or DA-88, you can expect some repair bills in your future.

Format: Typically, when new professional formats debut, companies unveil the workings of the format in scholarly journals or convention presentations, such as AES papers. Unfortunately, this has not been the case with Alesis or Tascam, so obtaining solid information about either format is no easy task.

Much has been said about the way the systems record the control track on the tape. On the Tascam DA-88—and other 8mm systems, in-

—CONTINUED ON PAGE 43



MICHAEL JACKSON'S "BLACK OR WHITE"
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THE FOSTEX COMETH

At last fall's AES show in San Francisco, Fostex (Norwalk, Calif.) announced that it would be entering the modular multitrack milieu, with a digital recorder compatible with the Alesis ADAT format. The resulting machine, the Fostex RD-8, uses the same S-VHS transport and record electronics as the Alesis deck, but adds sophisticated synchronization and control features. At the recent NAB show in Las Vegas, I checked out a pre-production unit.

The RD-8 is completely compatible with the ADAT and can be used as either a master or slave deck (with the identical D-sub 9 sync connector as the Alesis). Like the Alesis machine, up to 16 of these Fostex 8-tracks can be synched for up to 128-track recording. The fiber-optic digital I/O ports are identical to those used on the Alesis, as are the BRC remote and meter bridge connections.

Preliminary features for this three-rackspace deck include an onboard SMPTE chase-lock synchronizer/

reader/generator (24/25/29.97/30 frames DF-NDF), RS-422 (Sony P2 9-pin) control for interfacing to video editors, video sync in/out and word sync in/out/thru (both with 75-ohm termination switches), pullup/pull-down (44.056 and 47.952kHz sampling for 29.97 fps resync), MIDI Ma-

SMPTE rates, sync status, sampling and/or clock rates, etc.), as well as autodiagnosics and locator info. As an adjunct to the large, 10-digit, LED readout of hours/minutes/seconds/frames/subframes, data in the LCD window can also include song titles, take numbers and more. On the RD-

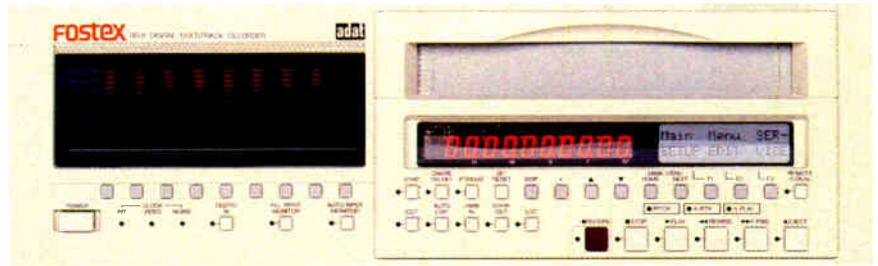


PHOTO: GEORGE PETERSEN

chine Control, 44.1/48kHz sampling, XLR time code in/out, onboard 170ms track delay, multimachine offset, and -10dBV (RCA) and +4dBu (D25 sub multipin) analog inputs/outputs.

Like the Alesis BRC controller, the Fostex RD-2 has a 2-line-by-18-character LCD window that displays multiple pages of software access for operational data (incoming/outgoing

2's back panel, a DIN input for a standard IBM-PC keyboard provides an inexpensive, quick means of inputting alphanumeric data, with 10-key style entry of SMPTE location points.

Initial deliveries for the Fostex RD-8 are slated for September 1993, with pricing presumed to be in the \$5k (or thereabouts) range.

—George Petersen

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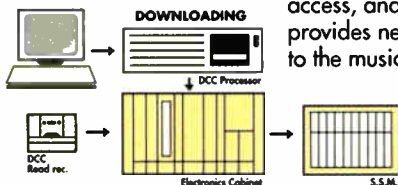


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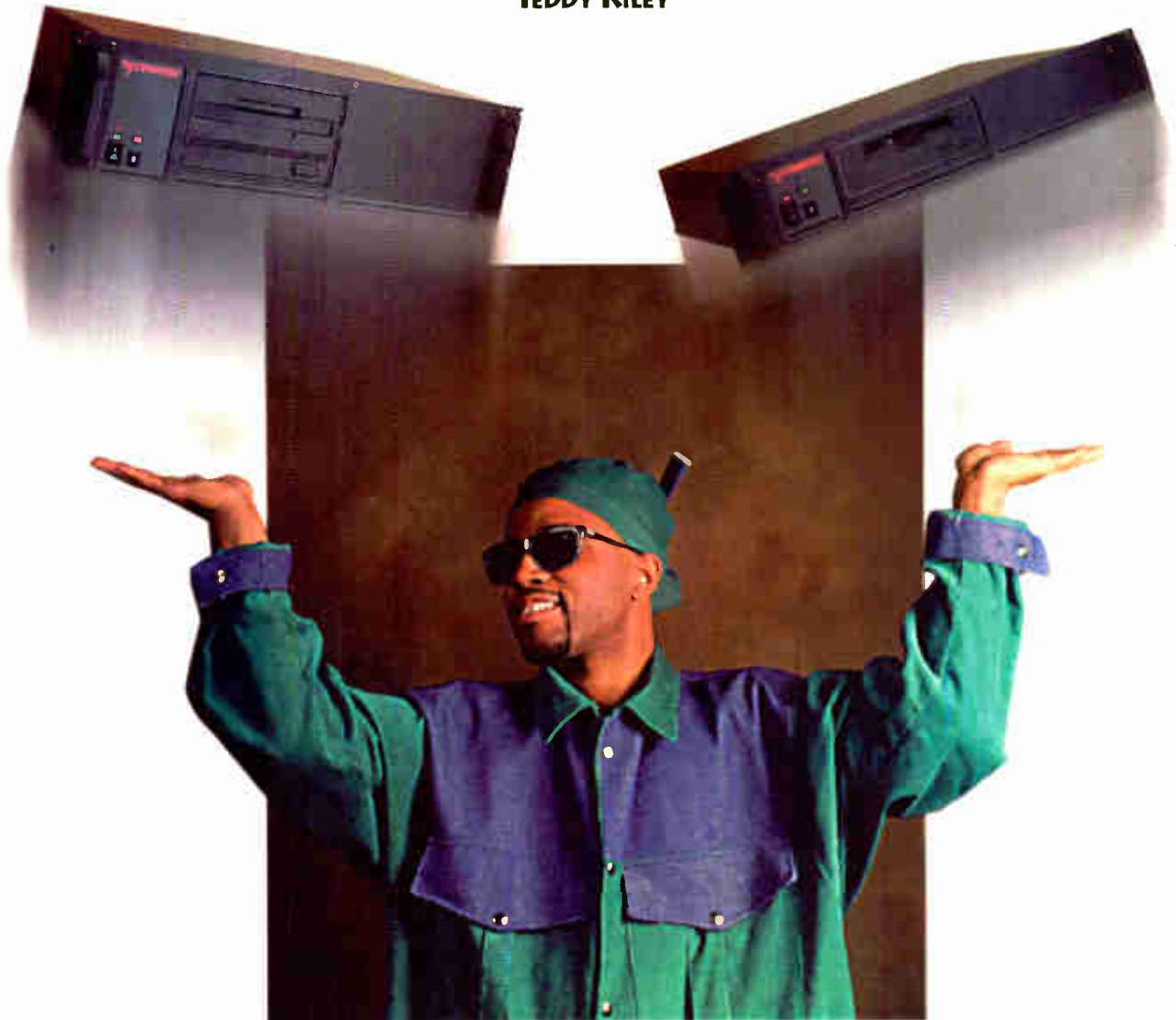
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—FROM PAGE 38, DIGITAL MULTITRACKS

cluding VCRs and camcorders, as well as DAT—the servo control data is imbedded with the helical-scan information. Alesis uses a longitudinal control track (as do many video formats, such as VHS, U-matic, 1-inch and D-1/D-2 digital). There is no right or wrong here, just two different ways of accomplishing a similar result.

In terms of error correction, both formats use systems based on Reed-Solomon codes, a proven, standard method of error correction in both consumer and pro digital audio devices.

Though both Alesis and Tascam use a helical-scan, rotary-head assembly (as do VCRs and DATs), the data-storage schemes used in the two formats are quite different. And like DAT, the DA-88 uses Hi-8 tape, which is a high-coercivity, metal-particle formulation. These tapes have tightly spaced magnetic particles, thus increasing the amount of data that can be stored in the same area. Such tape formulations also require higher record and erase currents. This is not much of a concern in a DAT recorder; however, in a multi-track recorder using high-coercivity tape, where extremely high record/erase currents must exist in close proximity to the relatively weak playback signal coming off the tape, system tolerances are critical.

The track pitch—meaning the actual width of each helical-scan—on a standard DAT tape is 13.6 microns. The DA-88 has a track pitch of 20.5 microns; ADAT uses a 100-micron track pitch. Unlike analog tape, there is no direct correlation between track pitch and audio quality in a digital system. However, a narrower track pitch means more data can be packed into a smaller space, and both systems increase the tape speed (above standard video rates) to handle the difference. The Tascam format yields a longer playing time but requires absolute precision in head tracking and alignment in order to achieve 100% playback compatibility among different DA-88s. The Alesis approach uses a 30-micron read head within the 100-micron track pitch, with 35 microns of tolerance on either side of the recorded track, which should assure intermachine playback compatibility, but at a trade-off of reduced recording time (40 minutes) and slower fast-forward/rewind times.

A major difference between the

formats involves the way that data is stored on the tape. With ADAT, the information from each of the eight audio tracks is stored in discrete data blocks. The Tascam deck contains four sets of electronics from its DA-30 DAT recorders and stores audio data as four sets of track pairs (1-2, 3-4, 5-6, 7-8). When recording on a DA-88, if only one of the tracks in a pair is selected, such as Track 8, data from the playback of Track 7 is read and copied back onto the tape, along with the new information of Track 8. If AC power to the recorder is interrupted (or if a write or read error occurs) during an overdub on

Track 8, part of the data on Track 7 will be lost, and a similar scenario could ensue for any other glitch caused by dirty tape heads, electrical spikes, etc. And if that track-pair error happens a week after you flew Eric Clapton in for a hot solo on Track 7, it will be just another reminder why backup copies of important sessions are imperative. Alesis gets the edge here.

SYSTEM COST ANALYSIS

Both systems offer combinations of features, functions and accessories, so exact head-to-head matchups can be difficult. Here's a look at several

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comparable systems, with retail pricing. (Note: All ADAT machines include an LRC—a simple transport control—at no charge. Tascam makes an optional single-machine remote, the \$200 RC-808, which offers track arming and input monitor switching functions in addition to basic transport controls. As the LRC and RC-808 are not exactly comparable units, they are excluded from the systems listed here —Eds.)

Basic Machine

Alesis ADAT: \$3,995.

Tascam DA-88: \$4,499.

Single Transport, SMPTE Chase

Alesis, \$4,990: ADAT, \$3,995; A1-2 synchronizer, \$995.

Tascam, \$5,298: DA-88, \$4,499; SY77 SMPTE sync board, \$799.

Two-Machine Basic System

Alesis, \$8,000: (2) ADATs at \$3,995, including dubbing cables; generic sync cable, \$10.

Tascam, \$9,183: (2) DA-88s at \$4,499; PW88D dubbing cable, \$100; PW88S sync cable, \$85.

24-Track System, Autolocator, SMPTE Chase, Meters

Alesis, \$14,995: (3) ADATs at \$3,995, including dubbing cables; (2) generic sync cables at \$10; BRC autolocator with SMPTE, \$1,995; RMB meter bridge, \$995.

Tascam, \$17,154: (3) DA-88s at \$4,499; (2) PW-88D dubbing cables at \$100; (2) PW-88S sync cables at \$85; SY-77 SMPTE sync card, \$799; MU-8824 meter bridge, \$899; PW-88M meter bridge cable, \$90; RC-848 autolocator, \$1,499.

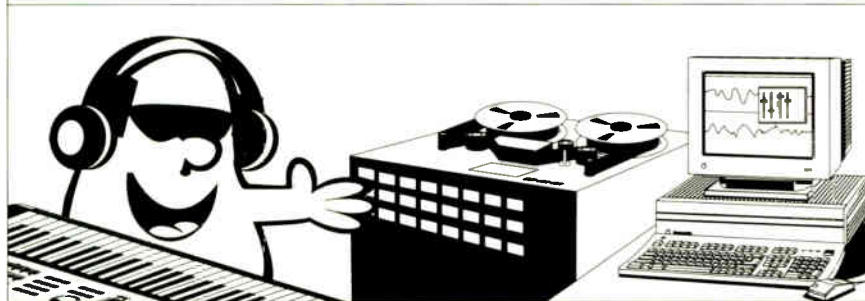
AND THE WINNER IS...

Sorry, but you'll have to figure this one out for yourself. We've presented the facts, figures, specs, features and pros/cons of both systems. Now it's up to you to decide which system fits your recording needs. However, one thing is clear: When a digital 24-track costs less than 24-tracks of pro noise reduction, the real winner is the entire audio community. I wonder what lies ahead five years from now? ■

When not in the studio, George Petersen spends most of his time pondering film format debates such as 16mm vs. 17.5mm and Super-8 vs. center-perf 9.5mm controversies.

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THE BEST OF

Both Worlds

by Rick Schwartz

We are starting to see more and more integration of analog and digital devices, especially tape- and disk-based products. Someday an engineer will be able to assemble every device in the recording chain like building blocks, from sound capture, processing, mixing and archival, as shown in Fig. 1. Although it's now possible to go with an all-digital signal path,

there are several good reasons engineers continue to mix and match the best of both worlds from tape- and disk-based systems.

How many good-sounding digital microphones can you name? What about transparent-sounding digital compressor/limiters? Good engineers use the right tool for the right job—whether it's analog or digital—which is why they track drums and

bass using analog tape, and vocals on a digital multitrack. Although analog devices are still preferred for some parts of the signal chain, as digital technology continues to improve, there may come a time when an all-digital chain is not only possible, but actually desirable.

THE MOVE IS ON

Audio products are going digital for a number of reasons. In the case of a DAT machine, we have indexing capabilities,

faster transport shuttle times, and generally better specs than a similarly priced analog recorder. As a result, it seems that analog tape machines may be going the way of the vinyl record. Purists will continue to sing their praises, while the masses cast their votes for a digital solution.

Case in point: While sales of analog multitrack machines are now on

the decline, digital audio workstation sales are increasing. Why? Because nothing can match the speed, accuracy and flexibility available from nonlinear editing. As many of you can attest, once you've edited using a hard disk system, it's hard to go back to a razor blade.

Although DAWs have generated a lot of interest, they are now being forced to share the spotlight with a new breed of tape-based products that offer eight or more channels of digital audio at a very reasonable price. These

low-cost Modular Digital Multitracks

are available from a number of manufacturers, including Akai, Alesis, Fostex (due out in September) and Tascam. Surprisingly, the availability of tape and disk devices has not been adversarial in nature. In fact, they seem to complement each other quite well. One could even say that,

Blending Tape- and Disk-Based

by providing an extremely low-cost form of high-density removable media, MDMs supply the missing link DAWs have always needed.

TAKING CONTROL

On the surface at least, the integration of tape and disk may seem like a marriage made in heaven. There are several issues that need to be addressed, however, including machine control and digital data exchange.

Let's start with built-in machine control, because it's already slated to appear in products from most of the manufacturers. MDMs can be controlled through the use of conventional serial or parallel interfaces, or via MIDI (also serial in nature). One of the more popular types of machine control is the Sony 9-pin serial interface. Assuming both devices feature a 9-pin connector and common software protocol support, your worries are over—simply plug and play.

The MDM should perform well as a slave. Though not strictly a random-access device, the unit's shuttle times are generally faster than those of a conventional tape transport, especially if the recorder is based on an 8mm mechanism. The inclusion of industry-standard machine control also makes it possible for MDMs to lock up with analog tape machines using an external synchronizer. Even if your workstation doesn't have 9-pin support, it can operate as a code-only master if it can output SMPTE time code while playing. If not, check and see if it has a MIDI jack on it. Some workstations output MIDI Time Code, which can be converted into SMPTE using a third-party device. A more elegant solution could be the use of MIDI Machine Control, an option that is starting to appear on some products.

In addition to basic transport control, your workstation should also be able to arm



SESSION SPOTLIGHT

Trevor Rabin and Michael Jay on the New Yes Album Project

Yes producer/guitarist Trevor Rabin and engineer Michael Jay explored new musical horizons via advanced computer technology during the production of the band's new album. And Mark of the Unicorn's Digital Performer for the Macintosh affected the process greatly. As in the past, the Mac was used as a writing tool, allowing band members to mock up song ideas using samplers and synthesizers. But now computers are being used in all stages of the production, providing incredible new power and flexibility.

Digital Performer's hard disk-based digital audio tracks allowed band members to add bass, guitar and vocals quickly in a totally nonlinear environment. Jon Anderson also recorded his lead vocals directly into the Mac using Performer. Background vocals were recorded onto multitrack tape and then mixed down directly into the Mac for editing. "Being able to cut and paste everything from acoustic drums to stacked background vocals," Jay explains.

—CONTINUED ON PAGE 49

occur in the timeline, with the presumption that audio information exists between those two points. This would allow the user to print out an EDL for all tracks in a project, both tape-based and nonlinear. Waveforms for tape-based tracks could be built in the background by the computer and displayed in the timeline to facilitate more accurate tape editing.

THE LANGUAGE BARRIER

Once your deck is under computer control, it's time to start exchanging digital information. Data transfer involves the exchange of EDL information, as well as the actual sound file data. Ironically, edit lists are harder to exchange than sound file data. Sound files can be digitally

transferred from one device to another using the AES, S/PDIF or similar digital I/Os. If the transfer is done properly, the copy should be almost identical to the original. The idea here is that you would cut on disk and then transfer the material to tape. Unfortunately, the transfer is a real-time process—as is mixing—so it shouldn't be a factor for most users.

THE TECHNOLOGY BRIDGE

Another problem is the barrier between project and professional studios. Although low-cost digital multitracks have yet to establish themselves fully in the professional mainstream, they are deeply entrenched in the home-studio market. Musicians love them because of their at-

—CONTINUED ON PAGE 50

Technologies

tracks on the MDM and punch-in/out—either manually or at specific time code location points. In the future, expect DAW software designers to include tape-based virtual track support in their products. Workstations with such a feature could graphically display where punch-ins and punch-outs

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—FROM PAGE 47, SESSION SPOTLIGHT

“has allowed us to zero in on the ideal form of a song during the recording process.”

Multiple Macs were used to achieve additional digital tracks. Slave computers were linked using the network output on the Mark of the Unicorn MTP interface. In addition, a 10-BaseT Ethernet connection was used for sound file exchange. Besides the internal hard disks, four external hard disks were used: three Dynatek 1.2GB drives and one 660MB drive, for a total of more than 4 GB of online storage.

MASTER SYNCHRONIZATION SOURCE

For the best possible sound quality, Jay and Rabin needed to find a sync source accurate enough to clock the 20-bit converters housed in the Lexicon 2020 A-to-D converter and Digidesign Pro Tools hardware, but which could also serve as a master controller for every device in the studio. The solution turned out to be a TimeLine MicroLynx, with the ACG-2 option. The MicroLynx time code generator (resolved to its own internal black-burst sync) was used as the master time code reference for the entire system; the multitrack served as the motion master. This configuration, Jay recalls, made the system feel as if the multitrack was the master, when in fact it and both MIDI Time Pieces were receiving time code from the synchronizer's internal TC generator.

The MicroLynx also provided word clock for the Lexicon 2020, which is currently being used as a front

end to Digital Performer. According to Jay the 2020's built-in compressor provided a tape-saturation effect, but without the negative analog artifacts.

DRUM SUBMIXES

Before recording the drum parts, Jay and Rabin pre-mixed all of the tracks to about a half-dozen mono stripes, which were printed on a multitrack slave tape. Guide tracks on the slave consisted of guitars, bass, keyboards and vocals, as well as percussion that drummer Alan White would need to play against. Six days were spent in an outside studio tracking acoustic drums, organ and other parts.

The final drum mix was then recorded back to hard disk using Performer, allowing other parts to be edited to fit the new tracks better. Jay used Digital Performer to slip sync on the drum mics and claims the use of this technique allowed him to clarify the image by eliminating time smear for a punchier sound.

According to Jay, “The use of hard disk technology has allowed a band like Yes to write and record to the point where there is now no clear line between the demo and final stages of an album project.”

“We have moved far beyond using the computer to merely sequence,” Rabin concludes. “We’re now realizing the optimum in performance by being able to manipulate sound in a way unimaginable ten years ago. I sincerely believe that most music will be created this way in the near future.” —Rick Schwartz



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tractive price, great sound quality and removable media, which allows tapes to be exchanged between friends during collaborative sessions. If enough professional studio owners take notice, MDMs could be an effective link between personal-use and professional facilities.

Artists could start a project at home, by recording basic tracks and time-consuming overdubs. Once tracking is completed, the tape could be brought to a professional studio (with the same-format recorder) to record critical overdubs, final vocals and mixing.

conventional recorders, with a cost as low as \$400 per track.

Another reason for integrating a low-cost digital multitrack with a workstation is to supplement disk-based tracks. Adding an MDM to an 8-channel workstation doubles the amount of tracks at a reasonable cost. By linking several boxes together, it's possible to have more than 24 tracks, with a recording time longer than 2-inch tape. Why mix linear and nonlinear tracks? Disk-based tracks are perfect for slipping elements against time code and performing critical edits, while tape-based tracks are ideal for long-term

These pint-sized units are capable of providing up to 864 track-minutes on a single 8mm tape, which translates to a cost of only one cent per track-minute—much less than other forms of removable media, including analog tape, data DAT or magneto-optical cartridges (Fig. 2).

There are several caveats, however. Backup would occur in real time instead of two to four times normal speed. Also, although the information on the tape is stored digitally and is for all practical purposes first-generation, there is one big difference. The time code pointers generated by workstations on original sound files and regions would not be present. However, if manufacturers decided to write their EDL information at the beginning of a tape as analog data, users with software that could read the header section would know exactly what was on each track and the precise moment each sound occurred. Once read, the EDL could be imported into a digital audio workstation, and tracks could be record-

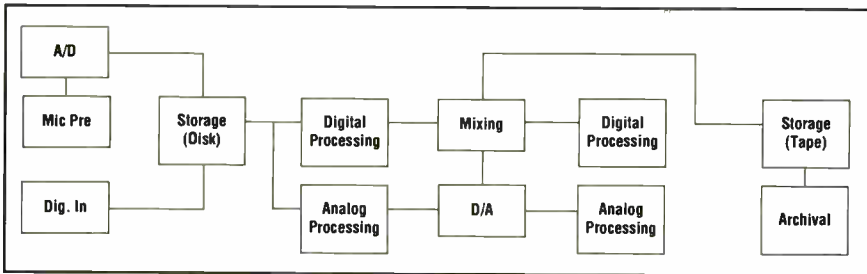


Figure 1: One example of a modular approach to the recording process: Conventional tape machines could be added with the addition of synchronizer modules. Complex configurations could be stored and recalled.

As some of you may have discovered while working in project studios, because of bad room acoustics, improper wiring and noisy mixing desks, it's almost impossible to achieve a good mix. By going to a professional studio, the project recordist could take advantage of an expensive array of signal processing gear and exotic microphones. By bringing in a recorder for use as a slave deck, you might even consider replacing drum machine tracks with real acoustic drums. The sooner professional studios embrace this technology, the better.

Audio post houses are just starting to examine the use of MDMs; for film and television applications they serve several purposes. First, they act as a bridge between the sound editor and the dubbing stage or on-line facility. Tracks can be edited using nonlinear techniques, then transferred straight across to an MDM so they can be locked up and used for mixing. An MDM is inexpensive enough that it could become a cost-effective alternative to

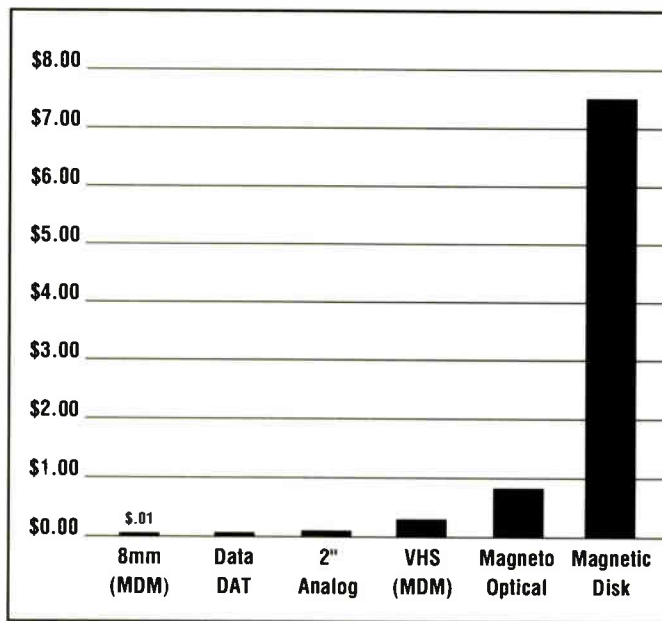


Figure 2: Cost comparisons, per track per recorded minute, for 8mm tape, Data DAT, VHS, MO, analog and hard disk systems

storage. A single 8-track, tape-based system has enough room for stereo dialog, music and effects, plus a stereo composite track. Combining tape and disk gives the user the best of both worlds.

OTHER CREATIVE POSSIBILITIES

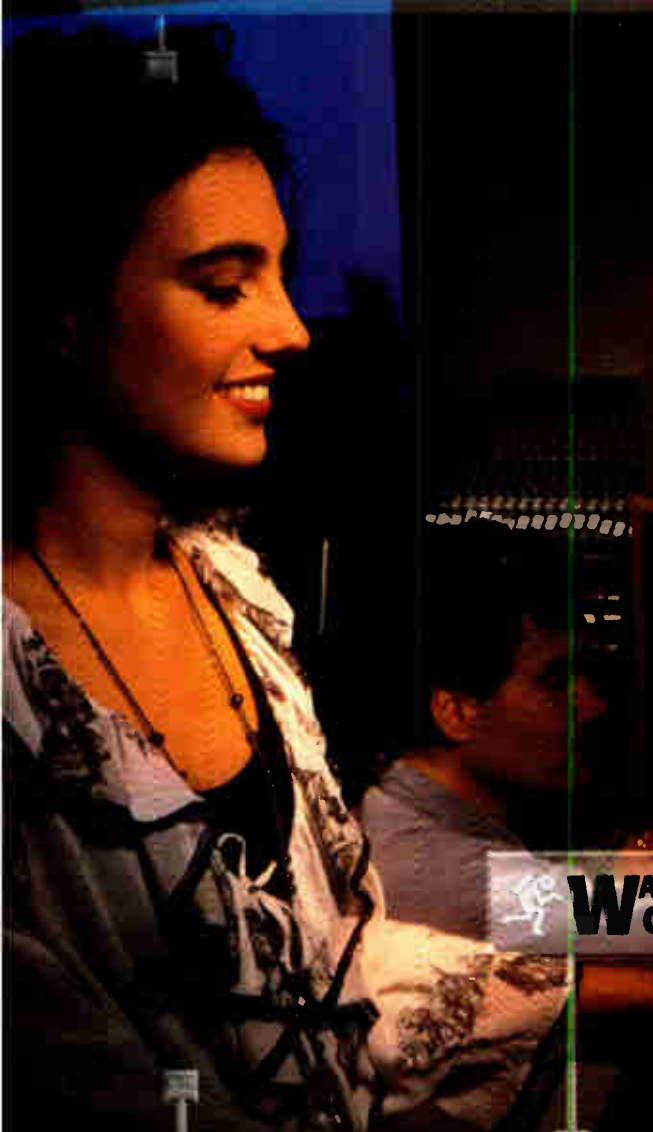
MDMs are also useful for archival applications. The long recording times offered by products such as the Tascam DA-88 have made audio post houses and digital workstation users stand up and take notice.

ed under computer control using the list as a guide. This feature would result in a much more efficient use of disk storage space, because the DAW would need only to record the sections on a tape that contained audio information (plus user-specified handles). All of this extra functionality could be possible without any modification to the hardware.

FREEDOM OF CHOICE

As can be seen, no matter what kind of work you or your studio handle,

STARR PARODI • COMPOSER, PRODUCER
ARSENIO HALL SHOW KEYBOARDIST



"On the Arsenio Hall Show, many groups want to reinforce live drums with sampled loops from master DAT or master CD. I like to

pump the volume of the samples high to get a big sound. When I do, the show's sound engineers come out of the booth and give me this 'you're doing it again' look...because the signal from the CR-1604 is so clean and hot that it regularly peaks their meters. Yet the 1604 never distorts. High headroom and dynamic range are why Jeff and I use Mackies in our commercial production studio and on the road...most other compact mixers in this price range artificially color the sound. Incidentally, not only does the Arsenio Hall Show use a total of four Mackies, but it's also the mixer I see most often in the racks of groups that we have on the show."

WHY PROS PREFER MACKIE... PART ONE

Starr Parodi/Parodi Fair Productions: Film trailers and television: El Mariachi, Trespass, Extreme Justice, Prelude to a Kiss, Mississippi Masala, Straight out of Brooklyn, Graduation Summer, Livin' Large, The Edge, Fame; Commercials: Subaru, Arco, Chrysler, Coors Pure Water 2000, Paramount Theme Park, Better Homes and Gardens, Charter Hospital and many more. In addition, Starr has released a stunning debut album, "Change," with another coming soon.

Before you buy a 16-channel mixer, call us toll-free. You'll learn why successful professionals who can afford to own any compact mixer overwhelmingly choose the remarkably affordable Mackie.

WAYNE SHARPE • OMNIMAX FILM AND COMMERCIAL SOUNDTRACK COMPOSER

ABOVE: Starr Parodi and husband/co-producer Jeff Fair in their home studio. Essential equipment includes Akai digital samplers, Panasonic DAT, eight Korg keyboards and of course, two Mackie CR-1604 16-channel mic/line mixers.

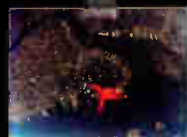


Marzo awaits his orders to be transported on his mission to discover the "secrets of OMNIMAX." From the Liberty Science's signature film "Welcome to the Max."
 © 1993 Rosalini Film Productions, Inc. Soundtrack by Wayne Sharpe.

Wayne Sharpe photo: Sheila Giacie
 Starr Parodi photos: Peter Figen



Wayne Sharpe: Film music for 70mm "Welcome to the Max," "Atlantis," "Geresene Demonic," Commercial scores for Revlon, Dristan, Cover Girl, NEC, Red Lobster and Hawaiian Punch national TV spots; MIDI consultant/programmer for Beach Boys, Tommy Shaw (Styx & Damn Yankees), Rick James, and others.



View from 10,000 ft. above Manhattan as Mario falls to earth from outer space. From Liberty Science's signature film "Welcome to the Max."
 © 1993 Rosalini Film Productions, Inc.

"My soundtrack for 'Welcome to the Max' was mixed direct to six discrete digital channels at Toyland Studios through three Mackie CR-1604 16-ch.

mic/line mixers combined via a MixerMixer. The producers wanted the cleanest possible sound and needless to say, the CR-1604s delivered as usual. I've used Mackies to produce my recent television commercials and movie soundtracks, and continue to be amazed at the sound quality that comes from such affordable mixers. I've also recommended CR-1604s to a lot of other musicians. All I can say is, "Accept no substitutes."

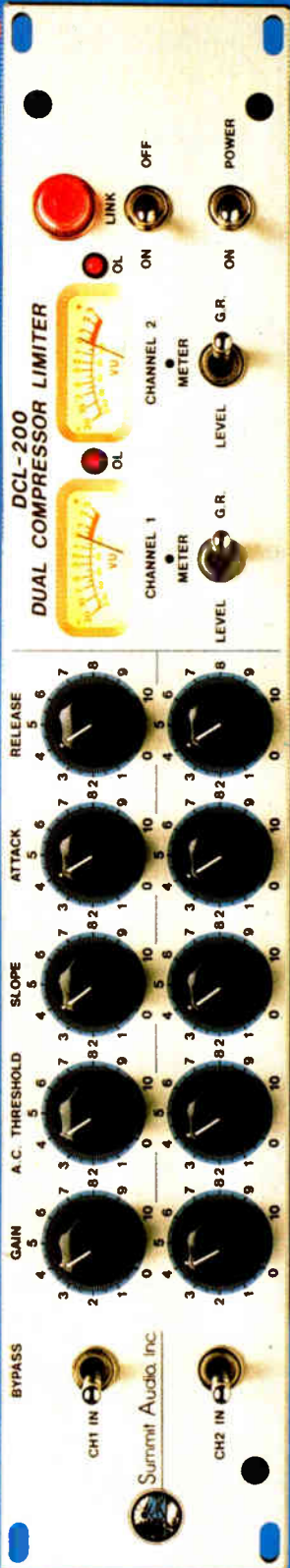
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the addition of a low-cost digital multitrack is worth considering. Right now, digital multitrack recorders are available from a number of manufacturers, with more on the way. Users can choose between long recording times, up to 20-bit dynamic range, as many as 12 tracks, and even video-sync capability. It's not an easy decision.

Although 8-track is now the most popular configuration, expect to see 16-track capability within the next year or two. If 16 is possible, why not 24? Only time will tell. Until then, it is easy to lock up multiple MDMs, without the use of an external synchronizer. By linking multiple units, it is possible to go way beyond the 24- or 48-track canvas that most of us have become accustomed to working with.

OFFLINE GOES ON

Audio products are not the only devices that are moving from analog to digital. Random-access video editing systems are also on the rise. Anyone who attended the recent NAB convention in Las Vegas knows that the new buzz words are *nonlinear online*. The emergence of reasonably priced video editing systems that promise to deliver broadcast-quality images may have a profound effect on the audio post-production industry as well.

Until now, the main purpose of using a nonlinear video editing system has been to create an EDL for the online session. This setup allows an editor to work fast, as well as offering the flexibility of trying different options in a low-pressure (i.e., inexpensive) environment. Now, for the first time, video houses have the ability to finish a spot in-house.

How will this effect the audio industry? Some facilities are starting to get pressure from clients to buy audio editors that are file-compatible with their picture-cutting systems. The ability to read digital files from an offline session allows the audio sweetening facility to start where the picture editor left off, without a time-consuming laydown. There is no need to import an EDL, because edit points are already in the system.

First-generation source elements are already on disk and do not need to be retransferred. Once the media from the video editing house is online, the audio facility can fix bad

edits, split tracks, add additional material and mix. There's no need to lay back audio before the online session, because the mix stripes can be stored on the same disk as the source audio. If additional picture cuts are made in the online session, the audio tracks will reflect all changes without going back to an audio facility to conform the tracks and remix. It's clear that disk-based video editors are having a profound effect on the entire post-production process.

INTEGRATED SOUND AND PICTURE

Now that DAWs have gained widespread acceptance, users are starting to ask, "What good is random-access audio without random-access video?" SSL made this clear when it first showed Scenaria—an audio workstation with disk-based video—at last year's NAB convention.

In addition to compatibility issues, there are other reasons to consider an audio editing system with integrated digital video. The post-production process is extremely repetitive; hundreds, sometimes thousands, of edits are made in a single day. A typical seven-second preroll, plus the time it takes for the transport to locate and park, really adds up over the course of a normal session. It's like driving a speedboat with your anchor dragging on the bottom of the lake; no matter how fast your engine is, your top speed is limited by the friction caused by the anchor. In this case, the boat anchor is the video transport.

Integrated video offers three main advantages: extremely fast logging, near-instantaneous lockup and the ability to scrub sound with picture. Frame-accurate scrubbing of sound with picture is simply not possible using conventional video transports or even laserdisc players. Once you've used a hard-disk editor with integrated picture, it's hard to go back to a conventional video transport.

Best of all, prices continue to drop on the computer technology that makes all of this possible. Although an affordable all-digital solution is on the way, it may not be the best solution. Integrating the best of analog and digital technologies makes the most sense for many of us. ■

Rick Schwartz is a freelance technical writer and currently serves as a West Coast audio specialist with Avid Technology Inc.

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MASTERING THE WORKSTATION

Learning Curve

The big day comes. The postman rings twice, you answer the door, and, grimacing, he dumps a box at your feet the size of a hotel room in Tokyo. Like a child at Christmas, you rip open the packaging and, as your eyes fix upon a forlorn sheet of yellow paper that says "Read Me First" in 24-point type, you think:

- My God, what do I do with all these packing peanuts?

- I didn't know it came with a free copy of Encyclopedia Britannica...

- If I just close this up the way I found it, maybe I can get a full refund.

Congratulations, you've bought a workstation. Despite the fact that it took months to research your purchase and put together the right deal, that was the easy part. Now you've got to take it out of the box and make it work. That slight queasy feeling in your stomach is natural—it's called anticipation. Whether it matures into excitement or a full-fledged case of buyer's remorse depends on how you approach the first days and

weeks of getting to know your new machine.

During the dawn of the DAW age in the late '80s, you would have been pretty much on your own, with only the manufacturer to provide support. Today, there is the experience of those who have gone before to draw upon. Here are a few words to the wise from some seasoned workstation hands. Remember, they started off as novices too.

MANUAL LABOR

These days every workstation is marketed as "easy to use." This sounds more attractive than "really hard," but don't let the user-friendly graphics and point-and-click operation instill overconfidence: Many first-time users report that the learning curve is steeper and longer than they ever imagined. Often this is due to the fact that mastering the workstation requires mastering the underlying computer operating systems, as Roger Stauss, chief engineer and co-owner of Noteworthy Studios in Granville, Vt., reports.

"I entered the computer world and the digital audio worksta-

tion world all at the same time, so I had both the Mac and the [Sonic Solutions] SonicStation to learn simultaneously," he says. "Because of the Mac, it was easy to pick up the basics. But the Sonic's advanced editing features seemed overwhelming at first, because all the parameters are so adjustable.

"Eventually, when I understood how flexible the system is, my work was actually simplified because I have the tools to solve so many problems. Now so many things are second-nature, but it took me six months to get there."

Becoming proficient takes a definite commitment in time, which, according to Jeff Berlin, production engineer for WXKS-FM in Boston, may in fact leave time for little else. "I spent 15 hours every day in January learning this machine [4-track Pro Tools]," Berlin recalls. "I was dreaming about edits at night! I started working on actual on-air productions the day we set up the system, but it took longer to do the work, because I would approach a spot or promo several different ways



ILLUSTRATION RANDY SOUTH

so I could learn the system's capabilities. At the same time, I had to learn a whole new language—in fact that's one of my major criticisms of the industry. One manufacturer calls one edit 'shuffle,' another calls it 'ripple,' and another calls it 'abut,' when they're all butt splices. If the industry would standardize on a single language, it would be a lot easier to learn things."

In the first throes of new-tech rapture, the temptation to take shortcuts can be great. Many first-time users attempt to put aside the manual completely and get right down to work. Don't, Berlin warns: "My message to those who don't read manuals is: You've got to, or you will never fully utilize all the capabilities. It's a small investment in time that will save you hours down the road."

INSTALLATION HEADACHES

One of the most valuable pieces of pre-installation data a manufacturer or dealer can provide is the electrical and cooling requirements of your system. Massive hard disks have a matching appetite for power,

and an improper circuit can cause more than the usual grounding problems, as Stauss found out: "Special attention has to be paid to where your voltage is coming from in terms of filtering. We initially had problems not so much with hum but with grounding discharges corrupting data. We ended up running new circuits with fresh grounds and grounded our console with three grounding rods and a big chunk of copper.

"Out here in the country, we also have to deal with the fact that the voltage fluctuates a lot, which can cause the A/D and D/A converters to mute," he continues. "There can also be total blackouts that cause us to lose power for ten or 15 seconds. When we first started, we had a power outage during a windstorm, and our hard disk was just a mess. We lost the whole project, so we quickly learned from that. We solved the problem by using an uninterruptible power supply that will keep us going for about a half an hour, until we can finish what we're doing and power down." Cable runs are another common

installation headache, particularly in configurations where the workstation is to reside in a machine room, while the user work surface stays in the control room. Some computers are finicky about just how far they will allow a monitor and keyboard to be re-

**Congratulations,
you've bought a
workstation...
that was the easy
part. So, here are a
few words to the wise
from some seasoned
workstation hands.
Remember, they
started off as
novices too.**

moted from the CPU, so it pays to review your particular setup ahead of time with the manufacturer or dealer and inquire about any such restrictions.

Keep in mind that hard disks whirr and whine loudly, so it may not be acceptable to keep your CPU in the control room if a critical listening environment is essential.

MAKING THE PROPER CONNECTIONS

One of the biggest "gotchas" to be aware of is digital synchronization. Keeping the signal path in the digital domain may not be as easy as connecting AES/EBU ports. As Boston-area pro-audio dealer Mark Parsons of Parsons Audio emphasizes, "You cannot have stuff running wild [on] a DAW. That forces the user to learn about sync, and why it is necessary. You have to have an understanding of issues like clocking, sampling rates, emphasis/de-emphasis, copy-protect and so on. Then there are the mysteries, like certain old DAT machines that just don't transfer properly, although manufacturers are getting better at correctly implementing the AES/EBU standard."

Ron Mann, owner of Lexington, Mass.-based Mo' Ron Music, learned about sync on the job. "I did not actually purchase A/Ds for my Spectral Synthesis system," he explains. "I chose instead to utilize the capabilities of external units with built-in A/Ds, such as my Panasonic SV-3700 DAT and Lexicon 300. At first, what happened was a problem that occurred only when I tried to run the system at 44.1 kHz. I would occasionally lose sync, which would cause pops in the audio track.

"It was not clear which unit was causing the problem, so I ended up talking to all of the manufacturers," he adds. "It turned out that the Spectral supports internal sync as well as external, and was not passing the sync signal because of the way I had the thing wired. In fairness to everyone, I've read articles about how connecting digital equipment is so difficult, but, in fact, these are a complete exaggeration. There may be some problems, but it was largely a matter of ignorance on my part. I needed to be educated. None of this would have happened if I'd gone for the integrated Spectral Synthesis system anyway. So you have to do your homework."

MIDI is another potential area of concern. In the old days, most work-

station manufacturers ignored it. Now MIDI ports are becoming standard equipment. But don't assume your workstation's MIDI implementation will be as facile as your favorite synthesizer's, as Mann cautions. "The Spectral system does not currently use the standard Windows MIDI DLLs [Dynamic Link Library]. Consequently, I need to run two MIDI interface cards connected by a merger. My one big criticism of the PC world is that it is behind the

**"If you don't have a lot of money, expansion flexibility is the most important [factor] in your initial investment."
—Ron Mann**

Macintosh in terms of MIDI integration. The prices are there, the functionality is there, but the manufacturers need to cooperate more."

A lesson to be learned here: Before you buy, test your system in a production configuration as similar to your own as possible, including the necessary MIDI, machine control and SMPTE interfaces. Most systems will perform adequately in a stand-alone environment—it's the peripherals and add-ons that tend to cause the conflicts and bottlenecks. If you're considering a Mac or a PC system and intend to use additional software applications and shareware, load these on the system. Software conflicts may bring you to a halt faster than any hardware mismatch.

SYSTEM DOWNTIME

Face it: It's a computer; it crashes. If downtime is absolutely intolerable to you, you have two choices: Find the DAW that crashes the least in your application area (you will have to rely on word of mouth and references from current users in your field), or stay in the analog domain and find a tech with a beeper and a fast car.

Otherwise, practice safe computing and get in the habit of making frequent backups. Or buy a workstation with an auto-save feature that does it for you. Either way, keep in mind that crashes may happen fast and furiously in the beginning but may become a thing of the past as your expertise increases.

Of course, the problem isn't always you; it is often a software bug.

This is especially true if you choose to take the pioneering approach and use beta software. You may be rewarded by being the first to take advantage of advanced capabilities, but you don't get something for nothing.

Lydian Tone of Chace Productions in Burbank has an interesting anecdote: "I bought the third Doremi DAWN system and was really the first to apply it in post-production. I've probably called Doremi every day since then. We learned together:

I learned their system, they learned my application. Over the years they've added features like the ADR module, fades and wipes, and master machine control. The system is really taking off in Hollywood. But you've got to put in the effort to get the results."

Indeed, learning the manufacturer's bug-reporting and feature-request procedures can help you shape the future of your system. Regarding hardware failures, there's good news and bad news. The bad news is that disk drives still grind to a halt, power supplies blow and D-to-As fry. The good news is that many workstation manufacturers and dealers have adopted "no-hassle-service" policies. Increasingly, it is standard industry practice to swap out failed components via overnight courier or supply loaner equipment in the case of more extensive repairs.

In Stauss' case, an unsatisfactory system was returned for a full refund. "We originally purchased another system that just couldn't handle music tracking," he recalls. "It would just start skipping around during a long sound file, because the system was too slow to access all the data. It took too long to get us up and running, so the dealer took it back." Stauss' experience proves that one of the most effective safeguards you can have throughout the learning process is a reputable dealer or manufacturer backing you.

Another enemy of full productivity is the dreaded backup task. Berlin considers backup and restore the number one problem with workstation technology today. "I recently did an interview that was 20 minutes long and cut it down to two minutes," he recalls. "To save disk space, I then compacted the file. I had to wait 45 minutes for the computer to work on this task. During

that time, I couldn't work on anything else. It probably would have been faster just to cut the job on tape, but then you sacrifice the ability to later restore the job exactly as it was, which is the advantage the workstation gives you."

FUTURE EXPANSION

One of the hardest factors to predict at the time of purchase is your future expansion needs. Business conditions change, and so do technologies. One thing is for certain: Staying ahead of the curve requires periodic software and hardware upgrades.

Mann advises that you budget for these at the time of purchase: "Especially if you don't have a lot of money, expansion flexibility is the most important [factor]. Your initial investment may seem substantial, but if you can't add tracks, I/Os and other capabilities, you're sure to lose it. You have to determine what your ultimate parameters are and see what it will cost you to get there. If you can afford to upgrade, you can afford the system."

One of the areas you likely will expand first is online storage. Your

44.1kHz files make short work even of 1.2-gigabyte hard disks, as theater sound designer Dave Budries, owner of Sound Situation in Glastonbury, Conn., quickly found out. "I have a huge investment in disk drives—five hard disks and two magneto-optical drives," he says. "I didn't foresee it when I first bought my Pro Tools system, but my work has escalated so that I need different drives for different applications."

Tone concurs: "The only thing I've upgraded is storage media. The problem is MO drives haven't been fast enough for real-time recording, so we've had to go through two generations of drives to get to the current Tahiti II. Of course, it's always infuriating when you buy something like a drive or RAM and see the price fall the next week. But that's technology."

The danger of buying an expandable system is falling prey to "The More You Get, The More You Want" syndrome. One way to avoid it is by focusing on those upgrades that will provide the highest immediate return in terms of greater capacity or faster operating speed. This is the approach

Stauss intends to take. "I would like to do a number of things on our SonicSystem, such as upgrading to 16 tracks, increasing the number of analog ins and outs, and adding onboard processing, like reverb. But as soon as we can, I am going to increase the clock speed of the Mac from 20 MHz to 40 MHz, because we've got the audio quality. Now we need to improve the system speed."

The ultimate upgrade? That has to be a second system, an unequivocal sign that the first one has proven a good investment. Budries recently added a Digidesign ProMaster 20 to keep up with his workload. "I originally thought my Pro Tools system would stay in the studio," he says. "But when I realized I was going to take it on the road with me, I bought a second system as a backup. I did it out of a fear of failure, because if I can't produce in a timely manner, then I have problems. This way, if I have downtime for any reason, I can reconfigure and keep working. And I'm very much considering a third system now." ■

Ted Pine is a freelance writer and an audio industry consultant.

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USE READER SERVICE CARD FOR MORE INFO

by Paul Potyen

DATA STORAGE TECHNOLOGIES

FOR DIGITAL AUDIO (AND OTHER DIGITAL STUFF)

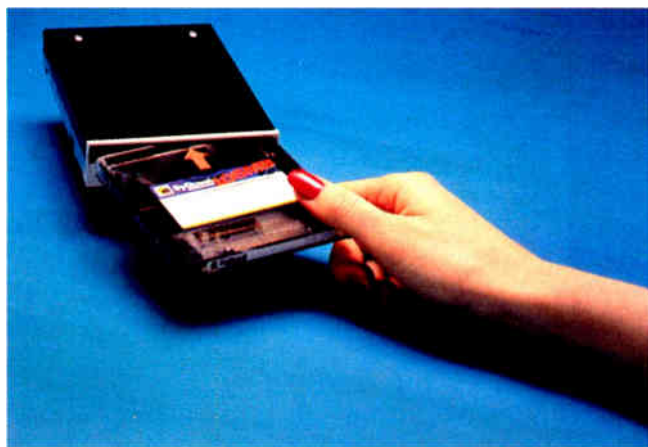
If you use a digital audio workstation, you have undoubtedly noticed that at 10 MB per second of 44.1kHz stereo, your audio data gobbles up space like a hungry nine-year-old in a pie eating contest. Random-access digital audio offers many advantages over conventional tape-based methods, but convenient data storage is

Whether you are using a turnkey stand-alone workstation or a PC/Mac-based system, the technologies are the same. With a variety of other options, conventional magnetic fixed hard drives are not generally considered to be an attractive economic choice for storing large amounts of data on anything but a temporary basis. Your best bets for archiving large amounts of data are removable magnetic media, removable magneto-optical drives, digital tape systems and recordable CD-ROM systems.

Your best bets for archiving large amounts of data are removable magnetic media, removable magneto-optical drives, digital tape systems and recordable CD-ROM systems.

SYQUEST REMOVABLE CARTRIDGE SYSTEMS

The Syquest systems seem to have won the first round over the Bernoulli systems in the removable magnetic format wars. The installed base of 44MB cartridge systems now number more than 800,000, and the new 88MB systems are backward-compatible. Although it's not byte-for-byte the most economical means of storing data, it is fast enough for recording, editing and playing digital audio. And it's a format that is widely used in the computer industry; cartridges fit conveniently on a shelf, and



Syquest 105MB removable cartridge drive

not one of them. However, some significant developments have taken place in this area since we last peeked into *Mix's* modern, well-equipped media lab.

Figure 1

MEDIA	COST OF SYSTEM	COST OF MEDIA	COST/MB	SPEED
conventional hard drives	\$1,500/GB	\$1500/GB	\$1.50	10-20ms
Syquest 88*	\$600	\$95	\$1.10	20-25 ms
Syquest 44	\$375	\$60	\$1.20	20-25 ms
DAT Tape drives	\$1,300	\$15	\$.08	<20 seconds
650MB MO	\$2,600	\$95	\$.15	27-90 ms
128MB MO	\$1,300	\$40	\$.30	30-40 ms
256MB MO	\$2,000	\$70	\$.27	30-40 ms
Floptical 20MB	\$350	\$20	\$1.00	65-75 ms
Recordable CD-ROM	\$4,000	\$25	\$.04	200 ms

*read/write on 44/88MB carts

they're easy to transport.

If you decide to opt for the 88MB version, be advised that there are two types: The first will format/write/read 88MB formats but will see the 44MB cartridges as "read only"; the second, slightly more expensive version will read and write both types of cartridges but can format only 88MB cartridges. Make sure you know what you want and what you're getting.

Syquest also just introduced its new 105MB format, which is being sold through PLI and Mass Micro. With a 14ms seek time, a transfer rate of 1.3 MB/sec, and a suggested retail price under \$1,200, it's designed to be an attractive alternative to the 128MB optical cartridges.

Meanwhile, Iomega, developer of Bernoulli technology, has not given up. Just released is a new 150MB MultiDisk system, with access speeds that match those of fixed hard drives. List price of the drive is \$1,225, and the 150MB disks go for \$245.

MAGNETO-OPTICAL SOLUTIONS

Magneto-optical cartridges have been around for a while (see "The

Byte Beat," November '91), and while MO technology has advanced greatly, it continues to play a game of catch-up with traditional magnetic media. Prices for drives and media have continued to fall, and data access times—a critical factor in terms of digital audio playability—are improving as well. Today there are three common MO formats: the double-sided 650MB 5.25-inch disc; the single-sided 128MB 3.5-inch disc; and the 20MB Floptical. Of these, the most popular among audio manufacturers seems to be the 650MB disc. At about \$350, the 20MB Floptical drive is also an economical way

Pinnacle Micro's recordable CD

for those with standard Mac IIs to achieve 1.4MB floppy compatibility, since the drive will also recognize that format. Another format that has recently emerged is the 256MB 3.5-inch system, which is also compatible with the 128MB system. A 1GB double-sided-format Tahiti drive has been available from several manufacturers for a couple of years and has made a few inroads in the digital audio community, with the exception of DAWN, Augan and a few others.

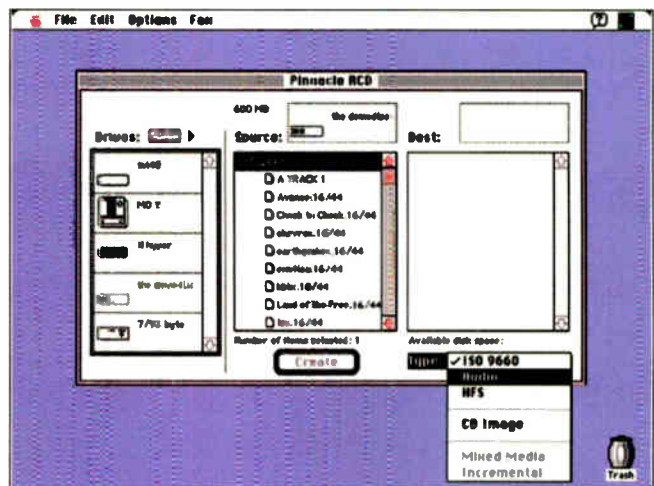
Unfortunately, none of these op-



Figure 2: Mezzo archiving software lets you select ProTools sessions, StudioVision files and SampleCell banks, as well as standard Mac data files.



Figure 3: The main window of Pinnacle's RCD controlling software.



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tions allows a complete 74 minutes worth of CD-Audio to be stored on a single piece of media from which all tracks can be read. (Both the 1GB and 650MB cartridges read only one side at a time.) With its improved access times, MO can provide a convenient rewritable storage system that is as easy to load and play digital audio from as any removable media. But don't expect to be able to record audio directly to 5.25-inch MO systems without special configuration and software tweaking by experts in random-access digital audio performance issues. Transfer rates depend on software as well as hardware configurations, and vary between MO drive systems.

DIGITAL TAPE ARCHIVING SYSTEMS

Tape-based archiving systems provide the most economical means of storing your data, at the expense of fast random access to that archived data. They come in several formats, although, not surprisingly, data DAT seems to be the most popular in the audio industry. Data DAT tapes are similar to audio DAT, though they are more expensive than their audio counterparts due to stricter quality control.

Archiving your data using DAT requires hardware and software. Audio DATs recorded on one DAT recorder will play back on another manufacturer's deck (at least in theory, but let's not talk about audio standards today). This is not necessarily the case with a data DAT. If you make a backup of your files using one software/hardware configuration, don't expect that another studio using a different configuration can make use of that tape. You will likely encounter more incompatibilities, caveats and trap doors when using DAT systems than with other types of media.

On the PC side, a variety of proprietary tape-archiving software options are available, while Retrospect, from Dantz Development Corp., Berkeley, Calif., is the most widely used archiving software for the Macintosh. However, owners of Macintosh-based DAWs will also want to consider Mezzo Media from Grey Matter Response (Palo Alto, Calif.), which is the only program of its type specifically designed for the demands of digital audio and video. Background archiving of files is pos-

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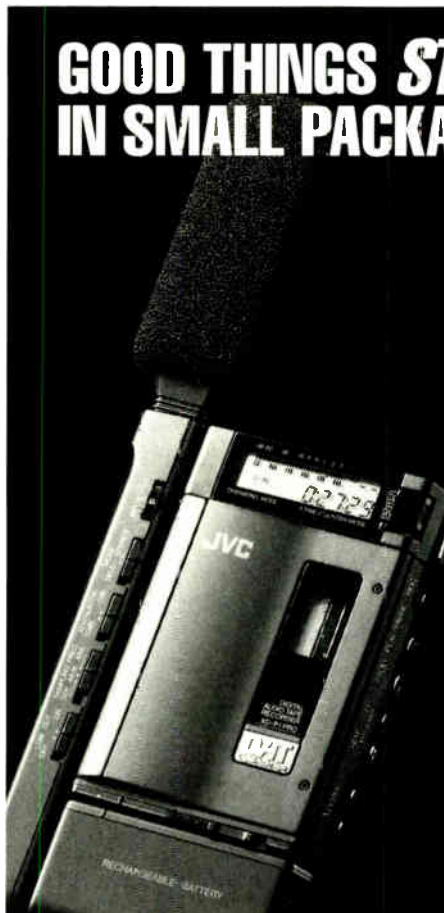
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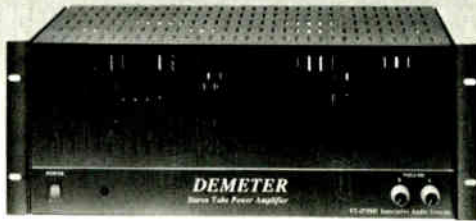
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sible with Grey Matter tape systems in connection with Digidesign's System Accelerator cards. Another handy audio feature is the ability to archive files in Pro Tools and Studio Vision formats (see Fig. 2), which then makes it possible to update that information incrementally (and much more quickly than recopying an entire new set of files).

DAT archive systems come in two versions: standard (DDS format) and compressed (DDS-DC format). Normally, either 60-minute or 90-minute tapes are used (corresponding to 1.3 GB and 1.9 GB of uncompressed data). Typical transfer rates for DAT are on the order of 11 MB/minute, or 150 KB/sec. The implementation of a compressed data format normally takes place in the firmware of the data DAT recorder. It allows a data transfer rate in the range of 350 to 700 KB/sec and provides double the storage capacity of uncompressed data on a DAT. Though compression of normal computer data is reliable, it's advisable to use the standard DDS format for archiving digital audio, as compression techniques *do* affect the data—not exactly what you want when archiving digital audio. Among the other tape archiving formats, 8mm tape is widely used. It provides higher transfer rates than DAT and, as you might expect, costs more.

A few final comments about DAT. On the plus side, at less than \$.10/MB, it's among the most cost-effective of archiving media choices. On the minus side, it's linear and therefore slower in retrieving files than random-access media. And unless you have the additional hardware to allow you to perform backups in the background, you should be aware that the process is not the simple click-and-drag or copy command you execute when you copy a file to another disk: It involves navigating from within a separate application. If you've been looking around for a data DAT system that also records and plays back 44.1kHz digital audio, forget it. While it's theoretically possible, no one has done it yet.

RECORDABLE CD-ROM

One of the most rapidly changing technologies in the computer industry today, CD-ROM recorders are yet another attractive option for an audio facility. (See "CD-ROM Recorders," *Mix*, March '93.) Costs of the drives

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are plummeting: Pinnacle Micro (Irvine, Calif.) is shipping its RCD 202 for the Macintosh for a list price of \$3,995 including software, and the pressure is likely to bring the price of drives from other manufacturers down. The price of the write-once discs is also coming down due to the emergence of the Kodak Photo-CD technology. And software is being enhanced and refined to allow these desktop CD makers to burn CD-Audio, CD Data, mixed mode (data and audio) CD-I, and multisession discs (where you can write part of the disc and leave the rest writable for a subsequent session).

While it's a real technological and price breakthrough, the Pinnacle system I looked at was not without its problems. At the time of this writing, Version 1.1a of the software did not implement mixed-mode, HFS or multisession capability, although these features are all promised in the near future (see Fig. 3). In order to create ISO 9660 discs, the source drive needs to be able to transfer at 1 MB/sec. And my unit was mysteriously incapable of creating an audio CD that would reliably play. However, I have not heard from anyone else who has had this experience. On my system it took 45 minutes to an hour to create a one-off disc. More expensive systems let you write at a faster rate.

The advantages of systems like the Pinnacle over stand-alone CD recorders are several: First, you can easily purge your workstation's hard drive of up to about 650MB of digital audio—or any other data—onto a stable, random-access, compact medium. Second, you can use the same CD recorder and the same data on that hard drive (Sound Designer or AIFF files) to make a full-length audio reference disc that your client can play in a CD player. And finally, computer-based systems are more accurate than stand-alone systems for writing the PQ subcode on audio discs.

CD-ROM's cost of \$.04/MB is by far the most cost-effective of the storage media, and it offers easy random access of data. The biggest issue for CD-ROM continues to be its inherent slowness, but engineers are chipping away at that problem, too, as evidenced by the new line of double-speed CD-ROM drives. What was once thought of as the biggest

disadvantage of CD-ROM—its inability to be rewritten—is now seen by many as a distinct advantage. And today the increasing visibility of CD-ROM in the consumer marketplace is beginning to create beneficial side effects for a growing segment of the pro audio industry.

Several data storage technology companies are aware of the special needs of the pro audio industry and are addressing them. One of them is Dynatek Automation Systems Inc. (Toronto, Ont.), which specializes in rack-mounted storage systems, including all the types discussed here with the exception of CD-ROM recording. Dynatek's audio/music business is split between Macintosh systems and proprietary audio systems from companies such as Roland or Akai. I was able to check out a 3U system for the Mac that included a data DAT, an 88MB Syquest and a 650MB MO drive, and was impressed with the ergonomic, compact hardware design, as well as the Macintosh software that permitted easy installation and formatting of media.

Rorke Data (Eden Prairie, Minn.) also specializes in hard drives, optical disc subsystems, tape backup systems and media for audio and video post applications. The company provides customized or OEM-standard storage solutions for SCSI-based DAWs and is endorsed by the Synclavier Owners Consortium (formerly NED).

Grey Matter Response (Santa Cruz, Calif.) manufactures tape-based archiving systems tailored for audio—in particular, Digidesign products. GMR offers 11 rack-mountable Mezzo models, combining 4mm or 8mm tape backup drives with high-speed, high-capacity disk drives. And the company has announced a June release for Mezzo Media for Windows, a tape backup unit for Digidesign's PC-based Session 8 digital recording system.

In any event, it appears that you have more ways to store your data than ever before. If you have the need and the money, it's a good possibility that at least one of these options will satisfy your taste. ■

Associate editor Paul Potyten's taste runs toward peach pie, and he has fantasies about entering a pie-eating contest.

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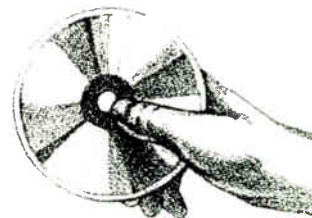
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DESIGNING

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NETWORK

FOR DIGITAL AUDIO

BY GARY HALL

Recording/mastering engineers and film/video sound editors are now accustomed to the speed and flexibility of random-access digital audio workstations. But today's systems are isolationist. Material must be loaded before work can begin, and the final act consists of transferring results in real time to a delivery medium.

It is difficult to move material between systems, to share common source libraries and pass results from one system to another. With disk-based editing now an accepted part of production, many engineers and facility managers face the problem of integrating the benefits of random-access audio into the realities of studio operations.

Part of the solution to these problems is digital tielines. Connection standards such as the AES/EBU interconnect format provide the equivalent of analog wiring for digital audio. Although hampered by vagaries and omissions in the documents, these make it feasible to transfer digital audio, two channels per line, between studios in real time.

Another part of the answer is portable media, such as optical discs and removable disk drives. Though these and other formats can be used to transfer work in progress between studios and operators, it's generally at a cost in performance and storage capacity. Also, the media themselves are relatively expensive—enough to limit their wide-scale use.

THE AUDIO NETWORK CONCEPT

Removable media and point-to-point con-

nections are vital, but at best provide the equivalent of analog forms. Audio workstations hold the promise of integration on a much larger scale, extending random access to the entire facility. Multiple operators should be able to use common storage and source materials. I/O devices, processing and work outputs could also be shared transparently.

Local Area Networks for computers provide a model for this logical step in the digital audio revolution. Networking has transformed the use of PCs in business, linking desktop units into powerful systems. As with copiers, fax machines and overnight delivery, the office LAN has become an indispensable business technology.

Likewise, digital audio workstations can be linked into high-speed networks with storage, processing, source materials and work output shared and available to all. To borrow an already worn cliché, a digital audio network would be a "data highway" between studios and machine rooms.

But the design of a local network for digital audio is difficult. There are substantial differences between the needs of business networking and those of audio or video. The requirements for professional performance and sound quality make the issues especially acute.

THE DEMANDS OF AUDIO

Office LANs were conceived for office automation, keyed to the needs of individuals pecking at keyboards and transferring files from time to time. To provide audio

TDA's (Those Darn Acronyms)

by Gary Hall

Discussion of networks often degenerates into alphabet soup. There aren't as many acronyms and buzz words as there seem to be, but knowledge of the most prevalent can alleviate confusion. Read on!

with the transparency of access that LANs offer to word processors and database programs, a digital audio network must meet special criteria, including bandwidth, transmission integrity, local vs. central sound storage and network manners.

Bandwidth: Digital audio is a dense medium. A single channel of audio at 16-bit resolution and a 48kHz sample rate requires 768,000 bits per second, a number that rises proportionately for higher sample rates or greater resolution.

Practical audio network applications require simultaneous transfer of numerous channels in real time. Analysis of the context of use for a professional digital audio network indicates the need to support work groups of two to 75 stations, or "nodes," with anywhere from four to 100 audio channels on the net. Table 1 shows estimates of the number of workstations and total audio channels in various applications.

Low-cost LANs operate in the area of 2 kbits to 300 kbits per second, and their use in audio is limited to exchanging files at less than real time between your disks and somebody else's. Mid-performance networks currently operate between 2.5 and 10 megabits per second. Theoretically these could offer some number of channels of pro-standard digital audio, but in most cases inefficient protocols prevent using more than a fraction of theoretical bandwidth.

Of the various high-speed alternatives that currently exist, one option is the potential offered by the Fiber Distributed Data Interface standard for high-performance networking. Using FDDI, multiple stations can be connected in a "star" configuration, with lines from individual network nodes connecting at one or more central "concentrator" units via duplex (two-conductor) optical-fiber cables.

The FDDI network standard offers a raw bandwidth of 100 Mbps, allowing the delivery of multiple high-grade digital audio channels. FDDI also uses a Token Ring (described below) protocol that can deliver continuous data reliably, even under heavy usage. Also, because of its fiber-optic implementation, FDDI

GENERAL TERMS

LAN	Local Area Network	A network covering a limited area, such as a single office or building.
MAN	Metropolitan Area Network	A network able to link systems across an entire city.
WAN	Wide Area Network	Larger than either a LAN or MAN. The term includes (but is not limited to) networks on a planetary scale.
OSI (as in "OSI model")	Open Systems Interconnect	A document, released in 1978, covering the structure of standards for computer networks. OSI is not a standard in itself but describes the parts, or layers, of a network, such as physical cabling, data rates, protocols, etc.
NIC	Network Interface Card	A plug-in board to connect a computer or workstation to a network.

SOFTWARE AND COMMUNICATION PROTOCOLS

CSMA/CD	Carrier Sense Multiple Access with Collision Detection	A method of message arbitration in which each station transmits independently. If two stations transmit at the same moment, a "collision" occurs. The stations in conflict then halt transmission for a variable interval.
TCP/IP	Transmission Control Protocol/Internet Protocol.	A widely used standard for communication and message routing at the network level. TCP/IP was developed by the U.S. Department of Defense and implemented in the ARPANET network.
Token Ring	A message arbitration scheme in which network stations are configured in a physical or logical ring. When one station finishes sending messages, it transmits a bit pattern, called a Token, to the next station. If this station has messages to transmit it does so at this time, then passes the Token to the following station.	
Ethernet	A popular standard for business networks using CSMA/CD collision detect arbitration. Data rate is 10 to 20 Mbps, although 100Mbps Ethernet rates are currently being discussed.	
Appleshare	The software layer of networking capability for Macintosh computers. Appleshare can operate with low-cost Appletalk hardware, but also with Ethernet or FDDI.	

NETWORK STANDARDS

Appletalk	The physical and data protocol built into Macintosh computers. At 230 Kbps, it is the slowest—and the least expensive—of networks for the Mac. Appletalk uses a bus topology and collision detection.	
10BASE 2, 10BASE 5 and 10BASE-T	Ethernet variants using different types of cabling. 10BASE 2 specifies thin coaxial (RG-58) cable. 10BASE 5 uses thicker co-ax cable, and 10BASE-T uses unshielded twisted-pair. The type of cabling affects the distances over which the network operates.	
ARCnet	Attached Computer Resource Network	A widely used network operating at 2.5 Mbps over coaxial or twisted-pair cable. Though normally configured in a bus or star topology, ARCnet uses a token passing protocol to arbitrate communications.
FDDI	Fiber Distributed Data Interface	The highest performance of the current established standard, with a raw data rate of 100 Mbps, it is also the most expensive. Though used less extensively to date than Ethernet, ARCnet, etc., application of FDDI and CDDI (see next item) is increasing steadily.
CDDI	Copper Distributed Data Interface	A variant of FDDI that substitutes coaxial cable for fiber-optic connections. Transfer rate is maintained, but cable run length is reduced.

NETWORK MEDIA

UTP	Unshielded Twisted Pair	The type of cabling used for telephone systems. UTP is popular for low- to mid-performance networks.
STP	Shielded Twisted Pair	Adding a shield to twisted-pair cable improves noise immunity and allows somewhat longer run lengths.

STANDARDS AND SPONSORING ORGANIZATIONS

ANSI	American National Standards Institute
CCITT	Consultative Committee on International Telegraphy and Telephony
DARPA	Defense Advanced Research Projects Agency
ISO	International Standards Organization
IEEE	Institute of Electrical and Electronic Engineers

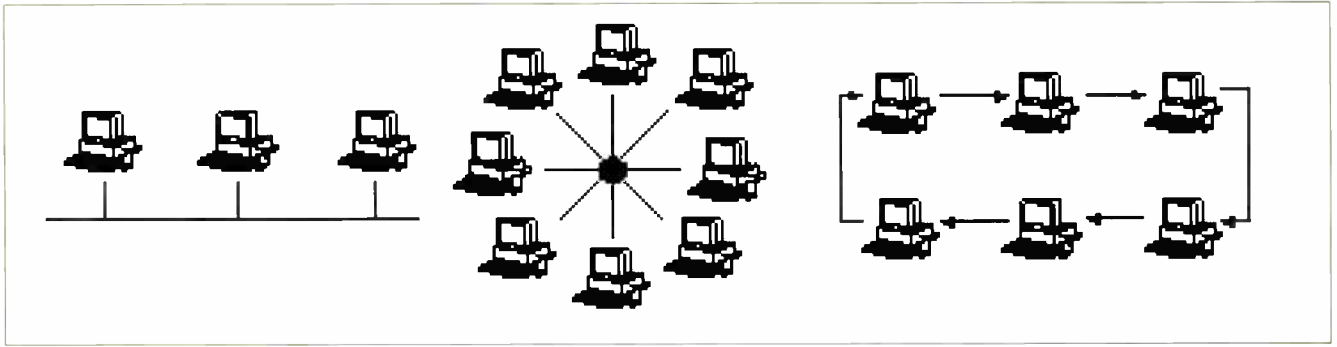


Figure 1: There are three network "topologies" in common use: the bus, star and ring configurations.

is noise-immune and supports very long cable runs—up to two kilometers between nodes and up to 200 kilometers on a single ring!

However, FDDI networking is relatively expensive to implement. Including interface cards, concentrators, cables and connectors, the cost of an all-FDDI network is about \$4,000 per node. But, like other new technologies, FDDI is running down a steep cost curve. Industry observers expect the cost of FDDI to decline more than 25% per year over the next few years.

A "twisted pair" implementation of

FDDI, known as CDDI (Copper Distributed Data Interface), is currently undergoing standards review and should be fully standardized by the fall of 1993. CDDI got a big boost when it was selected by Microsoft for its corporate campus in Redmond, Wash. CDDI maintains the functionality of FDDI in terms of bandwidth and protocols but is limited to 50 to 100 meters between nodes. CDDI and FDDI can be intermixed freely on a network using standard converters; a reasonable strategy might be to use CDDI to

—CONTINUED ON PAGE 71

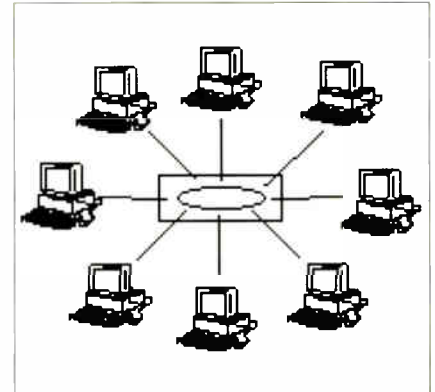


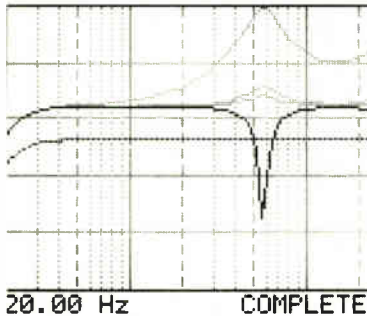
Figure 2: In the "star-wired ring," the ring is established within a "concentrator" unit in a central wiring closet or room.

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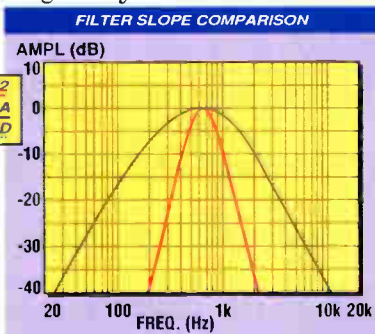
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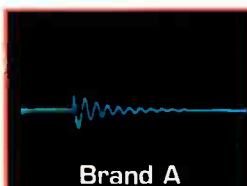
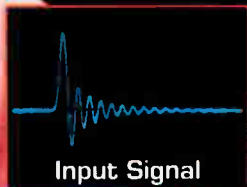
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Improving the Efficiency of Workstation Networks for Post-Production

by Mark Yonge

With notable exceptions, audio hard disk systems have an enclosed structure combining a processor and a hard disk. Enclosed systems need to copy, or upload, material onto the disk each time it is required and before any creative work can take place.

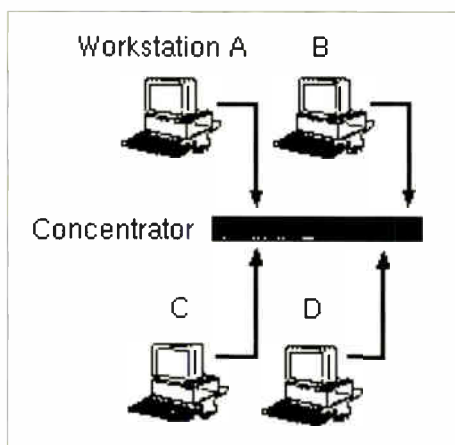
Though material will always need to be transferred into the digital system at the beginning of post-production, duplication at later stages in the post-production chain is unnecessary. The time absorbed by data transfer is a fundamental obstacle to working efficiently.

Simple 2-channel work is not at the heart of audio-for-picture post-production. Instead, this application requires multichannel capability, and work typically will pass through a number of stages for preparation, editing and mixing before a master is produced. The need for efficiency has generated strategies for moving work through these stages, including faster copying and, more importantly, networking systems.

A practical digital audio network should:

- provide multiple operators a working area, each with unrestricted random-access control
- permit operators to be located anywhere in the building
- provide a high-speed intermediate data store (both short-term and long-term) for work in progress
- provide high-speed search and import facilities for additional sounds for use in the project
- provide offline backup routines without involving operational facilities
- expedite rapid changes of a

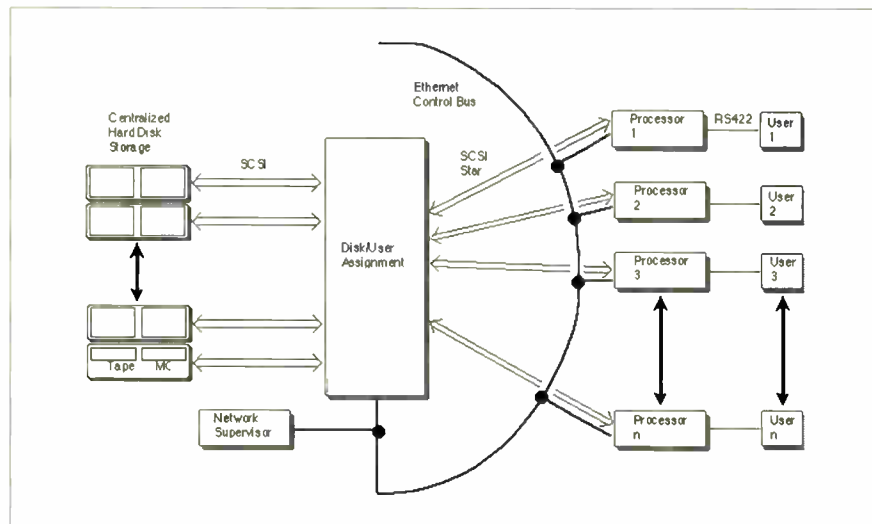
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network and how conflicts are resolved. In a LAN or a digital audio network, nodes are linked by a common electrical or optical connection. The way stations are connected affects the type of arbitration protocol that can be used; three possible topologies are shown in Fig. 1.

Figure A: Simple office style LAN.

Figure B: Ring & star Hybrid Network. (These figures refer to article at left)



—FROM PAGE 68, DIGITAL AUDIO NETWORKS

connect local work groups, with FDDI running between groups on different floors or in different buildings. Increasing use of CDDI promises to bring the price of a high-performance network below \$1,000 per node within one to two years.

Transmission Integrity: Digital audio has a requirement even more at odds with the philosophy of office LANs. Business-oriented networks deal in transactions that are not especially time-critical. When traffic is high, transmission of a given packet can be deferred for milliseconds, seconds or even longer. At worst, the user experiences slowdown, or "clogging," of the network.

Digital audio is much more critical in this regard, requiring continuous data at a fixed rate. Interruption in transmission results in dropouts. A digital audio network must be able to guarantee delivery of audio data. Once a transfer has begun, no interruptions can be tolerated.

The key to transmission integrity is the selection of messaging protocols regulating how stations share the

Of the common network-wiring topologies, the "ring" configuration offers the best opportunities for protocols to handle constant high utilization. But ring connections are hard to maintain in practice. Moving even a single station interrupts the ring, and it becomes difficult to bring individual stations on and off the net.

For this reason, high-performance networks are gravitating toward a "star-wired" ring (Fig. 2), which combines the performance of the ring with the flexibility and reliability of a star configuration. Whatever the physical configuration, a scheme must be provided for each node to transmit and receive messages and requests. Two common schemes for controlling network access are Collision Detect and Token Passing.

Collision Detect is used in Ethernet and Appletalk networks. In this protocol, individual stations transmit as needed, with minimal regard for other stations already using the net. If a station accidentally "steps on" a message from another node, the collision is detected. All parties then cease transmission for a variable interval, after which each again at-

tempts to send its message. (Actually, the scheme is a little more sophisticated, with provisions for locking out collisions once the first of a message has been transmitted.)

Though this seems awkward, Collision Detect is reasonably efficient for LANs with moderate traffic. However, its efficiency drops markedly when the rate of collisions becomes high. Analysis shows that CSMA/CD can achieve about 37% overall efficiency, but this is a long-term average; in the short term the data rate can fall to zero deadly to audio applications.

Token Passing, or Token Ring, networks take a different approach. Each node observes rigid but democratic protocols for accessing the network. A special bit pattern, called the Token, is used to signal that a given node has the floor. Only one node may "hold" the Token at time, and while it holds the Token that node is permitted to "speak."

When the node finishes, the Token is "passed" to the next station. That node then can speak or, if no transmission is required, it immediately passes the Token to the next node. This proceeds at high speed around the ring, so that there is never the danger of collision, and the available bandwidth is always shared efficiently.

Token Passing can be adapted to the needs of digital audio by tailoring the size of the data packets and the number of packets transmitted on one pass of the Token. This assures that network bandwidth can be used efficiently, even with numerous audio streams in progress.

Local vs. Central Sound Storage: The characteristics of a digital audio network also influence the overall configuration that a digital audio network will take. With LANs designed for business use, there are two common approaches: server-oriented or distributed-storage network configurations.

Many networks are arranged around one or more central File Servers, where data and programs are stored (Fig. 3). This mode of operation supports the typical business pattern, in which day-to-day work output and records are stored in ever growing databases representing the heart and soul of the business operations.

Another approach, typified by Macintosh Appleshare, provides

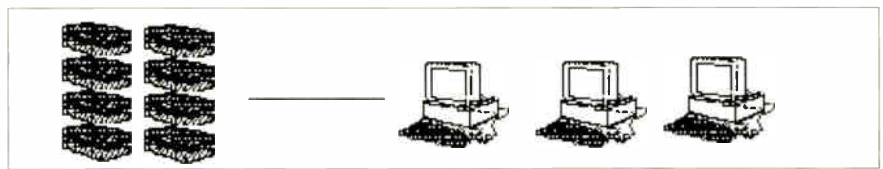


Figure 3: In a server-oriented network topology, individual stations are tied to central storage for data, programs and work files.

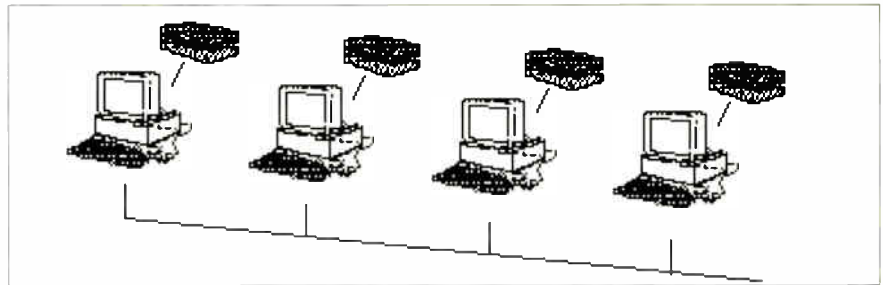


Figure 4: In a distributed-storage network, data files are maintained on hard disks attached to individual computers and workstations.

Application	Number of Stations	Channels per Station
Music Production	1-3	4-48
CD Prep	1-6	4-8
Sound-for-Picture: Dialog	1-8	4-24
Sound-for-Picture: Music	1-3	4-24
Sound-for-Picture: Effects	1-12	4-12
Sound-for-Picture: Mixing	4-25	8-100
Radio: Production	2-5	4-16
Radio: On Air	2-20	4-8

Table 1: Estimated requirements for audio network in various applications (source: Sonic Solutions)

sharing between individual local systems (Fig. 4). In effect, each desktop becomes a file server. Office nets often combine the two approaches, with critical databases stored centrally and open sharing of locally maintained files.

Digital audio networks are likely to emphasize a distributed approach for two reasons. First, the usage patterns and "half-life" of audio data are different from those of business data. Usually the materials of a production project are in use for a period of days or, at most, weeks. There are exceptions, such as sound effects libraries, but the bulk of materials are more transient. This makes it convenient to perform loading and off-loading in individual studios rather than in a central machine room.

The other factor that favors distributed storage is relative network bandwidth vs. that of the sound storage devices themselves. FDDI, running at 100Mbps data rates, has sev-

eral times the transfer rate of SCSI (used to connect hard drives and peripherals) or other commonly used interfaces. If materials are stored in a single massive collection, overloading could result as multiple users request source materials from the same disk system. By distributing storage, clogging is avoided and more efficient use is made of network bandwidth.

For these reasons, it can be advantageous to implement networks as a SCSI-to-FDDI interface. For example, each interface card could feature two independent SCSI buses that connect directly to a workstation's local bus (or buses, for multi-channel). The interface card transfers data efficiently between the network, the workstation processing card and individual SCSI devices.

Network Manners: FDDI Token Ring protocols ensure efficient utilization, but it is quite possible to exceed transfer capability across the

network and easier to exceed the transfer rate of the storage devices. Having to manage a bandwidth that is high but unevenly distributed means that high-level protocols and conventions need to be used to share resources equitably. Such considerations are critical to successful operation of a media-oriented network and are completely absent in business-oriented systems.

In the system mentioned above, which functions as a SCSI-to-FDDI interface, provisions are made for reserving bandwidth. If a user selects this option, the system automatically calculates the peak data bandwidth required from the network and individual SCSI buses before beginning playback or data transfer. If the rate required exceeds capability, or if that bandwidth is already reserved by another user, the operator is warned, avoiding the chance of audio being interrupted once transfer has begun.

THE FUTURE

High-speed networks currently support transparent sharing of audio and non-audio data files, "diskless" editing stations and application of local processing functions to remote sound files. But this is only the beginning of high-performance networking for digital media. As high-performance networks become more widespread, both for media and other applications, costs will start to drop. CDDI promises further savings by replacing costly and hard-to-handle optical fiber with shielded or unshielded twisted-pair.

With today's real-time access to sound files, we might expect to see the introduction of stand-alone file servers (including write-once optical and CD "jukeboxes") and the ability to use and control remotely located I/O devices such as CD recorders, 8mm tape drives and video transports. Individual systems might also be able to gain access to processing resources on remote systems.

Although the use of data compression for production will probably be limited, there are many valid applications in broadcast and multimedia where multiple channels are needed.

Correctly implemented networks should directly support audio transfer at any desired bit rate. Beyond FDDI/CDDI, we can expect to see proposals for even higher-speed networking systems, such as Asyn-

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chronous Transfer Mode, which offers rates in the Gbps range. ATM opens the possibility of hundreds of users on a single network that could span continental distances. Imagine editing in San Francisco from sound on a hard disk in New York, together with video on a hard disk sitting in L.A. Such capabilities will be the reality for professionals before the end of the decade.

Also on the immediate horizon are plans for transparent translation (with sample rate conversion and/or data compression) between audio and video file systems, including the Open Media Framework standard. (See "From Specifications to Standards:

OMF and the Path Toward Cross-Platform Compatibility," p. 80.)

Non-audio media have the same requirements as digital audio for high-bandwidth and guaranteed transfer. The combination of high-speed networks with high-grade data compression opens the way for networking with digital video as well as audio. Ultimately, this offers the potential to expand into a true multimedia network, supporting the needs of a wide range of professional, as well as industrial and even consumer, applications for visual and audio media. ■

Gary Hall is technical support manager for Sonic Solutions.

—FROM PAGE 71, POST-PRODUCTION
job when necessary.

These are all functions taken for granted in a regular office network. However, many assumptions currently valid for office LANs are wrong for digital audio networks.

There is an alternative network strategy that achieves the required result much more directly and reliably. Two separate structures form a single hybrid network, giving multiple users access to a central audio storage resource for intensive work without compromise or conflict. Imagine a system that supports a central resource of hard disks, optical discs and backup tape drives, and which makes them available to a number of users on request. For the resource assignment it uses high-speed, point-to-point SCSI interconnects in a "star" configuration. A separate Ethernet serial network connects all processors in a "ring" structure to coordinate and control activities.

Such a ring & star hybrid is fundamental to fast work flow. If, for example, you have a system and a total of eight users (including offline backup), this is equivalent to 64 simultaneous channels, including varispeed of up to 150%, with no interaction be-

tween users and no theoretical limit to expansion.

WORK FLOW EFFICIENCY

Distributing audio and project storage resources is simply a matter of assigning devices to users. Projects may be switched from room to room in a matter of seconds, sending material from auto-conform to the editor, or from the editor to the mixer, for instance. Working disks can be held by the network for temporary storage of partly completed projects.

When the time comes for tape backups, these are managed by the network controller directly using Exabyte data tape drives. The offline backups are handled in the machine room and do not need to involve the operational areas at all. Effectively, the rooms have no backup or restore downtime and can be scheduled to fit the work, not the other way around.

With work flow transfers measured in seconds, not minutes (or hours!), such a topology represents a big step closer to the ideal post-production environment. ■

Mark Yonge is Product Manager, Digital Products, at Solid State Logic, based in Oxford, England.

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Exhibit B: When Digidesign was judging new consoles to use with their own 20- and 16-bit digital recording & editing systems, they knew the board would have to be good. Very good. And quiet. Very quiet. Their verdict? The D&R Orion.

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by Mr. Bonzai

LEE HERSCHBERG

RECORDING AND ENGINEERING AT WARNERS

I'm listening to the clear sonic substance of *The Pabinni Brothers*, a 1992 album recorded by one of the true grandpappies of our audio family. It's a tasty bowl of Hawaiian soul featuring Ry Cooder, David Lindley and Jim Keltner, and engineer Lee Herschberg grabbed it out of the air and put it on tape. Listen up, you young pups!

Herschberg must be an honorary Brother by now—he's been at Warners since 1966. He gets to take a Private Music vacation in Hawaii once in a while, but his main job is Director of Recording and Engineering, which includes the digital archiving of the entire Warner library. Herschberg started out in 1956 and routinely engineered major artists and big orchestras in countless sessions day in and day out. The nice thing here is that he has survived with his ears and his sensitivity intact, after so many years in a tough and sometimes thankless field.

Prior to his long term at Warner Bros., Herschberg drove the console for Reprise before the label was purchased from Frank Sinatra. Before that he was with Decca/Coral Records. His work spans a period in the '50s with Bing, Frank, Sammy and Liberace; through the new studio scene of the '60s and '70s with artists such as James Taylor, Gordon Lightfoot, Joni Mitchell and Van Morrison; and on through the birth of digital to the question marks of today's technology.

Herschberg and I spoke in the deep caverns beneath the handsome Warner Bros. fortress in Burbank. The library and the archiving is a model for any label concerned with preserving our musical heritage. The studios are a bit funky, lived in, and designed for everyday recording label chores. Herschberg confides that he's glad that after Warners unloaded Amigo Studios, the company never got around to further serious studio

competition: "Label-owned studios have their own special problems, such as the artist never wants the label listening."

Bonzai: How did it all begin for you?

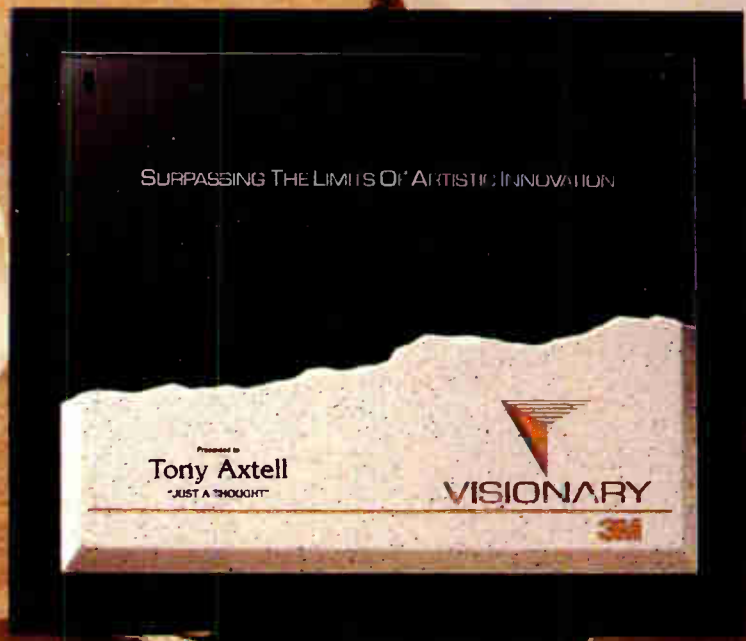
Herschberg: I started with Decca/Coral in 1956, down on Melrose, which later became Richard Perry's old place. We had one studio, and I started out transferring radio transcriptions—spent a month in the attic doing old Al Jolson recordings. I learned about disc cutting and did



some second engineering. I was there from 1956 until 1963. During that time I eventually moved up to mixing. Just about everybody was on Decca in those years; I did a session with Louis Armstrong, a few of Les Brown's albums, Liberace, and I did the first Lawrence Welk stereo album. There were so many artists, and those were really pretty exciting years.

From '56 to '63, I must have mixed about 300 albums; we'd knock off a

PHOTO MR. BONZAI



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few each week, at least. One of the producers I had been working with, Sonny Burke, was doing most of the Reprise things at that time, and I started doing those projects. I actually got hired full time at Warner Bros. in 1966, and I've been with them ever since.

Bonzai: You go way back with digital, don't you?

Herschberg: Yes, when we owned Amigo Studios, we had one of the very first 3M DMS [Digital Mastering System] transports. I believe it was 1979; we had a 32-track and a 4-track. Amigo was originally Snuff Garrett's demo studio, and then Warner Bros. bought his publishing company and acquired the studio as well.

Bonzai: Who made the decision to go digital?

Herschberg: I think 3M urged us to try the system, because we had 3M analog machines. They knew we were working with a lot of big-name artists.

Bonzai: How has the sound changed since those early digital days?

Herschberg: All I ever wanted from a tape machine was to give me back what I put into it. The 32-track 3M is probably the best-sounding tape machine I have ever heard, in terms of transparency. It made a big difference when you started doing overdubs. Basically, if you would do a track analog, play back, and start doing overdubs you had the tendency to want to add a little EQ to your tracks, because they didn't sound quite as bright as they did going in. Digital never had that problem. I always liked it, because you could really relate to what you had and fit the new pieces—the overdubs—on to it better.

Bonzai: If this machine sounded so good, why did the system fail?

Herschberg: I don't think it failed. I think 3M is in the tape business, and that's what they were looking for. They didn't want to go into tape machine manufacturing. It was a platform for developing new types of tape, I believe. The 3M digital machines were excellent, and we also had a full complement of analog 3M 24-tracks, 4-tracks, 2-tracks.

Bonzai: Weren't you the engineer on the first digital multitrack album?

Herschberg: Yes, Ry Cooder's *Bop 'Til You Drop*. They called it the first multitrack digital rock 'n' roll record. I'm sure Ry is cringing at the thought of that even today [Laughs]. He liked

it, yet he became one of the first non-digital fans, really.

There are many people, still today, that like the enhancement that analog gives to tape. It kind of softens the bottom, takes the hard edge off things. You go all digital and mix to analog 2-track—that seems to be what a lot of people prefer today. I lean in that direction myself, although I've done a lot of projects that were all-digital, mixed to a DAT which you can throw into the computer and use for all your editing. That's very, very handy—to walk out of a studio with all of your mixes on one or two little tapes in your shirt

We used to say, "Wouldn't it be nice to have tape that would take more level and be quieter?" Now that we're digital it's, "Wouldn't it be wonderful if this wasn't so harsh-sounding?"

pocket is a real pleasure. It used to mean lugging armloads, carloads of tapes around.

Bonzai: Can you recall other early digital projects you were involved in?

Herschberg: We did a lot of interesting work: the first Yellowjackets album, some digital recordings with Paul Simon, Clapton.

Bonzai: How long did you hang in there with the 3M digital system?

Herschberg: We had it and used it until we sold Amigo Studios seven or eight years ago. Christopher Cross did his first album on that 32-track. We rented it out quite a bit. Up until the sale, that machine was in full-time use. In the early days, the editing process was very difficult—nearly impossible at times.

Bonzai: How extensive is the digital setup here at Warner Bros. today?

Herschberg: Well, basically all of our masters are in the ½-inch [Sony] PCM-1630 format. All of the masters in our library come in that way. An artist, wherever he is working in the

world, will go to a mastering studio and send us the finished ¾-inch [U-Matic] digital tape. From that, we manufacture everything for our licensees all over the world, do all our singles editing, do all of our promotional CDs for radio stations. Everything is generated from that 1630 tape originally prepared at a mastering studio.

Bonzai: Sounds like a pretty big job. Are you responsible for all of this?

Herschberg: All of the production engineering, yes. And last year I would estimate that we did about 85,000 real-time cassettes. We make cassette copies for people who are reviewing albums, for liner notes, for radio stations, for all of our licensees worldwide. We send them a cassette of every piece of product, and they decide if they want to release it in their region.

Bonzai: So, you get to listen to and evaluate work from recording studios all over the world?

Herschberg: All the time. And you talk about the quality of recordings today—well, the music is not as pleasing to the ear as it was ten or 15 years ago. Sonically, it's tougher to listen to things. In the days of 45rpm disc mastering, the battle raged over who could get the most level on a record single. Your record had to sound as loud as anyone else's.

The limit was that the grooves couldn't cross over each other and the thing had to track when it played. But now you don't have a problem with a CD or a DAT. Everything can be at full level, and with digital compression/limiting, records are consistent—you don't find any louder or softer. They're all very compressed, very tough and really an assault on your ears. Everything is full level, very loud.

It's the same battle today: If you mix an album that has a lot of dynamics and you play it against a rap record or the grunge bands, you're just not going to hear the one that has the big ups and downs in dynamics.

Bonzai: Many engineers prefer analog for certain aspects of recording and digital for others. What are your preferences?

Herschberg: Sonics aside, a digital machine really eliminates all the problems of analog machines. You don't have tape print-through, wow, flutter, bleed through the sync head between adjacent tracks. With digit-

—CONTINUED ON PAGE 95

OMF

AND THE PATH TOWARD CROSS-PLATFORM COMPATIBILITY

by
Ted Pine

With apologies to Professor Henry Higgins, why can't a disk be more like a tape? After all, analog 2-track is eminently portable, offers instant backup and provides near-universal compatibility. When, oh when, will it be possible to swap digital data with the convenience and ease of analog?

At this year's National Association of Broadcasters convention in Las Vegas, the dream came one step closer to reality as a group of multimedia, video and audio manufacturers including Sonic Solutions, Alias Research, OptImage, Philips and Chyron demonstrated the ability of diverse applications to read, write and exchange data files using the Avid Technology-sponsored Open Media Framework Interchange format.

OMF Interchange has been

developed as a "super-standard," a common container for all types of digital production data, including EDIs, digitized media (such as audio, video and still images) and project information. (See "The Byte Beat," September '92.) The OMF format includes a file header that alerts production equipment as to what kind of data to expect within a data-stream, so that each device can choose to use, ignore or translate what's coming.

So far more than 100 vendors across a wide spectrum of industries have agreed to participate as OMF partners, including such prominent high-technology companies as Apple Computer, Silicon Graphics and Intel, and leading audio manufacturers such as SSL, Digidesign and Roland. What remains to be seen is how many incorporate the standard—and how quickly.

Perhaps the biggest obstacle to widespread OMF Interchange acceptance is not de-

velopment time, but competing companies' natural wariness about collaboration. Says Avid product manager Dave Grandin, "Every time I talk to a partner, I know that somewhere in the back of their mind they're thinking, 'I'm talking to Avid.' There's a lack of trust that needs to be overcome, and I think the best way to do this is to show that OMF works and adds value for end-users.

"Our intent was simply to do something in a timely fashion to meet customers' needs," he adds. "Once we've gotten OMF Interchange to a point where it has some maturity and is proven to work, we'll be happy to hand it off. For example, we've submitted the specification to the International Multimedia Association and offered it to SMPTE, and if it were adopted as a recommended practice we would probably work to put it under the umbrella of one of those organizations."

A Selective Guide to Cross-Industry Standards Initiatives

In simpler times, audio standards were created by audio professionals. In the age of multimedia and converging industries, audio standards are being created by computer manufacturers, phone companies, cable operators and a host of others. Many are designed for specific niche-oriented applications, but no one knows which

might cross over and affect professional production.

Keep in mind that all standards aren't created equal. Some are created by manufacturers, some by committee, and some are created by actual standards organizations themselves. Those created by actual standards and professional organizations are available for use by any and all; manufacturers' standards, however, may involve a licensing fee or other royalty arrangement, as is the case with MPEG. With that in mind, here are a few standards initiatives to keep an eye on:

STANDARD	ORGANIZATION	DESCRIPTION	STATUS
AIFF-C	Apple	File interchange format for compressed and uncompressed n-bit audio primarily used by Motorola processor-based systems; supported under OMF	Widely used
Bento	Apple	Container file format used in OMF format that allows applications to work with unfamiliar file types	1992
OMF	Avid	Specifies interchange file formats for EDL, digitized content (audio, graphics & video)	Implemented by Avid and Sonic Solutions; Version 1.0 document available to general public from Avid
T 419 ODA	CCITT	General framework for specifying audio files, including sample rate, bits per sample and compression type, for Telecom applications	Pending
"3X Proposal"	ECMA	Proposed standard for 2GB magneto-optical disc	Fall 1993
ECMA 184	ECMA/ISO	Standard for 1.3GB magneto-optical disc	1993
Recommended Practices for Interchanging Digital Audio Streams	IMA	Defines set of interchange formats including 8, 11.025, 22.05 and 44.1kHz formats compressed and uncompressed; defines 4-bit ADPCM compression algorithm based upon Intel's DVI algorithm	1992
CCITT Draft Recommendation T.419 ODA/ISO/IEC 8613-9.2	ITU-TSS/ISO/IEC	Specifies a general-purpose audio content architecture for describing audio files within documents independent of media or computer platform, including sample rate, bits per sample and compression type	Spring 1994
.WAV	Microsoft	File interchange format for uncompressed 8-, 12- and 16-bit audio, primarily used with Intel processor-based systems; supported under OMF	Widely Used
SMPTE 12M For Television, Audio and Film—Time and Control Code	SMPTE	Revised specification to make use of user bits easier and to provide for alternative applications, such as working with film edge numbers	Revised 1992
SMPTE 258M Television—Transfer of Edit Decision Lists	SMPTE/ANSI	Describes expanded EDL format for 99 audio channels, including level and grouping data	1993
Working Group on Ancillary Data	SMPTE	Formatting AES/EBU audio and auxiliary data into serial digital video ancillary data space; audio frame sequencing for switching video signals with embedded audio and audio clock recovery	
Working Group on Digital Audio Interfaces	SMPTE	Specifying BNC coaxial cable interface for AES/EBU audio; revising RP-155 audio levels for D1 and D2 machines, minimum levels in AES/EBU channel status.	Early 1994
Working Group on Digital Control	SMPTE	Developing communications scheme as a "superset" of ESBUS for Ethernet	Late 1993 or Early 1994
MPEG-1	Sony/Philips	Specifies video and audio compression standards for storage and transmission in recording, broadcast and Telecom applications	Late 1993

MULTIPLICITY OF MEDIA

The scope of OMF Interchange is focused on standardizing file formats and interchanging digital media. Thus, OMF1 specifies neither certain recording media, nor a universal fil-

ing system.

According to Grandin, "It was decided at last October's partners' meeting to concentrate on what was determined to be the most pressing need—file exchange. As far as a standard fil-

ing system goes, that's more of a mainstream computer industry issue, and we will likely leave that to standards organizations to address."

There is already plenty of standardization activity going on in the

The Proliferation of Compression Formats

As an open standard, Avid's Open Media Framework Interchange format has been designed to accommodate future extensions easily. One of the first areas of extension is likely to be audio compression. OMF does not currently specify any compression formats, but with the growing success of systems such as Studer's Dyaxis II, which offer optional AC-2 encoding and decoding, and the potential adoption of MUSICAM Layer II as a worldwide digital broadcast standard, the need to accommodate compressed audio data may be imminent.

According to OMF product manager Dave Grandin, "There is a provision for dealing with compression in the future. In the header area we can tag the datastream with the type of compression that's been used, encapsulate the compression tables that will let you decode the datastream, plus keep track of how many times the data has been compressed and decompressed."

The concept of maintaining a file history may be of particular importance, as more and more compression types are put into use. (For more on data compression, see "Insider Audio," p. 18)

It's not known how these various algorithms will interact with one another when a file is compressed and decompressed multi-

ple times. Without some sort of flagging scheme, a user may unknowingly end up with a pox of digital hash and distortion.

In the foreseeable future, standardization of one or more compression types seems unlikely, as different algorithms become adopted for different niches. But the idea of "transcoding" (converting between different encoding types without a decompression and compression generation) is appealing, according to David Haynes, Studer Editech's VP of engineering. "I think that it is an exceedingly difficult problem to solve," he concedes. "The amount of time and resources that it would take to do it would not be recouped by most companies." ■

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Figure A. 27x27x10 in.

THE YAMAHA DIGITAL MIXER/20-BIT RECORDER

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area of magneto-optical disc technology. For example, late last year the European Communications Manufacturers Association approved two different proposals, for 1GB and 1.3GB magneto-optical standards. Both are backward-compatible with the older 640MB ISO standard, allowing smaller-format disks to be played on the newer drives as well as the ability to format new disks at lesser capacities when required. (See "The Byte Beat," p. 58)

Others are looking beyond physical media to networking in order to solve the interchangeability problem. For example, Sonic Solutions, which has integrated OMF support throughout its product line, showed a new version of its SonicNet FDDI network at NAB, named MediaNet. Designed to work with any Macintosh-compatible multimedia application, MediaNet was used at NAB to link Sonic Solutions' booth in the audio hall with the two Avid booths in the video and multimedia halls.

According to Sonic Solutions president Bob Dorris, "MediaNet incorporates our Media Optimized File System tuned at a low level for high-

ly efficient storage and retrieval of typical multimedia data. Yet on the desktop it presents itself as a standard Mac HFS file device, like a floppy or hard disk. Since OMF is primarily an interchange standard, this does not affect the kinds of storage and retrieval and networking strategies that you can adopt for reasons of speed, efficiency and capability. We envision a world where translation between MediaNet and other networks occurs on the fly—where the user just sees the data and doesn't need to know much about what's happening in between." (For more on audio networking, see "Designing a High-Performance Network for Digital Audio" p. 66.)

OF EDLS AND AUTOMATION

There is no guarantee, of course, that any standard, however worthy, will be adopted. For example, in 1991, the SMPTE Working Group on Editing Procedures issued the first draft of SMPTE 258M "Standard for Transfer of Edit Decision Lists." This specification, which has now been ratified by ANSI, described a data format for an expanded EDL that includes

up to 99 audio tracks, specifying subgroups, track levels and levels within groups, and permits subframe editing down to the sample.

There are also provisions for dealing with varispeed, resolving between frame rates, and capturing user-definable effects data. Although the standard offers significant new functionality for use with consoles and workstations, to date it has not been incorporated into any stand-alone audio product.

Committee chair Oliver Morgan speculates that this hesitancy is due to the SMPTE imprimatur itself. "I think it is regarded as a video industry standard, rather than an audio industry standard, because of SMPTE's position. But it was absolutely designed with the audio industry in mind. I spent a long time making sure we had real consensus with all involved in the process."

The progress of standards initiatives can be agonizingly slow at times. For example, in 1985 George Massenburg, president of GML, convened a working group at the spring AES convention to discuss a standard for the interchange of console

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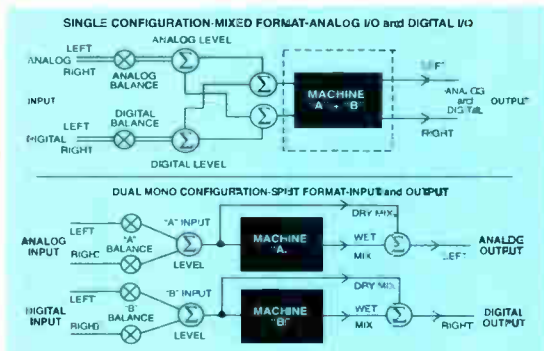
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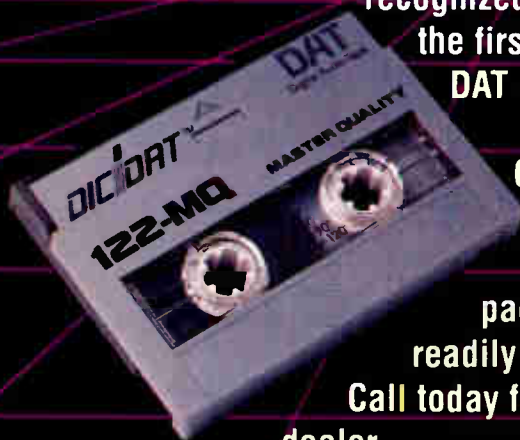
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automation data. Despite initial participation from many of the major manufacturers, interest in the initiative dwindled to GML and Otari. Nevertheless, over the past three years, the two companies have worked on a high-level exchange language called MXF, which allows conversion to and from either system's proprietary data formats and is able to translate data for fader moves, grouping controls and mutes with bit-level accuracy.

According to Massenburg, "Faders and mutes are easy. What's more difficult is translating data between continuous and event-based automation systems, or describing differences between various DSP processes, such as IIR equalization vs. FIR. Different manufacturers would most certainly have different ranges for some controls, not to mention the 'odd control.' So we've tried to broaden and generalize the specification so that each manufacturer will at least be able to see exactly what was intended in the foreign data to be translated, to know exactly how to interpret it and be able to choose how best to implement it."

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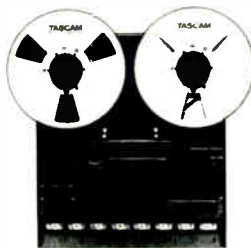
Whether created by committee or by a manufacturer, standards come into being only when the end-user market both demands and embraces them. To foster demand for OMF Interchange, Avid has announced a new program called "OMF Sponsors," for facilities that want to put OMF to use. There is also a hotline, (800) 949-OMFI, to handle all those hard-to-answer compatibility questions that you just can't bring up around your loved ones.

In Massenburg's view, the market must vote for standards with its collective pocketbook. "What it's really going to take to achieve true standardization is for the customer to start saying, 'I won't buy your system until you can share data.' You simply have to look at other areas of technology, like personal computers, for example. You see things like word processors being able to share fonts over multiple platforms easily and painlessly. What if you had to redo the look and feel of the document every time you switched computers? Similarly, you should be able to listen to that original monitor mix across platforms. It has to happen. The industry won't move ahead till it does." ■

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Tom Kobayashi, CEO of EDnet and former chief of Skywalker Sound, announced at April's NAB convention in Las Vegas that EDnet had completed its merger with Digital Patch



OPERATOR TIP OF THE MONTH: Check out long-distance audio transmission. The digital network concept is now a reality and could be just what you need. It makes sense, is almost reasonably priced and provides additional value through cost savings to your client, which can bring you additional profit.

Systems Inc. in order to provide the two best systems available today, from a single source. Another source is the telephone company, which demonstrated its prowess at TEXPO in San Francisco in early April, with ISDN (Integrated Services Digital Network), which is compatible with switched 56 service, offered today by both Pac Bell and GTE. EDnet also uses

these telephone company facilities.

Now for some background. A group of studios from around the country got together in 1988, says Dave Porter of Music Annex in San Francisco, "to offer a real-time service to our clients where sessions were transmitted via satellite between our respective cities. This was the beginning of the idea for EDnet and Digital Patch. The object was the time and money saved by not having the talent travel great distances to do a short voice-over. Because it was so expensive, it was reserved for special situations, emergencies or very expensive talent. Today, the producer has the opportunity, because of reduced cost, to direct the talent and get the right performance in real time from almost anywhere. We believe in the concept of a global recording community, and that the days of sending or receiving tapes by FedEx are over."

Like most innovations in our in-

—CONTINUED ON PAGE 90

Quite often we need to send digital materials from one part of the world to another. One solution might be to off-load the sound files to a Data DAT, Exabyte or MO cartridge, affix some stamps, and entrust your package to the U.S. Postal Service, Federal Express or equivalent.

Sometimes we need to have such audio materials reach their destination instantly, either because the deadline has passed, or maybe to let a client audition your musical selections. Alternatively, the end product might be scheduled for broadcast in just a short period of time, or even to be aired live.

For these and other applications, there now exists a technique for using dial-up data lines to carry digitized data around the world. Most local telephone carriers now can provide users with access to Switched-56 or Integrated Services Digital Network lines. Of course, dedicated T1, Fractional-T1 and DS3-compatible lines have existed for several years; however, such permanent connections tend to be expensive to install and costly to operate. Switched-56 or ISDN connections, on the other hand, are easy to install and, because you only pay for the time you're connected to a selected destination, represent a far more cost-effective

Digital Telephone Networks

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solution for the occasional user.

Switched-56 and ISDN are basically the same in format: a local termination is provided by your telephone company, into which you can connect your own data replay/record system and terminal adapter (the latter to convert the digital pulses to a series of synchronized tones that can be carried by the dial-up lines). Switched-56, as the name suggests, provides a data throughput of 56 kbps (or kbaud), while ISDN operates at a

higher 64kbps rate.

In the majority of applications, some form of digital audio data reduction will be needed for real-time transmission of program material. Currently available compression systems include Audio Processing Technology's apt-X100 4:1 coding scheme; Dolby Laboratories' AC-2 6:1 codec; and a variety of units based on the ISO/MPEG Layer II (MUSICAM) system. For radio-broadcast or speech-only applications, we might use CCITT G.711 (3.5kHz bandwidth) or G.722 (7 kHz) systems.

Let's take a look at some typical numbers. A mono narration track for a radio commercial might be digitized at a 16kHz sample rate. (After all, why use a high-

—CONTINUED ON NEXT PAGE

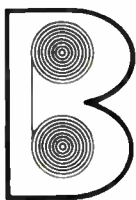
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—CONTINUED FROM PREVIOUS PAGE

er value when there's probably little energy in the audio spectrum above approximately 7 to 8 kHz?) At 16-bit resolution, the digitized signal will produce 16,000x16 or 256 kbps; passing this signal through a 4:1 digital compression system results in a 64kbaud signal capable of being sent anywhere in the world via ISDN. (The same mathematics can be performed with Switched-56 systems at a sampling rate of 14 kHz.)

For stereo transmissions and higher sampling rates, multiple ISDN lines can be synchronized to provide data rates as high as, let's say 384 kbaud, which could carry two channels of 48kHz data-compressed audio.

Alternatively, if Switched-56 or ISDN lines are un-

available (or too expensive), it is also possible to use conventional high-speed data modems to carry digitized audio. Consider a pair of hard disk-based systems connected together via modems and standard telephone lines. Just as text and graphics files can be sent at rates up to 14.4 kbaud using a variety of error-correcting algorithms, so large audio files might be transferred from one location to another. You'll need to be patient, however! At 14.4 kbaud (ignoring for the moment any error-protection overhead and data compression provided by the modem), it might take as long as 100 minutes to send 60 seconds of stereo, 44.1kHz data—probably longer. Here, additional APT, Dolby or MUSICAM-compatible data compression can reduce transfer times by a factor of 4 or 6:1. —Mel Lambert

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—FROM PAGE 88, GLOBAL RECORDING VILLAGE

dustry, digital audio transmission has happened so quickly that many of us did not even realize it existed, much less that it had become economically viable. According to Steve Lawson of Bad Animals in Seattle, "EDnet supports up to 12 channels of bidirectional, full-bandwidth communication, allowing the user to patch the full range of audio signals for any conceivable application, including SMPTE time code, to synchronize sessions in different cities. The technology is making your location, whether in the next room or 2,000 miles away, irrelevant."

To me, this is the key marketing feature of this system, which your studio can offer to overcome your secondary-market location or one-up the competition. Phil Ramone plans to use this method to afford New York studio players on Gloria Estefan's next album, which will be recorded in Florida. With the digital link, the musicians will play in New York to her vocals and other tracks at the Florida location!

So how much does all of this cost, and who is going to use this service? We spoke with Stewart Sloke, who along with Bert Bendis founded Digital Patch in Hollywood about a year ago, then merged with EDnet in April.

Their system, the "low-priced spread," costs a maximum of \$1,500 to install, with monthly maintenance of \$400 to \$475. The system sells time for \$30 per 15-minute segment connection anywhere in the U.S., with costs going down with longer usage. They currently have 38 subscribers in the U.S., Canada, UK and Australia.

Pac Tel's Switched Digital Services Division representative, Kathie Blankenship, sent us a pitch package of

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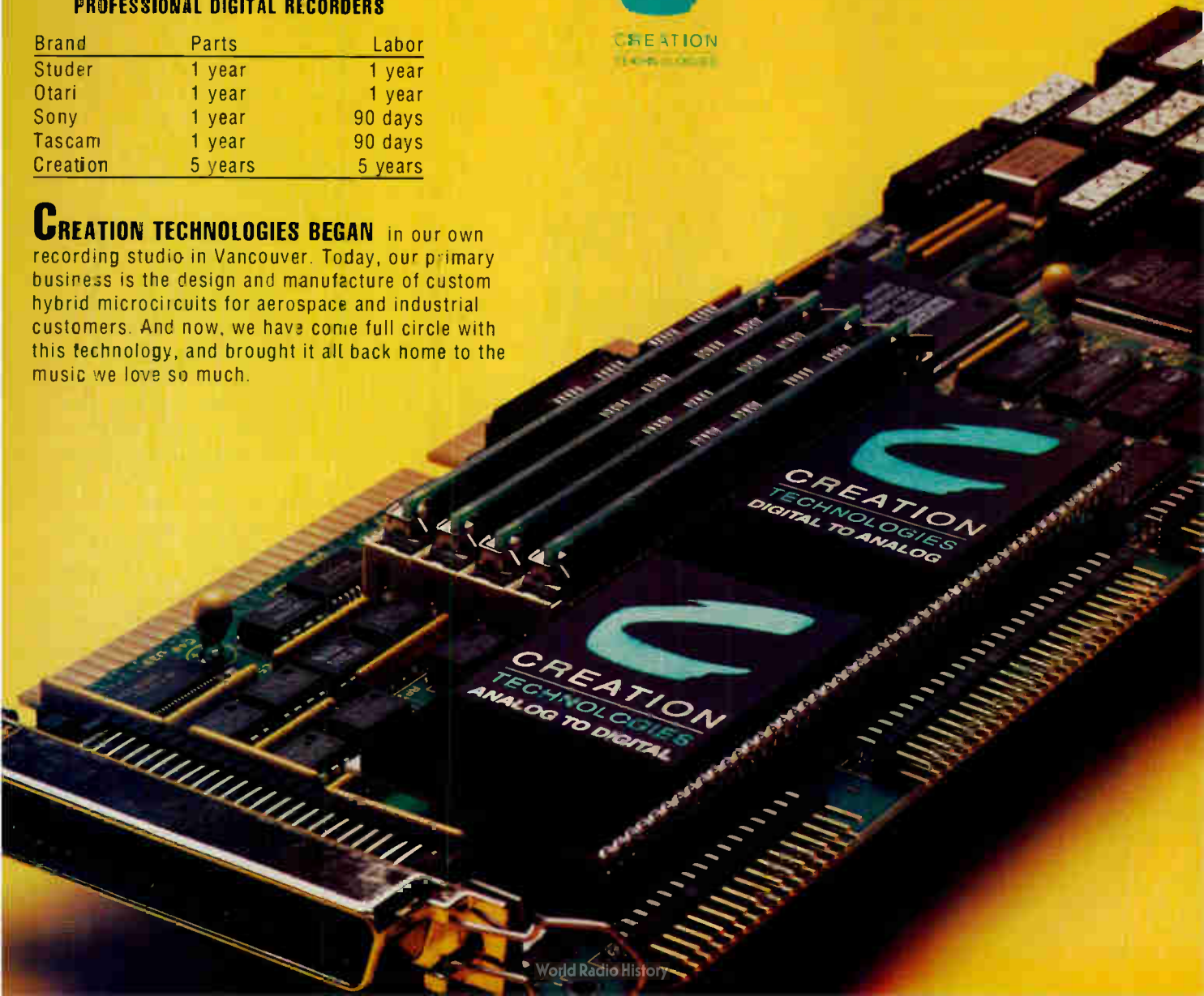
Brand	Parts	Labor
Studer	1 year	1 year
Otari	1 year	1 year
Sony	1 year	90 days
Tascam	1 year	90 days
Creation	5 years	5 years

CREATION TECHNOLOGIES BEGAN in our own recording studio in Vancouver. Today, our primary business is the design and manufacture of custom hybrid microcircuits for aerospace and industrial customers. And now, we have come full circle with this technology, and brought it all back home to the music we love so much.

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charts that showed the telephone company looks less expensive but does not include the required codec devices necessary to compress the audio to send it across the telephone lines. Her department recently demonstrated its system at TEXPO by having artist Graham Nash successfully provide a live demonstration from Hawaii to the trade show in San Francisco.

The more sophisticated EDnet system offers a T-1 nationwide key-city fiber-optic link to subscriber studios, providing them with "Bandwidth on Demand!" EDnet says that it is "your gateway to hundreds of other studios, sound effects libraries, editorial suites, client offices, screening rooms and mastering facilities." With 15 U.S. members as of April, EDnet's installation package is offered on a three-year lease ranging from \$350 to \$715 per month, plus time charges of \$100 per hour for two channels of audio, which can be synchronized to SMPTE time code. It lists ten audio network applications and eight video network applications that are as sophisticated as you could wish for and are also compatible with Studer's Dyaxis II workstation, Super Mac's Digital Film and the Avid Media Composer.

All of these digital services will be available at very reasonable prices in the near future. The basic technology is now available to the majority of studios rather than to the few who could afford satellite hookups just a few years ago. It is all making the world smaller and more accessible to all studios, regardless of their geographical location, which is the backbone of the "Global Village" concept.

It is keeping up with all of the available technology—and sensibly picking out what is best for you in your market and for your clients—that keeps you ahead of the competition. Call all of these companies and ask them to send you their promotional literature. They will be happy to do so, and you will be the winner if it makes sense, makes a profit for your company and offers a service that keeps your client knowing that you are the best source for recording requirements. ■

Chris Stone, a former studio owner, is a pro audio consultant and head of the World Studio Group, an international studio booking agency.

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DANCE	94%	6%
R&B	79%	21%
MODERN ROCK	79%	21%
ADULT CONTEMPORARY	77%	23%
HOT 100	71%	29%
RAP	59%	41%
ALBUM ROCK	59%	41%
COUNTRY	56%	44%

* Recorded and/or mixed on SSL consoles

—CONTINUED FROM PAGE 79

al, you have total erasure when you go over a track, no ghosts of tracks past: These are big advantages.

Sonically, I don't like digital for strings. They get a little "grindy" sometimes, especially if you have to combine tracks or bounce them over digital generations. For me, fuzz guitars and strings don't mix when they're recorded digitally. Some form of distortion occurs, and it gets a bit harsh.

Bonzai: Have we improved since the early days of digital?

Herschberg: I think so, although the 3M machine is still the best-sounding digital machine ever made. We recorded at a 50kHz sampling rate. The slower the sampling rate, the more likely you are to have problems. The 3M was a super-clean machine.

Bonzai: What do you think of the newer digital formats?

Herschberg: I think the system that ultimately will win will probably be a 20-bit or 24-bit system, perhaps at a higher sampling rate, which will clean things up quite a bit. Stay in the 16-bit realm and you'll have the same problems as with any of the present-day machines. As you increase the resolution, some of the problems will be solved. I've heard that Sony is getting ready to introduce their 20-bit or 24-bit magneto-optical disk system. [*The new Sony PCM-9000 MO Master Recorder offers up to 80 minutes of 20-bit/48kHz storage, with onboard editing.*] It's a big drawback for the CD to be a 44.1 medium—I think we'll have 20- or 24-bit CDs that will be much better. But that means new players, new hardware for the home.

Bonzai: Does that mean archiving the whole Warner Bros. catalog again?

Herschberg: Probably does.

Bonzai: Well, why didn't they just get it together in the beginning?

Herschberg: [Laughs] Basically, I think the 1630 is on the way out. You're not going to be storing things on tape anymore. It's going to be MO disks, which librarywise, will be a big improvement. Space is at a premium and we have artists who, when they finish an album, have 200 or 300 rolls of tape. We don't have the crew, the time or the machinery to go through and determine if it's all worth keeping. It gets put away, and you can imagine how our library is

growing. It's ridiculous: Someday we'll orbit a satellite and put our library in it; if you need a tape, we'll send up a shuttle.

Bonzai: When will we have a totally digital studio?

Herschberg: I don't know that it will ever happen if engineers have anything to say about it. There will always be some analog thing to a recording. When we were all-analog, we used to say, "Wouldn't it be nice to have tape that would take more level and was quieter? Wouldn't it be wonderful to take the noise out of tape?" Now that we're digital it's, "Wouldn't it be wonderful if this wasn't so harsh sounding?"

Bonzai: With all the product you hear, do you have any favorite engineers today?

Herschberg: Well, it's hard to tell, because one engineer handles the multitrack, and then you've got the remix specialists who are artists in their own right. How they do that month after month is beyond me. The engineers who are there year after year? Al Schmidt is still number one, and if you listen to things he did back in the late '50s, they are still incredible today. There are so many great engineers, really, like Thorne Nogar, Bones Howe, Lowell Frank, Val Valentine, Wally Heider—I'd better stop or I'd go on and on!

Bonzai: Any advice for the kids coming up?

Herschberg: Number one, they are going to have to be computer experts. As far as the digital future, I don't know. But I do know that computers enable you to do so much more than you could before. With sampling, sequencing and the multitude of tracks we have—and the ability to sort things out with digital technology—it's just great. But you must have a computer, and the kids have to start thinking that way. Qualified second engineers are absolutely necessary in the studio of today and tomorrow.

I was going to retire a few years ago, because I thought I had seen it all, and then digital editing came along and I got interested again. It's a lot of fun, and I am enjoying doing all that editing once again. If somebody in the building has a nine-minute song and they need a four-minute version they come to me.

Bonzai: What type of equipment do you use for archiving?

Herschberg: Basically, I use a Sonic

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Bonzai: How long will you be hanging around here at Warner Bros.?

Herschberg: I'm not through yet, but I've been here for 27 years, and I was actually working on Warner projects before that. I figure I've done 500 or 600 albums, recorded and mixed, and in the last seven or eight years I've restored and archived another 400. We use the Sonic system to take hiss out when necessary, but it's actually not very often. I have a thing about some of these digital programs. When the tape noise is taken out, sometimes the life is gone as well. Somehow you take some of the music or the harmonics along with the noise.

For my money, I want the character. It should sound like the original 2-track mix, maybe a little quieter. The original 3- and 4-track masters from the '60s still sound incredible, but the 2-tracks often haven't held up because it seems like we had problems in those years with tape. Now you can get an incredible amount of level on tape, and it doesn't deteriorate too badly. Oxide would come off or stick to the backing of the previous layer. We made analog Dolby copies of everything in our library 10 or 12 years ago and are about halfway through digitally copying everything at this point.

Bonzai: Are you still active in the recording studio?

Herschberg: Occasionally. You have to sort of throw a chain on me and drag me into the studio. I've done some independent projects, and I've had the luxury of managing my own spare time. It's really an ideal situation. I had a wonderful time last year working at Walter Becker's studio on Maui. I recorded and mixed *The Pathini Bros.* We used one of the nearly extinct 3M digital multitracks.

Bonzai: In your archiving, have you come across some of your own old tapes?

Herschberg: Yes, as a matter of fact, I started doing Sinatra recordings in '65 when Bill Putnam quit mixing. Lowell Frank, who was the head of engineering for Warner Bros. hired me as an assistant. When he gave up recording, I wound up inheriting Sinatra and the big artists. I went back to '65 and some of the first things I did with Sinatra, and we've reissued practically everything.

I tried remixing a few things and discovered that much of it couldn't be done any better. Granted, they were from a 4-track to a 2-track analog, and there was a little tape noise, but there was just something going on at the time with the boards and equalizers—I just couldn't touch the work that I had done. If I did, it wasn't any better; it was just different. If you start second guessing what the producer wanted back then, you often get into trouble.

Bonzai: Couldn't there be something in that old original that we might miss in 100 years?

Herschberg: Sure. And our library only goes back to 1958, '59. But if you look at Columbia and RCA, they go way back. Plus, these analog tapes really have a great shelf life. Meanwhile, I've got digital 1/4-inch 1610 tapes that won't play anymore—levels weren't good; control track levels vary a lot; there's drop-out and mis-tracking—for one thing or another. Analog I can count on; with digital, I don't know. And I've got an oven in the back for baking my old analog tapes. I've been doing that for quite some time.

Bonzai: Baking tapes?

Herschberg: Yes, sometimes the binder that holds the oxide to the backing—or something in that formula from tapes in the '70s—has become a gum that comes off on the heads of the tape machine and the machine will just stop. The only way to fix it is to bake it in an oven, and it rehardens and reformulates.

Bonzai: So, after all these years, you're still cookin'?

Herschberg: Absolutely. And if anybody wants to do a live session with a big orchestra, all at once, that's for me. That I know how to do. ■

Roving editor Mr. Bonzai offers his columns in three varieties: baked, half-baked and deep-dish.

Jon Anderson says "Yes" to Audio-Technica 40-Series microphones.

Jon Anderson is one of the most innovative of today's leading musicians. Co-creator of the seminal rock group Yes, his music has proven both popular and on the leading edge of musical thought. His current project is *Power of Silence*, an album for Geffen Records recorded primarily at his fully-equipped personal studio.

For this project Jon and his engineer Ron Wasserman used both the AT4033 and AT4051 cardioid microphones. Both were quite impressed by their ease of use. Ron Wasserman noted that Jon required almost no EQ to get exactly the sound he wanted, and that setup was much faster than with other studio microphones. In fact he said it almost seemed that the AT4033 would "automatically adjust" to whatever the situation required without "boominess" or need for compression.

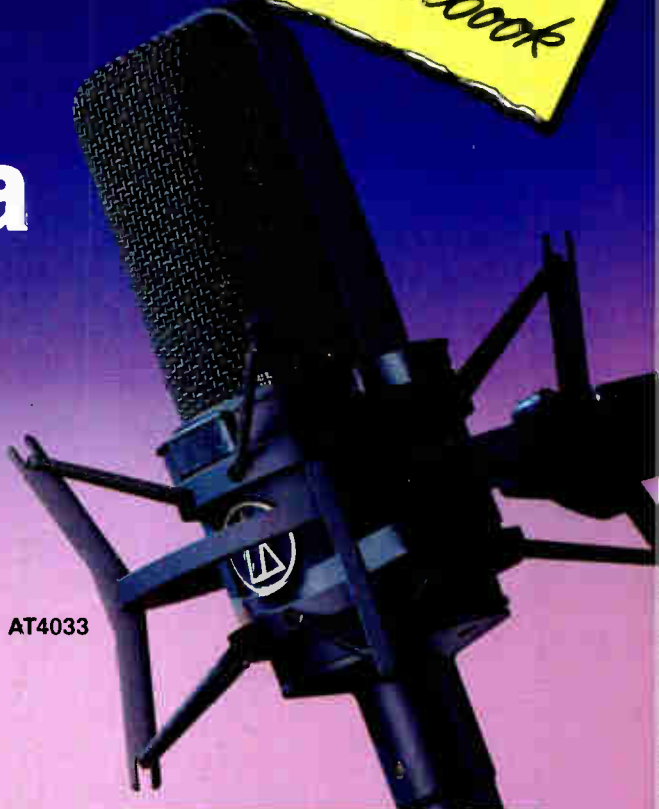
This capability fit right in with Jon Anderson's desire to work very quickly, and to avoid talent "burnout" during

repeated tests and takes. Jon has used many vocal mikes in his career, but he found the AT4033 remarkably clean despite high sound pressure levels and noted that "I could really get on it!" Ron also remarked on the amazing "clarity" and "unbelievably clean high end" of the AT4033 compared to his previous favorite microphones.

The microphones were used for many tracks including percussion, reeds, harp, acoustic guitar, and even a Bosendorfer grand piano. It was the consistently accurate response of the A-T 40-Series microphones to every challenge that made them so useful to both Jon Anderson and Ron Wasserman.

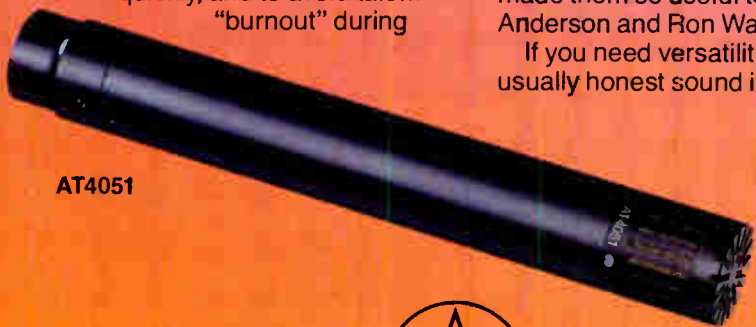
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NEW DIGITAL PRODUCTS

SSL OMNIMIX

Unveiled at NAB '93, the Omnimix system from Solid State Logic (U.S. offices in NYC) adds advances in surround sound technology to the Scenaria digital audio/video system. The system provides dynamic pan automation of up to 32 sources or submixes in 4-, 5- or 6-channel surround. MotionTracking allows precise placement and dynamic automation of individual or grouped audio elements to picture, while Spatial Processing emulates the fine points of spatial audio perception. Also included are a larger control surface with additional hard controls, a configurable output bus structure, simultaneous mix output in different formats and independent panning of mixes.

APOGEE FORMAT CONVERTERS

Apogee (Santa Monica, CA) has introduced two products for interfacing digital gear with devices that don't have AES/EBU digital I/O ports. The FC-PRODIGI converts AES/EBU digital signals to/from the PD (Mitsubishi/Otari) format; the FC-SDIF is used with SDIF-based gear, such as Sony's PCM-1610/1630/3324 machines.



PRO-BEL 44.1/48KHZ CONVERTER

British digital manufacturer Pro-Bel (now with U.S. offices in Dunwoody, GA) has introduced a 44.1-to-48kHz sample rate converter. The Model 5023 (fits into the standard Pro-Bel 6063 and 6065 card frames) converts asynchronous 44.1kHz signals (AES/EBU or S/PDIF) to the pro digital video standard of 48 kHz. High-resolution interpolation filtering is used for low-noise operation, and 16-, 18- or 20-bit dithering can be introduced, depending on word length.

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LEXICON ALEX EFFECTS PROCESSOR

Lexicon (Waltham, MA) has introduced the Alex Digital Effects Processor, offering digital reverb and effects processing in a \$399, single-rackspace unit. Alex has 16 presets and three adjustable parameters (decay, delay and FX level), plus remote control of program changes via a simple footswitch input jack, 16 user registers for storing sounds, ¼-inch stereo in and out jacks, and a two-character LED display.

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AMS LOGIC 3

Siemens, Bethel, CT, has announced Logic 3, a compact, low-cost (prices begin at \$60,000) mixing system featuring an all-digital signal path with the same quality as the larger Logic 1 and 2 consoles. Designed for use with the Audio-File workstation, Logic 3's assignable control surface has four motorized faders, 12 Logicator controls and a high-res color TFT screen for display of all mix functions. The board can be configured to provide 4-band fully parametric EQ, filters, dynamics controls and insert points in any signal path—all with dynamic automation. Maximum console size is 32 mono (or 16 stereo) inputs, with eight mono (or four stereo) subgroups and four stereo aux sends.

Circle #230 on Reader Service Card



EVENTIDE DSP4000 ULTRA-HARMONIZER

Now available from Eventide (Little Ferry, NJ) is the DSP4000, which provides ± 3 -octave pitch shifting, up to eight voices (four voices with simultaneous stereo reverb), delays up to ten seconds and an effects segue for transitions ranging from instantaneous to 60 seconds. The DSP4000 offers AES/EBU digital and analog I/O; 32/44.056/44.1/48kHz sampling rates, MIDI in/out/thru, PA422 serial ports and two footswitch inputs. Presets can be stored in internal RAM or on front-panel plug-in cards, which can be used with any DSP4000 unit.

Circle #231 on Reader Service Card



nVISION DIGITAL ROUTING SWITCHER

The NV3064 Series of digital audio routing switchers from nVision (Nevada City, CA) is designed for routing either asynchronous digital audio signals (AES/EBU) or time code signals (conforming to the ANSI/SMPTE 12M-1986 standard). The digital version accepts word rates of 28-54 kHz, which handles all current sampling frequencies, even with $\pm 12.5\%$ varispeed. The TC version provides accurate time code interfacing at up to 100-times normal speed. Either device can be slaved to existing router/control systems, and PC and Mac software control packages are available.

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360 SYSTEMS DIGICART/II

The updated DigiCart/II audio recorder from 360 Systems (Tarzana, CA) makes 16-bit stereo recordings (in linear mode or with Dolby's updated AC-2 data reduction) at 48, 44.1 or 32kHz sampling rates, with 16 preset keys for instant replay of selected cuts. Storage is provided by a hard disk with almost two hours of audio (three- and eight-hour hard disks are also available) and a Bernoulli drive, which utilizes 30-, 49- or 68-minute discs; up to five external hard drives can be added for 40 more hours of audio storage. Like a cart machine, the DigiCart/II offers playlisting, stacking audio tracks in a variety of formats; like a workstation, it provides a variety of editing features for tracks and playlists. Three different remote control units are available.

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DORROUGH DIGITAL AUDIO METERS

Listing at \$850, the 280 (horizontal) and 380 (vertical) meters from Dorrough Electronics (Woodland Hills, CA) provide 2-channel display of AES/EBU input. Models 280/380-D offer a 40dB range, while the 280/380-E have a 60dB range. The units provide simultaneous display of peak and perceived power, selectable peak-hold and overload indication. Meters can be mounted on consoles or panels, and they fit in standard 1.5-inch console openings; 12-24 VDC external power is required.

Circle #234 on Reader Service Card



TASCAM CD-901R CD RECORDER

Slated for release later this year is the Tascam (Montebello, CA) CD-901R CD recorder, priced at \$5,999. The unit conforms to the Orange Book 2 standard, recording CDs that can be played back on any standard player. The unit has AES/EBU (XLR) and S/PDIF (RCA) digital I/O, as well as XLR balanced analog connections and an RCA monitor output. Manual increment allows up to 99 tracks per disc, with up to 99 index marks per track, or the track number can be incremented automatically from DAT Start IDs, PQ codes or when the audio level dips beneath a set level. Features include Track Skip playback, RAM buffer for instant start-up, remote control and RS422/RS232C serial control port.

Circle #235 on Reader Service Card

FOSTEX DAT RECORDER

Fostex (Norwalk, CA) introduces the D-10 DAT Master Recorder for broadcast, post-production and project studio uses. For \$2,850, the D-10 offers an Instant Start feature and onboard RAM to eliminate preroll and loose cues when dropping in effects. Also included are an auto-cue function, selectable front-panel display of SMPTE time code, a RAM- and tape-based scrub function, and a jog shuttle control, auto-rehearse for previewing edits and auto-record for microprocessor control of punch-in/out. Analog connections are XLR balanced and RCA; digital I/O is AES/EBU and IEC; and the unit can record material from any source, at 44.1 or 48 kHz.

Circle #236 on Reader Service Card



DELUXE SOUND EFFECTS

New from RTV Communications Group (Ft. Lauderdale, FL) is Deluxe Sound Effects, a general-purpose sound effects library cleared for production use and priced at \$49.98. The five-CD set has a total of 412 tracks, including household, industrial, animal, combat, transportation, sports, human and weather sounds, as well as longer-length effects with various indoor and outdoor ambiances.

Circle #237 on Reader Service Card

HHB CD-R INDEXER

The CD-R Indexer from HHB (dist. by Independent Audio, Portland, ME) automatically translates Start ID markers on DAT cassettes into CD-R track-increment flags during dubbing, eliminating the need for manual insertion. Digital I/O is AES/EBU, or S/PDIF; the unit is compatible with CD-R hardware from Apex, Marantz, Meridian, Micro-Mega and Studer.

Circle #239 on Reader Service Card



SONY DIGITAL BETACAM VTR

Announced at NAB are Sony's new Digital Betacam VTRs, which provide 10-bit component serial digital recording with support for the 525-line, 16:9 aspect-ratio advanced television applications. Audio is recorded digitally as four channels of 20-bit AES/EBU, and video/audio test signal generators are standard, as are Digital Jog Audio and audio crossfade capabilities. Four models are available: the DVW 500 recorder/player and DVW 510 player, which use only Digital Betacam cassettes, and the DVW 500A and DVW 510A, which can play back both digital and analog Betacam cassettes.

Circle #241 on Reader Service Card

VALLEY AUDIO 730 DIGITAL PROCESSOR

The Model 730 is a new digital dynamics processor from Valley Audio (Merriam, KS) that includes traditional controls such as threshold, attack, release, ratio and gain, and allows for multiple simultaneous threshold setpoints and segment ratios. The single-rackspace 730 operates in MIDI control, RS-232/422 or manually programmable stereo or 2-channel modes, and offers 99 storage registers. Multiple analog and digital I/O protocols are selectable simultaneously (AES/EBU, S/PDIF and Toslink optical), and analog and digital inputs can be mixed. List price is \$2,000.

Circle #242 on Reader Service Card

STUDIO TECHNOLOGIES STUDIOCOMM

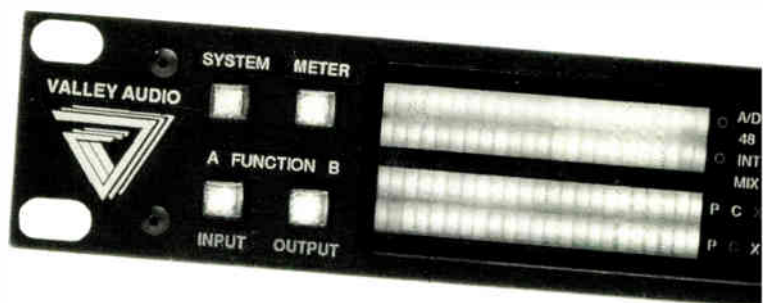
Designed to provide communications and monitoring functions for digital audio workstations, the StudioComm Series from Studio Technologies (Skokie, IL) is made up of the Model 50 Central Controller and the Model 51 Control Console, plus optional portable talent amplifier units. The Model 50 contains the electronics for seven stereo line inputs, two control-room monitor outputs, studio monitoring capability, a stereo line-level output for dubbing and an integral headphone system. Switches, LEDs and rotary knob controls for on-the-spot operator action are provided by the Model 51 console, as is an integral microphone that enables talk to studio, talk to headphones and slate tone with voice audio.

Circle #238 on Reader Service Card

FIBER OPTIONS 312B SERIES

The 312B Series of transmitters and receivers from Fiber Options (Bohemia, NY) employ 18-bit delta-sigma A/D processing, a sample rate of 48 kHz and optical AGC circuitry to convert two, four or six channels of stereo audio to broadcast-quality digital signals, which are transmitted over a single optical fiber and then reconstructed without degradation. Transmitters include ten-segment audio level indicators; receivers have two-color LEDs indicating audio level and clipping, plus a level/loss LED in case received optical power is lost.

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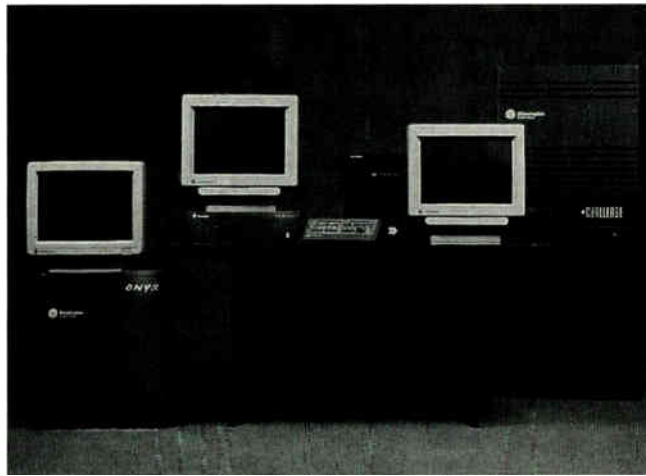


CHIP SHOTS

SILICON GRAPHICS ► SILICON STUDIO

A third-quarter release was announced for Silicon Studio, a video and film production solution from Silicon Graphics Inc. (Mountain View, CA) that fuses computer-generated graphics, digital video and advanced digital audio on a general-purpose computer system. A key element of the system is the Challenge video server, which simplifies collaboration and sharing of video resources and can store up to 30 hours of uncompressed online video. Also included in the Silicon Studio are three new SGI products for professional video production: the Galileo Video adapter for the Indigo; the Cosmo Compress JPEG-compression option for the Indigo; and Sirius Video, the latest-generation video solution for SGI high-end workstations and servers.

Circle #201 on Reader Service Card



TOUCHVISION SYSTEMS D/VISION DIGITAL VIDEO EDITOR

TouchVision Systems (Chicago, IL) announced version 2.11 of D/Vision-Pro for 386/25MHz IBM PCs and compatibles. The new software includes editing and mixing of six channels of CD-rate digital audio, importing of Targa files for titles and animation, improved video compression, support for more

than 60 hours of video, output of standard digital video files and more digital video effects. D/Vision-Pro software is available as part of a turnkey system that incorporates an Intel 386/33MHz and other hardware for \$12,990, or separately for \$3,950.

Circle #202 on Reader Service Card

DATA TRANSLATION MEDIA 100

◀ Data Translation (Marlboro, MA) introduced its Media 100 nonlinear video production system, a hardware and software combination that works with ordinary Macintosh systems to let business and creative professionals create finished videos. The system's video output is 60 fields and 30 frames/second with 4-track CD-quality audio mixed to stereo. It consists of two NuBus cards and software and was scheduled to be available later this summer at a price of \$11,995.

Circle #203 on Reader Service Card

AWARE AUDIOSUITE PRODUCTIVITY PRODUCTS

Aware Inc. (Cambridge, MA) introduced its family of Aware AudioSuite Productivity Products, a set of software-only audio compression technologies for Silicon Graphics workstations. AudioProducer provides high-resolution compression for professional audio production and archiving; AudioPublisher offers a wide choice of MPEG and other compression options for multimedia authoring, CD-ROM publishing and cross-platform distribution; and AudioPlayback permits playback of compressed audio files in multiuser network installations and cross-platform environments. Each product is available separately and as part of a complete AudioSuite package, which is priced at \$695.

Circle #204 on Reader Service Card

OPTIMAGE VIDEO AND AUDIO ENCODING TOOLS

Audio to MPEG is a hardware/software package from Optimage (West Des Moines, IA) that uses the Macintosh to create MPEG-encoded audio sequences. The program takes ECL input and encodes the audio sequence using a high-quality psychoacoustic model. The package, which includes grabbing hardware, will be available this summer for less than \$5,000.

Circle #205 on Reader Service Card



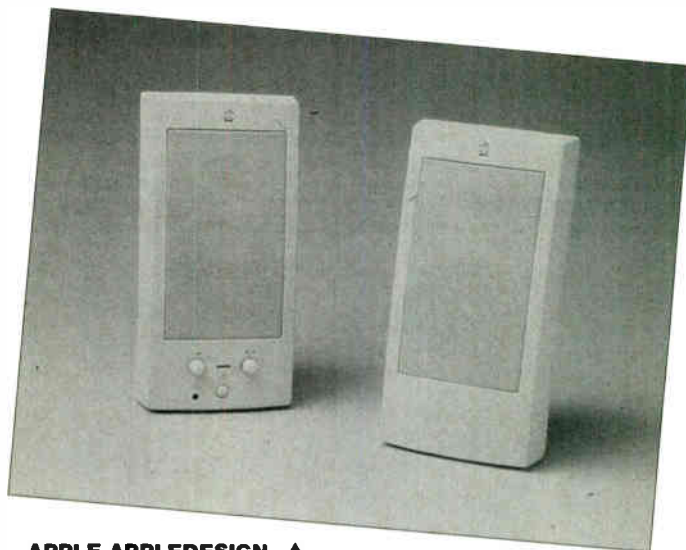
AVID MEDIA SUITE PRO FOR SGI IRIS INDIGO

Media Suite Pro, Avid Technology's (Tewksbury, MA) desktop digital-video-production system will be available on the Silicon Graphics IRIS Indigo PC this fall. The system is currently available for the Macintosh platform and is intended to allow users in the technical, scientific, industrial and corporate markets to create, edit, view and record high-quality video programs. The IRIS Indigo system will include application software, documentation, installation guide and cables. Hardware requirements are an IRIS Indigo system with 32MB

RAM and system disk, a 2GB disk drive, a 19-inch color monitor and a pair of external speakers.

Avid also revamped its line of professional-level Media Composer nonlinear editing systems. The new lineup consists of the 400s, 800 and Film Composer offline systems, and the 4000 and 8000 online systems. The Film Composer is the industry's first system designed to digitize, edit and play back at true 24 fps. The 4000 and 8000 Series replace the 2000 Series, and the top-of-the-line MC 8000 now offers images at 60-field resolution

Circle #206 on Reader Service Card



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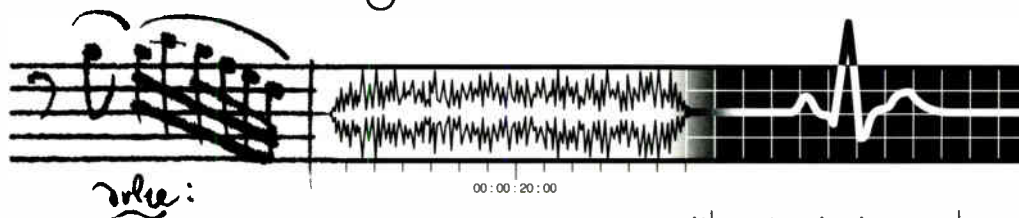
Underscoring its commitment to quality audio for the Macintosh computing environment, Apple Computer (Cupertino, CA) has introduced its AppleDesign Powered Speakers CD-ROM audio output and PC audio applications. The speakers are designed for

near-field monitoring and include noise reduction circuitry customized for computer-based audio. Volume control, off/on switch, balance control and headphone jack are all located on the front panel of the speaker. The speakers retail for \$179.

Circle #207 on Reader Service Card

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by Bob Hodas

TC ELECTRONIC M5000

Somebody finally has built a box that won't be obsolete four years from now. Somebody has taken some cues from the computer industry and put together an effects unit that can install a new operating system and programs via software disks. Somebody finally has built an affordable multi-effects processor with a modular hardware design, so the system can be upgraded without dumping the whole unit out the window. That somebody is t.c. electronic, and I applaud their effort.

The M5000 Audio Mainframe is aptly named; this computer was designed to be around for a long time. "Upgrade ability" are the key words in computer design philosophy and when combined with "affordable," "easy to use" and "sounds great," it is hard not to get excited. But I'm getting ahead of myself.

capable of up to 64 patchable audio channels. All cards are controlled from the front panel.

Software and operating systems can be loaded into the mainframe via an IBM-compatible 3.5-inch floppy and PCMCIA memory card slot on the front panel. (By the way, the PCMCIA card was voted Product of the Year for 1992 by *PC* magazine.) Of course, these devices also give the user an endless amount of storage space for as many programs as one can create. In addition, any favorite personal programs may be carried easily between studios that have an M5000. You can also save a session effect to disk and store it with the mix automation for instant access in case of a remix. The memory card may be inserted and accessed without overwriting existing programs, a feature studio owners will like. MIDI



The four slots on the M5000's back panel can be fitted with a combination of ADA-1 (analog I/O) or DSP-1 (digital I/O) slide-in modules. So up to four separate stereo effects engines can be loaded into the mainframe. Now that's power! (More on these to follow.) These modules connect to a high-speed 24-bit audio bus

access jacks will transfer programs from any computer with a MIDI interface, or direct from another M5000. Without going into details, suffice it to say that loading and saving programs is a very simple process. One can scan disk and memory card directories to find or delete files. Disks and memory cards are formatted in

the same manner as computer disks.

This type of storage freedom allows users to trade or create and sell algorithms and programs. A bulletin board has been established at t.c. electronic's main offices, so you can get the latest software and information via modem. Updates sold by t.c. are access-code-protected, so you can't just give them away to your pals, but you can give them the disk, and they can call in for an access code to upload into their machine. New software can be tried out in your own studio before making a purchase commitment using limited active time encoded disks. A lot of thought has gone into supporting the users of the M5000.

The two-rackspace front panel includes all operating controls. Above the disk drive and memory card slot, a pair of switches selects the DSP engines you want to address, while LEDs and labels indicate your choice. Five LEDs indicate Parameter Load, Time Code In, MIDI In, Digital In and LAN/SCSI (reading or writing data). The top line of the 80-character, backlit LCD is divided into five sections indicating the four parameters currently selected and the program algorithm. The bottom line is dedicated to the five Softdials directly below the screen and displays the four parameter values and the pro-



gram name. Two Page buttons scroll through the various pages containing the program's available parameters. Regrettably, pages, program names and parameter values do not wrap on the M5000.

A bright LED numeric display shows the current program number. A blinking display indicates that you

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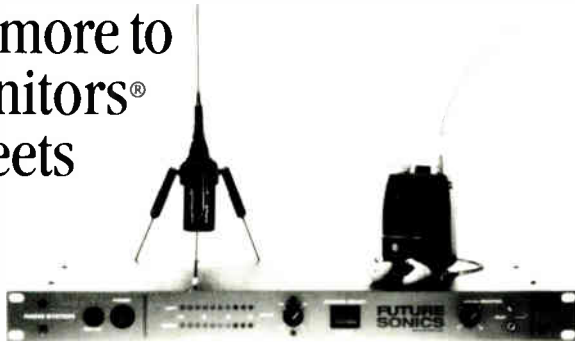
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are viewing a program not running at the time. A small Edited LED will light if you have adjusted any parameters, and three LEDs indicate which program bank is selected for Recall, Store or Preview modes. The three banks are ROM, RAM or File (floppy disk or memory card). A dual 10-segment left/right LED bar graph meter can be set to read either input or output of the DSP engine. Finally, six buttons with LED indicators select the following functions: Program is used to select, store or rename programs. Edit allows you to edit the selected program. Bypass is, well, you can guess. Utility gives the user access to various utility menus for settings in the selected engine. Do and Undo execute or reverse certain commands.

The back panel contains a plethora of connectors, including an IEC power receptacle with voltage selector; MIDI in, out and thru jacks; SMPTE (for time code-synchronized program changes and preprogrammed functions); and a pedal jack for an external switch. Several optional ports are also available. The SCSI port can be used for high-speed data exchange with hard drives, MOs or another M5000. Two LAN ports can be used for external control and file/data exchange. A remote jack connects to the optional remote control (currently under development).

Four slots hold the various I/O modules. The ADA-1 module is simply an analog I/O. It holds a pair of XLR male and XLR female jacks. The DSP-1 module contains the DSP engine and digital I/Os (XLR AES/EBU, and RCA and optical SPDIF). All I/O parameters are accessed under a utility menu. One may select between digital and analog sources and outputs, sampling rates, stereo or mono inputs, and digital format. The M5000 can even strip off the copy-prohibit bit or add one to the output. If not fully loaded, there are cover plates for the empty slots to keep dirt out. As stated above, this is a 24-bit internal processor. The AD/DA converter features 18-bit resolution, 64-times oversampling in, and 20 bits out.

The M5000 has three program storage areas. ROM holds 99 factory programs and cannot be overwritten. Our unit came with 80 programs; more will be supplied free of charge as they are developed. Edited pro-

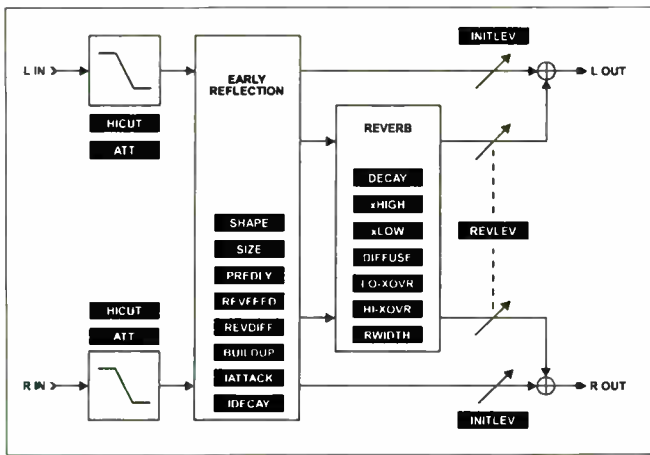


Figure 1: Reverb-2 flow chart

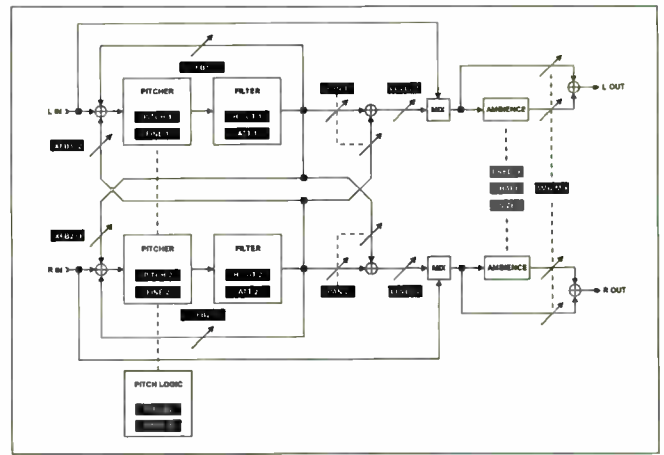


Figure 2: Revpitch flow chart

grams can be stored in 100 battery-backed RAM locations to build a user library. Programs from external drives or devices are loaded into a file buffer, which lets engineers load their favorite programs without harming the studio's RAM library. The file buffer is not battery-protected and will be lost on power down. But the current running program is always protected, because it gets copied into the working memory even if it came from a file. So, not to worry if you

have a short power outage on the gig. The M5000 always comes back to where it was.

Now a word about MIDI. You may control up to 32 algorithms or parameters with a MIDI controller. You can set up the M5000 to work with either 7-bit or the new 14-bit controllers. Program change messages recall programs, and MIDI mapping is standard. Each engine can have its own setup, allowing extreme versatility. I found the MIDI setup to be

quick and simple. I used a Yamaha MCS2 controller, which is very limited but got the job done. Operation was smooth, and all parameters that I would desire changing during a performance flowed with no zipper. Some parameters, such as room shape, are just too radical to change in performance, but users will find their own limits during initial explorations.

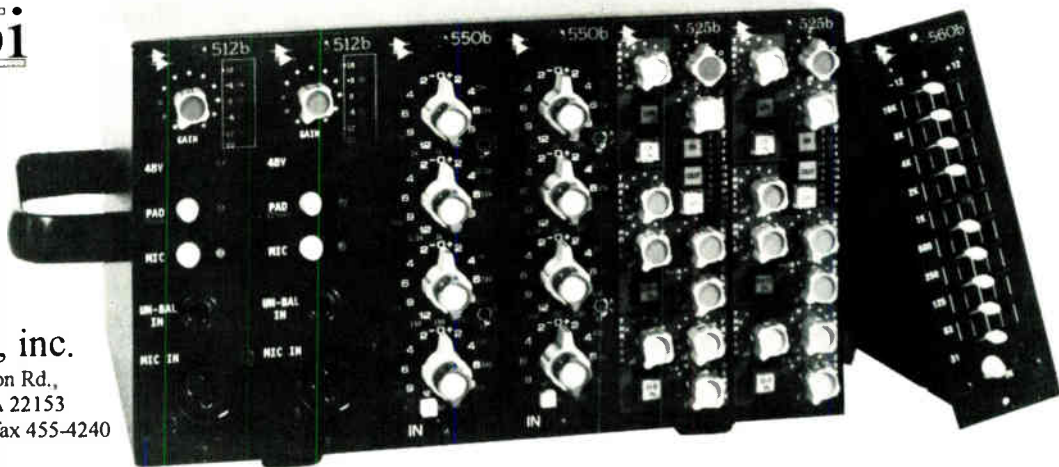
MIDI out is currently limited to program change information, but by the time this article hits the streets i.e.

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should have written its System Exclusive protocol, which will output all front panel operation and parameter changes to MIDI. This will allow the user to record into a sequencer for later playback. The upgrade will be supplied free of charge to all M5000 owners.

The manual is extensive, easy to read and covers all operational aspects and design philosophy. It is set up in a tabbed ring binder, so updates will be easy. Full parameter charts are provided, as are blank

charts for hard copy backup of user programs.

There are eight separate algorithms currently shipping with the M5000; more are under development. The algorithms are as follows: Reverb-1, Reverb-2, Nonlin-1, Chorus-1, Revpitch, Pitch-1, Pitch-2 and Delay-1. A variety of factory programs are supplied with each algorithm—enough variety to get you started. In fact, unlike many manufacturers' factory-supplied programs, many of these programs are usable right out of the box.

Reverb-1 and -2 are true stereo

in/out reverbs. Although they share the same basic control parameters, Reverb-2 adds four additional parameters for even finer control (Fig. 1). Nonlin-1 is a nonlinear, or gated-style, reverb that has a unique "repeatable tail" ability. The tail can be shaped independent of level and timing of the incoming signal. Chorus-1 produces chorus and flanging effects, while Delay-1 is a true stereo delay line with feedback. Revpitch (Fig. 2) is a high-quality pitch shift program designed to fix vocals and create harmonies. It is a rich effect to which the user can also add ambience within the program. Pitch-1 has two ultrafast, independent pitch shifters with an intelligent deglitcher. They can be cross-panned and crossed as well. Pitch-2 is a phase-locked pitch shifter capable of shifting stereo program while maintaining perfect phase coherence.

Each algorithm has its own set of parameters for fine-tuning. I definitely recommend reading the parameter descriptions for many of the algorithms. t.c. has included a number of diverse parameters covering just about anything you would want to tweak, and I had to learn a few new terms and techniques. The effort was definitely worth it and resulted in a finer understanding of the effects, along with better-sounding overall tracks. We don't have enough space to talk about all the parameters, but Figs. 1 and 2 illustrate this diversity.

Scrolling through and recalling programs was a no brainer. Paging through the parameters and making adjustments were fast, and simple too. I like having the parameter names displayed above the values; it makes adjustments fast, with no memory tasking. This is a common-sense approach that other manufacturers should take to heart. All in all, operationally, the M5000 is a winner.

In the reverb algorithms, the room shapes are quite good. The shapes were designed based on real-world examples and control the initial reflection pattern. The Hall simulates Boston Symphony Hall; Fan is based on the La Scala concert hall in Milan; Prism is a "golden ratio" shoe box hall; Horseshoe mimics the Vienna Philharmonic Hall; Club is your average club venue size; and Small simulates a small space, minus some of the annoying colorings that plague small rooms.

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And as for the big question ("How does it sound?"), when I hooked the M5000 up to the console it was just about as quiet as a Quantec XL, which I consider one of the quietest reverbs on the market.

On a mastering session, I used the M5000's optical digital I/O to connect a Sonic Solutions Sonic system and a Sony PCM-1630 processor. Setting up the I/O parameters was a breeze. The project was a 150-voice chorus and 40-piece orchestra recorded at San Francisco's Davies Symphony Hall. We needed just a bit more reverb to tie it all together. Unfortunately, I did not find the warmth that I was looking for with the M5000. The diffusion and reflection patterns were nice, but the current algorithms were a bit too metallic. (*As we went to press, t.c. had released two additional reverb algorithms —Ed.*) I am officially putting out a request for a warmer reverb, and I'm sure one of you readers will write one for me to use. (At least with the M5000 someone outside the factory can create new programs.)

My experiences with the special effects programs were all good. Pitch shifting was glitchless and sounded nice. The chorus and flanging worked well, and I really liked some of the delay effects. Some of the factory programs were usable right off the bat, and there's no problem dialing in something "special."

I used the M5000 for vocals on a project I was mixing for Bill Spooner (formerly of The Tubes). There were several vocal programs in ROM, and I found a couple that were close to what I needed. Some minor parameter adjustments quickly provided the sound I was looking for. The vocal program tone was fairly bright and good for a rock or pop tune. I then tried the reverbs on a couple of female vocalists, and ran into problems with an operatic-style vocal. Any held notes with even slight vibrato caused the reverb to beat annoyingly; no amount of parameter manipulation would fix this. On a woman with folk/pop leanings, however, things sounded quite good; her held notes did not set off this phenomenon.

Drums sounded just great in many of the reverb programs. Snare, kick and toms could all benefit from the M5000. I had fun adjusting from slight ambience to big halls. There's a lot to choose from. And electric

guitars sang in the M5000. Leads and rhythms were strong, clear and big. Once again, many of the factory presets worked great.

So, at this point, if I were to assign a genre to the M5000's current factory reverbs it would be rock or pop, and not acoustic music. The sound tends to be more metallic than wooden, but not sizzly or overly bright. It will be interesting to see what some of the programmers come up with for a more natural sound.

The retail price of the M5000 Audio Mainframe is \$2,000. The ADA-1

module retails at \$865. The DSP-1 retails at \$1,063, but is also available without the digital I/O for \$806. The minimum configuration for a strictly analog studio would require a mainframe, ADA-1 and DSP-1 without digital I/O; this configuration would retail at \$3,671.

t.c. electronic, distributed by Virtual Designs, 717 Lakefield Road, Suite C, Westlake Village, CA 91361; (805) 373-1828. ■

Bob Hodas is an independent engineer and producer based in the San Francisco Bay Area.

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AUDIO PRODUCTS FOR FILM PRODUCTION

SHURE FP32A PORTABLE STEREO MIXER

Building on its popular FP32 mixer, Shure (Evanston, IL) has added more than 40 new features and improvements.

Self-noise has been reduced by 30 dB to make the unit

compatible with digital recording formats and transmission schemes, while 48V and 12V phantom and 12V T(A-B) power are available for all types of condenser mics. Also included are active input gain controls, a bass roll-off switch to reduce wind noise and rumble, peak limiters for left and right stereo outputs, a 1kHz tone oscillator, a 1-second slate tone and a built-in condenser slate mic with automatic gain control. The unit has three balanced XLR-F inputs, two balanced XLR-M outputs (switchable for mic/line levels), unbalanced stereo tape output and two headphone output jacks. The FP32A lists for \$1,795 and weighs 3.5 pounds.

Circle #191 on Reader Service Card



AKG M/S STEREO MIC SYSTEM

AKG Acoustics (San Leandro, CA) introduces an M/S stereo microphone and matrix box for location production of TV, film and music. The C522/MS uses three cardioid condenser capsules to output independent mid and side signals, which can be recorded and combined to matrixed stereo in post-production. The rugged, all-metal mic is powered by a ten-year rechargeable battery and can interface with any recorder input: balanced or unbalanced, with or without phantom power. An optional UM52 matrix box allows monitoring the mid or XY signal through headphones while selectively generating M/S or XY at the balanced outputs.

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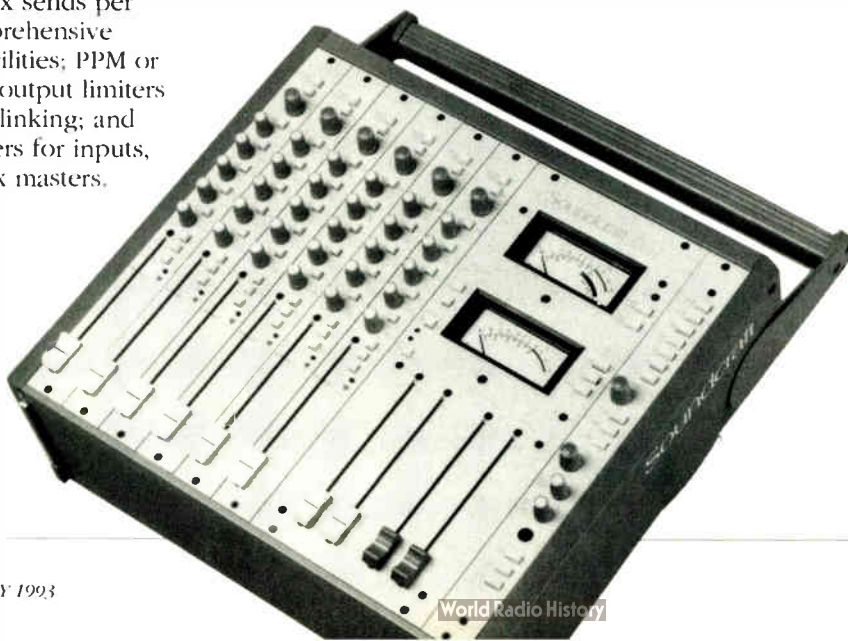
TIMELINE LYNX UPGRADE

Until August 15, TimeLine (Vista, CA) has an upgrade program offering owners of original Lynx-1 sync modules a \$1,000 trade-in toward the purchase of a Lynx-2 system. Lynx-2 features time code generator/reader (all code types plus MTC), internal serial control interface, 16-character time code display and built-in gearbox processor for X-frame and variable speed sync. Options include remote front panel operation, and plug-in VITC and film processor cards.

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SOUNDCRAFT LM1 LOCATION MIXER

Designed for location film and broadcast recording, the LM1 portable audio mixing console from Soundcraft (Northridge, CA) is available in 6-, 8- and 12-channel frame sizes. A flexible 4-bus routing system allows multiple application uses, and both L/R and M/S modes can be used for stereo recording, with M/S decoding on the monitor section. Other features include: AC or DC operation; switched gain control; 3-band EQ; highpass filter; peak indication; PFL; two aux sends per input; comprehensive talkback facilities; PPM or VU meters; output limiters with stereo linking; and 100mm faders for inputs, mix and aux masters.



METRO MUSIC

New from Metro Music, a music scoring company based in New York City, is the Metro Music Production Library, a 10-CD collection of music for broadcast, audio post, corporate and educational production applications. Available on annual blanket, needle-drop or per-production rates, the library has 247 titles (many with 60/30/10-second edit versions), for a total of 600 selections including blues, jazz, rock, hip-hop, dance, new age, urban and acoustic.

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SOUND REINFORCEMENT NEW PRODUCTS



CELESTION CR/CRI LOUDSPEAKERS

Celestion (Holliston, MA) introduces two series of speakers (in-floor or stand-mount versions), with curved enclosure fronts that allow the formation of arched arrays. The series include the 102 (two-way 10-inch, 200 watts power handling), the 122 (two-way 12-inch, 250 watts), the 153 (three-way 15-inch, 300 watts), the 183 (three-way 18-inch, 500 watts), the 151 (15-inch front-loaded ported reflex subwoofer system), the 181 (18-inch subwoofer), the 102M (two-way 10-inch wedge floor monitor, 200 watts), and the 122M (two-way 12-inch floor monitor, 250 watts). CR Series enclosures are plywood with black carpet, while CRI models are birch with black enamel finish.

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PROFESSIONAL AUDIO SYSTEMS

TOC SYSTEM 1

PAS (San Marcos, CA) debuts the TOC System 1 sound reinforcement series, consisting of the RS-1 Club Array Loudspeaker, the SW-1 Stage Wedge, the VM-1 Vocal Monitor and the EB-1 Extended Bass. All four units feature passive crossover filters and the TOC (Time Offset Correction) system for near-perfect phase response. The RS-1 and SW-1 contain 15-inch coaxial drivers, while the VM-1 has a 12-inch loudspeaker; each has a 1-inch throat compression driver and a 30°x60° constant-coverage horn. The EB-1 has a single 18-inch high-power excursion woofer, with 35Hz fundamental bass response in a 5-cubic-foot enclosure.

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RENKUS-HEINZ C-3 SUB

The Total System Concept loudspeaker family from Renkus-Heinz (Irvine, CA) continues with the C-3 SUB, a dual-15 subwoofer measuring only 32.5x21x23.75 inches, yet able to handle 600 watts with a max SPL output level of 127 dB from 30-100 Hz. The two 15-inch woofers, electrically connected in parallel but acoustically operating in series, are separated by a minimal isobaric chamber; one fires into the horn-loaded front chamber, while the other fires into a vented rear chamber, effectively doubling the cabinet's volume. The C-3 SUB was designed to complement the C-3 and SR-4 loudspeakers.

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TANNOY CPA 10S

The CPA 10S Dual Concentric loudspeaker provides 131dB SPL from 140-22k Hz in a 20x18x9-inch, trapezoidal space frame enclosure. The unit combines a wide-dispersion, constant-directivity 10-inch transducer with a 44-pound magnetic structure to provide 90° conical dispersion. Designed to complement the CPA 10S in the 25-500 Hz range, Tannoy (distributed by TGI of Kitchener, Ontario) offers the CPA 12.3, a subwoofer system with three 12-inch, long-throw drivers in a vertical array. Also available is a full-range arrayable system, the CPA 10SXB, delivering up to 130dB SPL from 55-22k Hz.

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COMMUNITY LEVIATHAN II

The Leviathan from Community Light & Sound (Chester, PA) uses radical-scale technology to solve acoustical problems of large environments. Low end is provided by six 15-inch Ferrofluid-cooled drivers



coupled to a Fiberglass horn measuring 84 inches from front to back, with a 72x72-inch mouth, 34Hz flare rate and 1,200 watts continuous power handling. An M4 compression driver and PC1542M horn handle mid-range (250-1,200 Hz), with power handling of 200 watts continuous within a 40°x20° pattern. A dual-driver PC464 horn provides output in the 1.2-10kHz range, matched with a newly developed mid/high driver with a low-mass/high-strength carbon fiber diaphragm and a combined radial/circumferential phase plug. The MF/HF sections are concentrically mounted within the mouth of the bass horn, and the unit is designed to withstand 100 mph winds and temperature extremes.

Circle #216 on Reader Service Card

by David (Rudy) Trubitt



L.A.'s Hollywood Bowl was the site for the recent Earth Day '93 concert. Acts included Paul McCartney, Steve Miller, Don Henley, 10,000 Maniacs and k.d. lang. Consoles came from Concert Sound London and Clair Brothers. Showco provided monitors and effects for McCartney's set. See story next month.

SOUND CHECK

NSCA PRODUCT NEWS

Although computer control (see page 113) was perhaps the biggest single buzz at the recent National Sound and Communications show in Orlando, there were plenty of new products to look at, too.

dbx showed its new aggressively priced dbx Project 1 series processors including the model 266 Dual Compressor/Gate at \$299, the 274 Quad Expander/Gate at \$449, and the 296 Dual Spectral Enhancer at \$349 retail list.

Also on hand were new AKG condenser microphones designed specifically for live performance: the hypercardioid C5900 hand-held vocal mic and C5600 large-diaphragm, high-SPL instrument mic. Both models include exten-

sive shock isolation and feature three-switch-selectable, bass-contour curves. The C5600 has a stand-adaptor built as an integral part of its housing. AKG also introduced the C621 miniature gooseneck microphone, designed for speech reinforcement in church, conference room and meeting applications.

JBL premiered the MPA Series of power amps, consisting of five models rated from 275 to 1,100 watts/channel into 4 ohms. These amps were designed to power a complete, perfectly matched sound reinforcement system featuring JBL components. MPA amps include Open Input Architecture slots that can accommodate a variety of removable input cards. These include input-connector configurations,

crossovers, optional transformer as well as forward-looking options such as Lone Wolf's MediaLink networking system.

Crest showed its new Modular Audio System amp, the MAS200. The unit is a 1-rackspace, 2-channel amp featuring independent switching power supplies. By removing the rack's front panel with three large screws, either channel can be pulled from the unit, even while the amp is running. The amp is reported to have an especially open-sounding top end. An optional interface card makes the amp NexSys-compatible.

On the loudspeaker enclosure front, Clair Brothers Audio Systems was on hand showing its first passive two-way box, the

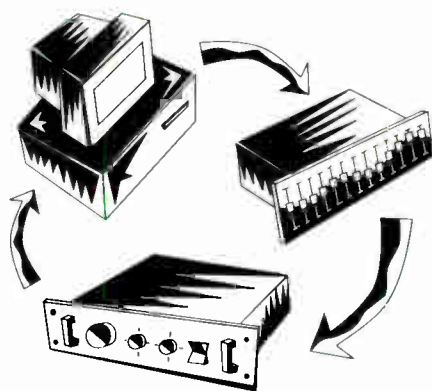
—CONTINUED ON PAGE 118

PHOTO: SIEVE JENNINGS

COMPUTER CONTROL CONCEPTS

by David (Rudy) Trubitt

I support SC-10, and so should you. Thanks to the participants in this AES subcommittee, the door to a new generation of sound systems has been opened.



At this year's NSCA show, computer control of sound systems remained a subject of intense interest and heated

debate. In its most basic form,

this technology allows the remote control and monitoring of audio equipment. Applications are as straightforward as adjusting the input level of amps from a computer at the mix position up to digital audio distribution and control of massive sound systems. (Those looking for more on this subject should read Bob Moses' columns in this space beginning in our March '93 issue.)

Today's computer-controlled systems have made significant inroads into the installed sound marketplace and, to some extent, the touring market. Tomorrow promises a potential revolution in the architecture of sound systems. However, 1992 saw the major competitors pulling in very different directions, leaving many (myself included) skeptical about the future. It seemed that competing agendas would make a single standard impossible.

This set the stage for a tragic setback to customers and manufacturers alike. Instead of the win-win success of MIDI, we

faced a repeat of the lose-lose quadraphonic fiasco. Fortunately, the first 90 days of 1993 saw the partial resealing of a Pandora's Box of incompatible standards.

Without the efforts of the members of the AES standards subcommittee, we'd probably be looking at four major competitors, each with incompatible network *and* applications protocol—Crown's IQ, Intelix's MindNet, Crest's NexSys and Lone Wolf's MediaLink. Instead, potential competitors are considering support for the work of the AESSC SC10 subcommittee. Note that as of yet, *no official standard or draft AES standard exists.*

Let's look at the situation as of spring '93—four companies, their respective systems and what the AES is doing to bring the industry together.

LONE WOLF'S MEDIALINK

Until recently, Lone Wolf's dilemma was this: The company had an impressive multimedia networking technology but lacked the big-company resources to bring its complete vision to market. Lone Wolf is shipping a MediaLink product called the MIDITap, which carries multiple bidirectional MIDI datastreams over a fiber-optic cable. These systems are in use in a number of studio and touring MIDI systems (INXS, Herbie Hancock, etc.). For several years, the company has planned to implement its network technology in a single integrated circuit, intended to carry 24 channels of CD-quality digital audio in addition to network control and

A Definition of Terms

To appreciate the significance of these events, a little background is in order. At the heart of computer control/audio networking technology is the physical and electronic interconnection of audio devices (and optionally, personal computers for system control and status monitoring). The physical interconnection between devices carries an electronic language that all connected devices understand. These two components (the physical link and the communications language) are often referred to as the *network* and *applications protocol*.

Taking MIDI as an example, its opto-isolated in and out jacks, transmission specifications and 5-pin DIN cable make up the "network" side of the equation, while messages such as notes-on and program changes make up the applications protocol. While the MIDI hardware spec is unchanged since its introduction, the protocol has continued to evolve, adding the ability to transmit time code, sampler sound files and show-control information, to name three. (Using MIDI as a network example is a stretch—at best, MIDI is a very limited network.)

The AES group is working hard to define a forward-looking applications protocol. This is the single most important task at hand, because it could represent a common language for the entire industry. Consider a printed English text. It could be sent by the U.S. mail or Federal Express. In both cases, the message would have the same meaning once received. The main difference is the path and speed in which it was delivered.

Communication in different languages adds an additional level of complexity—not only must a carrier be found, but translators are required in both directions. A common applications protocol avoids this additional problem. ■



monitoring on a single fiber-optic cable. However, lack of resources delayed the production of this chip.

Nevertheless, two companies decided to commit to Lone Wolf: Rane and QSC. Lone Wolf helped them create prototypes, which were demoed last year. At this January's NAMM show, other manufacturers began adopting MediaLink. By NSCA '93, Lone Wolf showed prototype equipment from QSC, Rane, Carver,

TOA, JBL and UREI together on the same MediaLink network. The company has also reached contractual or handshake agreements with other manufacturers, including Peavey and Fender Electronics.

Lone Wolf currently projects late-summer availability of its MediaLink chip. This means initial MediaLink-compatible equipment will not be transmitting digital audio over fiber. MediaLink Level 1, as it is called, uses off-the-shelf chips capable of

implementing the network at rates sufficient for control and monitoring, but not fast enough for digital audio distribution. The first MediaLink-compatible equipment to ship may be JBL/UREI's newly introduced Platform modular signal processing rack, scheduled for late-spring delivery. Rane and QSC are also likely among those soon to ship product.

Lone Wolf is also emphasizing Visual Network Operating System, its software development tool for manufacturers and end-users alike. Once a manufacturer creates a VNOS application, such as Rane's graphic EQ front panel, it can be used as part of a complete sound system by end-users on Macs or Windows-based computers. VNOS is said to be platform-independent, meaning applications will run without modification on both PCs and Macs.

As recently as January, most manufacturers were aware of Lone Wolf, but a wait-and-see attitude was the norm. Between NAMM and NSCA, a profound attitude shift took place, with numerous manufacturers now casually mentioning MediaLink support as a given. In my opinion, there is clear momentum moving in MediaLink's direction.

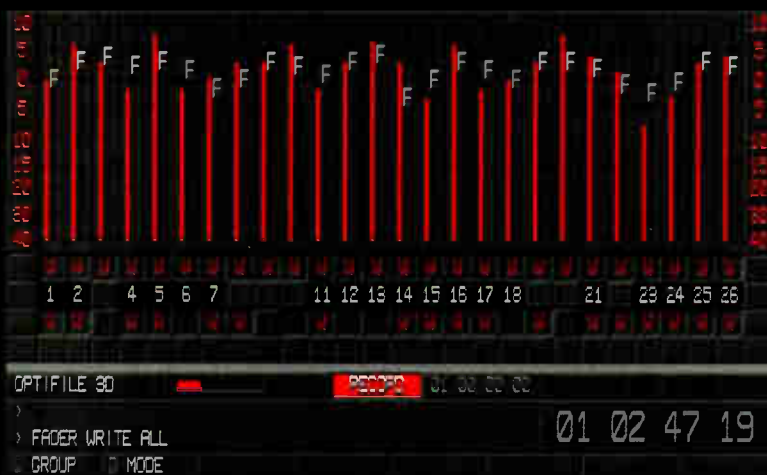
CROWN IQ

Crown's IQ System is probably the most widely used sound system control product available (numerous PA-422-based systems are also in use, but despite that system's status as an AES standard, PA-422 does not seem to be poised for long-term growth). Crown cites hundreds, perhaps over a thousand IQ Systems in the field and remains clearly committed to supporting the system and its installed base. The company offers a full line of IQ-compatible amplifiers, mic mixers, multiplexers and audio routing equipment. Today, these devices are controllable by everything from simple stand-alone push-button controllers to a Mac or PC on-site, or via modem from across the country. In addition, third-party manufac-

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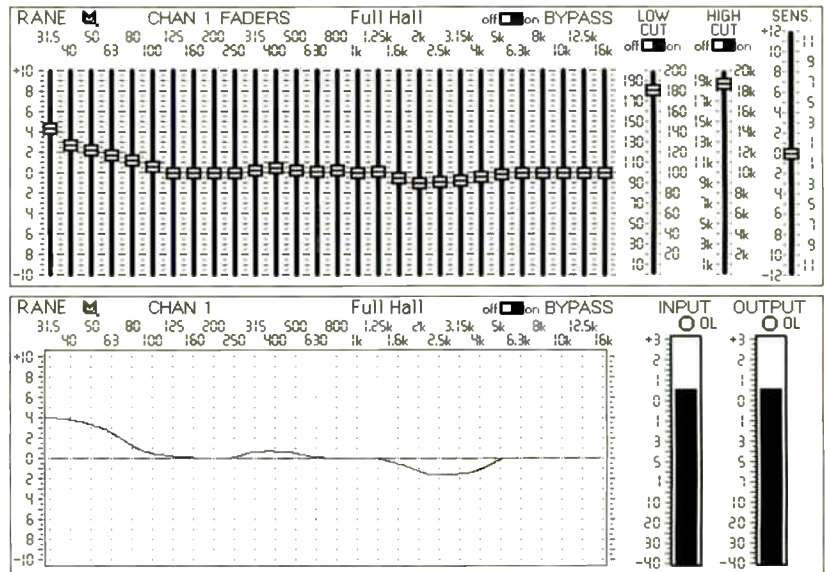
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turers—including White Instruments, Rane, TC Electronic, Sound Services and Systems Engineering Services as well as AMX and Crestron, both of which manufacture touch-panel systems for fixed installations—are offering IQ-compatible audio and control gear.

Crown is an early leader in this field and deserves credit for bringing a capable system to reality. Despite its success, the system is not supported by any of Crown's direct competitors. Without assigning responsibility for this stand-off, I consider it unlikely that any other major amp manufacturer (i.e., Crest, Carver or QSC) will license IQ for use in their products. This situation will probably limit IQ's ultimate level of acceptance by other manufacturers.

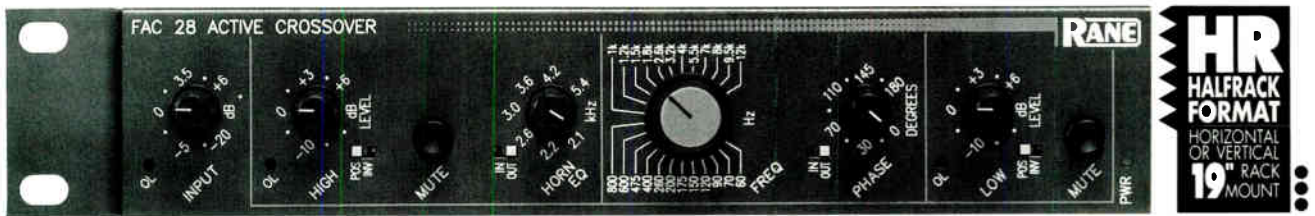
Note that Crown considers IQ to be an applications protocol, rather than a network. Crown and Lone Wolf, recognizing the potentially complementary nature of their respective tech-



nologies, have announced that they will work together to define how Lone Wolf's MediaLink network can carry the IQ protocol. *This does not mean Crown is abandoning IQ.* Rather, the companies will work to enable IQ equipment to also operate on a MediaLink network.

Computer-controlled equipment can display a more flexible arrangement of operator controls on a computer's monitor. The Rane Network equalizer can be displayed with traditional sliders (top) or as an editable curve representing the actual frequency response of the unit's current settings.

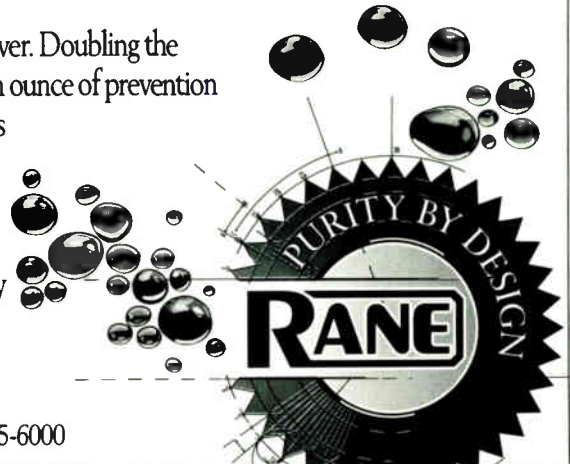
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The FAC 28 is the first commercially available 48dB/octave crossover. Doubling the roll-off makes the crossover region so small as to be virtually negligible. An ounce of prevention goes along way when it comes to cancellation problems. And the FAC 28's 24-position binary code frequency selector gives you the consistent accuracy of plug-in cards, but with the convenience of a knob.

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INTELIX'S MINDNET

Intelix has an eight-year history of developing control- and network-based products for the pro audio industry, currently with around 50 installs in the field. Intelix sold all its MindControl network hardware to Mark IV in 1991 but retained rights to the MindNet network applications protocol.

At NSCA, Intelix announced that it signed an agreement with Crown to become a licensed IQ

system software developer. Intelix will offer application design services to manufacturers wishing to create IQ-compatible products as well as contractors requiring end-user application assistance.

The company announced a similar agreement with Lone Wolf. Intelix intends to develop software applications for the VNOS operating system. The company will also offer application development services to manufacturers that wish to create MediaLink-compatible products.

In a sense, Intelix is operating along two parallel tracks. On the one hand, the company offers support services to potential manufacturers of both MediaLink and IQ products. On the other, it continues to offer MindNet and ObjectView networking products for licensing by other manufacturers.

CREST'S NEXSYS

The NexSys control system has also entered the field, including an installation at Disneyland's FANTASMIC! attraction (see March '93 *Mix*). In addition to controlling Crest amps, NexSys is capable of controlling MIDI equipment. The company also offers a unique loudspeaker-load monitoring product capable of remote detection and detailed reporting of different types of loudspeaker failures. The company's software control program runs on PCs under Microsoft Windows.

At NSCA, Crest Audio and Lone Wolf announced an agreement to interface and share technology toward NexSys and MediaLink compatibility. *This does not mean Crest is abandoning NexSys.*

THE SC10

At the center of developments has been the SC10 (for background on the subcommittee, see the interview with Bob Moses in the January '93 *Mix*). SC10 has broken the present standards task into three areas: analysis of various existing networks (SC10-1), definition of a common applications protocol (SC10-2) and education/information dissemination (SC10-3).

It seems likely that SC10-2 will be able to hammer out a protocol standard that probably will be adopted by most manufacturers. Exactly what protocol is chosen remains an open question. The group has been engaged in developing an "object-oriented" applications protocol for some time (more about object-oriented concepts next month). In addition, other parties have put forth aspects of their own previously proprietary protocols for considera-

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tion. Reaching a final decision on this matter will be a delicate process indeed. We'll keep you posted.

I feel the outcome of an AES network standard is less clear. MediaLink is almost certain to be a major player in the marketplace, although I don't intend to imply that SC10-1 will adopt it as *the* standard. In fact, with a common applications protocol, it will be possible, if not always convenient, for more than one network standard to exist in the market, even within the same audio system.

A high-speed as well as a slower, less expensive network could be adopted. A low-cost, basic system would be used for bread-and-butter jobs, while a high-speed fiber-optic network would be used for more complex projects. A common applications protocol would make it straightforward to bridge between these systems, although care must be taken so the faster network doesn't overload the capacity of the slower.

CONCLUSION

A likely scenario is that MediaLink will become a common network for multiple manufacturers. MediaLink has demonstrated the ability to carry dissimilar protocols simultaneously. So, a manufacturer with existing network-controlled equipment in the field could use MediaLink to deliver messages *in the company's original proprietary applications protocol*.

This means the same MediaLink network might carry the AES protocol alongside one or more different control systems (MIDI, IQ, NexSys, etc.). In this case, the burden of dealing with multiple protocols on the same network could fall to the user. This would be a source of frustration, as the user's audio system won't be controllable as a single entity. However, it would be possible for companies to build translators, or *gateways*, between their protocols and the AES's, which would shield users from having to manage dissimilar systems. Either way, this issue

will have to be confronted, as companies with gear in the field are unlikely to abandon the customers who supported their early efforts.

Will we have a single standard for computer control and networking of audio systems? Although there is still a great deal of behind-the-scenes wrangling to be done, I am more optimistic today than at any time in the past two years. If it comes to pass, it will be due in no small part to users, the SC10 and the nonaligned

manufacturing community's loud demand for a unified, common standard. This has provided the final push to make competitors consider putting aside their own agendas in favor of a common system that will benefit the industry as a whole. ■

In addition to more than 15 years in audio, David (Rudy) Trubitt has installed and administered computer networking equipment in some of Silicon Valley's largest electronics firms.



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—FROM PAGE 112, SOUNDCHECK

R-2DP, which was originally designed for the engineering department at Walt Disney World. Used on the parade route, the enclosure is intended for full-range high output for speech or music, indoors or out.

McCauley Sound Inc. expanded its offering in raw loudspeakers to a line of finished enclosures. The Pro Line Series includes floor monitors, full-range and a mid/high-sub two-box system with a choice of two 15-inch or one 18-inch enclosure for the bottom end.

Celestion introduced a full line of competitively priced full-range boxes: The CR series includes two-way 10-inch and 12-inch, and three-way 15-inch full-range systems, as well as subwoofers and floor monitors.

Tannoy began delivery of its high-powered Super-Dual co-axial system. (You may remember this system from a parking-lot demo outside the Anaheim Convention Center last year.) In addition to the expected sound reinforcement applications, at least one recording studio has taken delivery of this system.

Audio Teknology Inc. was on hand showing a new version of its LEAP loudspeaker design program. LEAP 4.5 adds many user requests as well as all new documentation. ATI also showed LMS, its PC-based speaker measurement system.

There were numerous other interesting product introductions. Keep an eye on our "Sound Reinforcement New Products" section for more details.

Last but not least, NSCA provided many opportunities to spend time listening. One of the most interesting demos I heard was for LARES, the Lexicon Acoustic Reinforcement and Enhancement System. This system starts with LARES processors (based on

one or more 480 mainframes), a room mic and a dozen or more speakers distributed around the perimeter of the room. The system can create an extremely effective illusion of a larger reverberant space. It can also be used to minimize feedback by subtle shifts in time delay from speaker to mic. This prevents the build-up of any particular resonant peak, thus suppressing feedback. The coolest sound of all, albeit of limited practical value, was created when Lexicon's Steve Barber cranked the reverb decay time in Feedback Suppression mode. The result was a goose-bump-inducing ambient wash of shifting, not-quite-feeding-back harmonics. A definite must hear: Maybe they'll do it again at AES.

BUFFETT ADDS ELF

Sound Image (San Marcos, Calif.) is readying its Phase Loc system for another stint with longtime client Jimmy Buffett. This year, there's a new twist: The company will be driving its subwoofer cabinets with ELF-1 Integrators manufactured by Bag End. Originally developed by Ed Long and Ron Wickersham, ELF stands for Extended Low-Frequency. The technology uses loudspeakers operating below the resonant frequency of their enclosures, with design goals including reduced size, improved linearity and extended low frequency.

Bag End normally sells the ELF integrator (a 1RU electronics package) with its own loudspeakers, but Sound Image is using its own cabinets with the unit. "My regular sub enclosure has four 18s in it, but they're all in their own small chambers," says Sound Image's Michael Adams. "Realistically, 40 Hz is about the best you can expect out of a live sound reinforcement [sub]," he continues. "But the ELF stuff just sounds much nicer. You get that last octave that I wasn't getting. We're going to send

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LIVE SOUND

out Buffett's tour with a five-way system, but actually we're going to run it four-way with subs. And the subs are going to be all ELF." The tour will also be using Yamaha's D2040 digital crossover/system controller when they hit the road late spring.

SUMMER TOUR NOTES

Maryland Sound Industries is out with a variety of acts, including Billy Ray Cyrus, Michael Bolton in Europe, Sheena Easton, Dolly Parton, Whitney Houston in rehearsals, Luther Vandross in Europe and Cindy Lauper in clubs. Also out with MSI is Julio Iglesias, who will do some South American dates and then hit the States. Highlighting that tour is an extremely complex effects-heavy monitoring system featuring 12-second reverbs, daisy-chained delays, etc., with Craig Melvin at the monitor desk... Showco (Dallas, TX) has been busy with Vince Gill, The Highwaymen, Reba McEntire, INXS (doing clubs and theaters with Benji Lefevre at FOH), Clint Black & Wynonna Judd, the Beach Boys, Dwight Yoakam, Paul McCartney, Harry Connick Jr., Santana, the Moody Blues, Alice In Chains, Farm Aid, and Prince's Teaser Spring Tour... Electrotec (Canoga Park, CA) has been working with Alan Jackson, Def Leopard in Europe, GNR in the States, Jackyl, and rehearsals with Lenny Kravitz in New Jersey for summer tours in Europe and later the U.S... Audio Analysts (Colorado Springs, CO) has been out with Bruce Springsteen and Van Halen. The company has also kept busy with lots of local work and two ten-day-long conventions for music company BMG, one in Phoenix and another in Orlando, which included both straight speeches as well as various musical acts. ■

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by Bob Moses

TRANSATLANTIC LIVE

AUDIO TRANSMISSION GOES 20-BIT DIGITAL



*King's College
Choir*

The angels were singing in 20-bit resolution on Christmas Eve, 1992. Thanks to a historic collaboration between Minnesota Public Radio, American Public Radio, the BBC and Wadia Digital Corporation, listeners around the world heard every bit.

"A Festival of Nine Lessons and Carols" is a Christmas tradition for millions of people around the world. The service, held in King's College Chapel in Cambridge, England, consists of carols sung by the world-renowned King's College Choir and lessons presented by members of the Cambridge community and the college hierarchy.

The Festival is adapted from a service that was conducted by E.W. Benson, later Archbishop of Canterbury, for use in his wooden shed church in Truro on Christmas Eve, 1880. Although some of the carols have changed, the service's basic format and lessons have remained virtually

unchanged. Each year, one new carol is commissioned for the event; this year, Nicholas Maw composed "Sweet Jesu."

The King's College Chapel is one of the world's most remarkable acoustic spaces. This monumental 500-year-old building stands nearly 300 feet tall, with 80-foot ceilings. The voices of the choir take on a soaring quality in this space and seem to drift slowly down from above. The King's College Choir sings at chapel services nearly every day of the college term and is considered by many to be at the pinnacle of English choral music.

Aside from being a cultural treasure, the Festival is also a historic radio event. The service was first broadcast by the BBC live from King's College Chapel on Christmas Eve, 1928. The annual broadcasts have never been interrupted, even during World War II, making this the longest-running program on

radio. Live stereo broadcasts to North America began in 1979. This year, American Public Radio distributed the live program to 225 public radio stations across the U.S. as part of a worldwide audience of 60 million.

For the first time ever, the service was transmitted live to North America using 20-bit digital processors. The technical achievements that brought this treat to our shores promise a new era of broadcast quality. Live sound on a global scale is now a digital reality.

Minnesota Public Radio takes charge of transmitting the Festival in the United States. Preston Smith, the program's producer and technical director at MPR, is committed to bringing American listeners into the 15th century stone walls of King's Chapel so they can experience the Festival fully. Each year, Smith and his team of engineers push the envelope of technology. In 1982,

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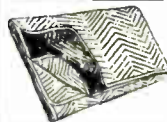
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LIVE SOUND

the program made radio history when it was transmitted across the Atlantic Ocean live on a transatlantic digital link. In 1984, the system won the Armstrong Foundation Citation for Technical Excellence. Every year, Smith and his crew pour their guts into this broadcast.

"I could have the BBC send a tape over on the next Concorde—it would be a lot less nerve-racking," Smith admits. "But this program must be experienced live. This is one of the world's best choirs, in one of the world's best spaces. We get letters every year from people who really appreciate knowing they are part of the live service. It's worth all the effort."

The audio signal follows an incredible path from King's Chapel to radios in the U.S. The service is mixed by the BBC's Julian Walther, in an Outside Broadcast van parked outside the chapel. The analog output of the OB van's mixer is digitized immediately by a Wadia Digital WA-4000 20-bit Reference A/D Converter. This A/D is as close to the audio source as it can get, and a paramount goal of the system is to preserve as much detail in the digital signal as possible.

The digital output of the Wadia is fed to the S/PDIF input of a Sony PCM-601 PCM Encoder. The 601, a consumer cousin of the Sony PCM-1630, converts PCM audio samples to a pseudo-video signal that's recorded onto conventional VHS, Beta-max or 1/4-inch U-Matic video-decks. The 601 is a mature device, using a Sony FI recording format that predates compact disc. The original idea behind the 601 was that video signals can be recorded and played back by conventional VCRs. But more interestingly, this video signal can be routed using the planet's normal video distribution networks.

The video signal output by the PCM-601 is transmitted via terrestrial microwave links from Cambridge to BBC Broadcasting House in London. The signal is

monitored at Broadcasting House, then sent on to an international satellite uplink station at Docklands, toward the east of London. From there, the signal is uplinked to a PAN AM SAT satellite and transmitted across the Atlantic to a satellite earth terminal in St. Paul, Minn. From there the data travels over a combination of fiber-optic and microwave links to MPR's Studio M in downtown St. Paul.

In Studio M, the video signal is fed to another Sony PCM-601, which outputs S/PDIF digital audio to a Wadia 2000 D-to-A Converter. The Wadia converts the PCM data back into audio, which is routed to a Neve V Series console. The underwriting credits and continuity are mixed into the program, and this final signal is provided to 225 other radio stations over American Public Radio's normal distribution system.

While it seems conceptually simple, there are a number of technical pitfalls that must be avoided in this process. Each year, Smith and his team carry out a number of prebroadcast tests to ensure that the transmission link will be trouble-free. This year's broadcast went off with no major problems. Smith and engineers Tom Mudge and Brian Kilian were able to relax in the studio and enjoy most of the Festival. Only one minor problem occurred about half-way through the service, when Kilian noticed the digital error level on the incoming signal was increasing. An adjacent data channel on the satellite was interfering with the signal and lowering their signal-to-noise ratio. Smith immediately called the satellite carrier, and the problem was corrected before it became audible.

Once you've experienced this system, it is hard to go back to the old way. Unfortunately satellite time does not come cheap, and it is certainly cost-prohibitive to use on a weekly basis. Other than "A Festival of Nine Lessons and Carols," the system has been assembled only a few other times to broadcast Garri-

son Keillor's radio specials from Europe.

USE OF DATA COMPRESSION

While much of the broadcasting community moves toward less-expensive transmission systems that use data compression, Smith is reluctant to use them on this program. "We did experiment with a data-compressed system in part of the path for our 1991 broadcast. We were disappointed with the sonic performance. The precepts of compression schemes are auditory masking methods, which are not kind to choral music. Choral music is so harmonically rich, there aren't many places to cut. And a lot of what goes away is the ambience of the signal. King's Chapel is a wonderful space—we want to preserve those ambient details!"

Smith's reservations are not limited, however, to the sonic quality of data compression. As with most new technologies, there are usually bugs in the equipment to work out and, with millions of people listening, Smith is understandably hesitant to try radically new techniques. He learned this lesson during that same 1991 broadcast. "The system crashed," he recalls, "making some rather loud pops about halfway through the broadcast. Fortunately, we had a non-data-compressed link in place that we were able to revert to."

Nevertheless, Smith is always under pressure to produce this program as inexpensively as possible. This year, Smith approached a number of international carriers to bid on the transmission. After explaining his needs, several carriers offered data-compressed transmission as an option to save money.

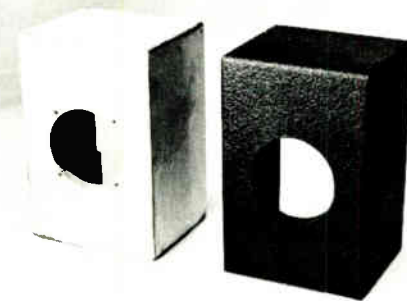
"When I replied that data compression was not acceptable," Smith says, "the reaction was nearly universal. It was as if I had denounced motherhood and the American way. I

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LIVE SOUND

was repeatedly told that the systems are digital and could not be detected, and that they all had many customers that were happy with it. Nearly everyone threw around the term 'CD quality,' which is a misnomer on two counts. First off, it cannot sound as good as a CD if there is a significant amount of data thrown away. The second, and perhaps more important point, is that the quality of the best CDs has improved dramatically in the past year or two, with the introduction of modern A-to-D converters such as the Wadia. When we say CD quality, are we talking about the CDs I brought home the day I bought my first CD player in 1984?

"Minnesota Public Radio uses a number of data-compressed systems on a daily basis," Smith continues. "Data compression does have its place; it can be a tremendous money saver, but none of the systems I've heard come close to being transparent. It's very hard to describe the changes that compression systems make, unlike evaluating a console or tape machine where you can say, perhaps, that the top end isn't right, or the midrange has a bit of edge to it. The sonic impairments of the data-compressed systems appear to be a moving target; the coloration changes with the music."

Currently, the international carriers do a better job transmitting video than audio. Transatlantic audio transmissions use an underwater fiber-optic link. Audio enters and leaves the service in analog format, and the link uses data compression that loses some of the ambient details. "The advantage of our system is we enter the digital domain several feet from the mixer in Cambridge and stay digital until we reach our Neve mixer in St. Paul."

All technical wizardry aside, Smith was most excited about the sound his system

delivered this year. "It was amazingly transparent, low in distortion and natural. I heard a greater dimensional sense to the stereo field. The sibilance of the choir was a lot smoother and natural-sounding. The IM we normally hear was missing. 'Sss' didn't sound like 'sch.' It was as close to what they were hearing in the Chapel as we could possibly get with today's technology.

"We have always placed our promotional emphasis for the annual Festival broadcast upon the music and the service. We've never promoted the broadcast as an audiophile event, though it was more so this year than any other. I'm confident that this was the best-sounding transatlantic radio broadcast that's ever been done."

In an age when professional audio manufacturers are scurrying to design local area networking and interoperability into new equipment, it is exciting to learn that these systems will not be limited to the "local area." Future sound systems will bust through traditional geographical boundaries. The ability to transmit high-resolution, uncompressed digital audio across the planet is a significant advance.

Ironically, this capability does not use some new whiz-bang device but, rather, off-the-shelf equipment that has existed for years. The system proves that ingenious application of familiar tools can expand the limits of what was previously thought possible.

And even more ironic is the fact that it is the world's oldest radio program that is pushing the technology-envelope into the future. This program is a historical, cultural, and technological wonder. Don't miss it next Christmas Eve. ■

Bob Moses is a senior digital audio engineer for Rane Corp. and a longtime participant in the AES computer control standards process.

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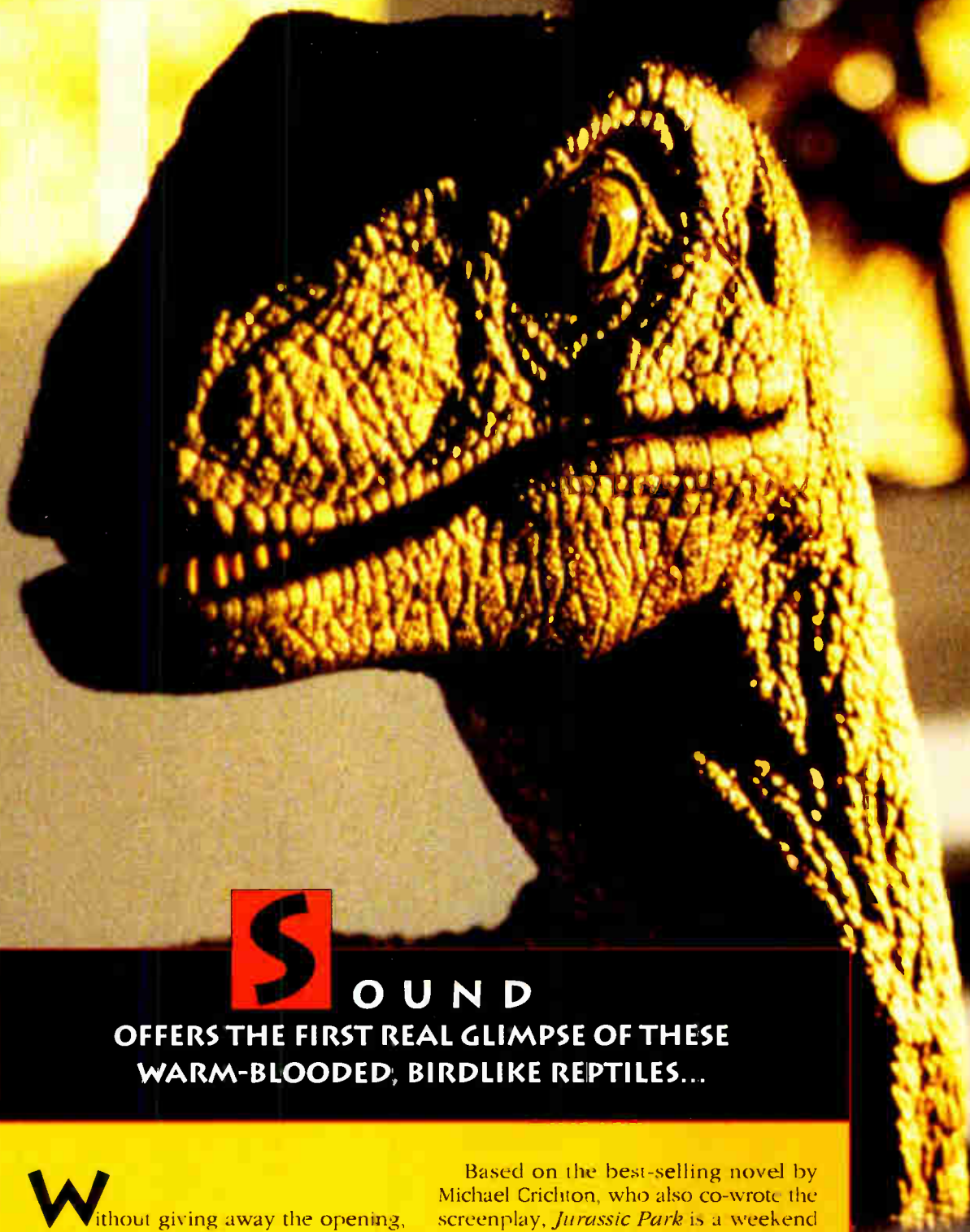
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Our heroes making their way back to Jurassic Park headquarters; velociraptor, pound for pound the most vicious animal that ever lived, says Crichton.



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Without giving away the opening, you're going to hear these dinosaurs before you see them. Whether it's the lilting melody of brachiosaurus, the vicious attack of velociraptor, or the earth-shaking footsteps of T Rex, sound offers the first real glimpse of these warm-blooded, birdlike reptiles at the center of Steven Spielberg's much-anticipated *Jurassic Park*.

by Tom Kenny

Based on the best-selling novel by Michael Crichton, who also co-wrote the screenplay, *Jurassic Park* is a weekend tale of an amusement park gone bad. Genetically engineered dinosaurs, the living heart of the world's most ambitious theme park, have begun to act unpredictably, so a team of specialists is sent to Isla Nublar for an assessment. None of them has yet *seen* a dinosaur. What follows is a two-hour, 14-reel roller coaster ride that is sure to be

PHOTOS: MURRAY CLOSE/© 1992 UNIVERSAL CITY STUDIOS & AMBLIN ENTERTAINMENT



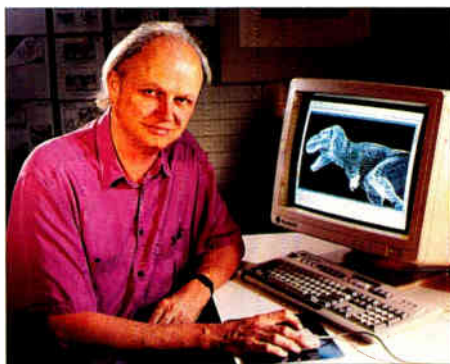
the box office splash of the summer.

"You don't see the dinosaurs as well as you hear them for the first part of the movie," explains sound designer Gary Rydstrom, "which is an interesting way to introduce their character. Spielberg and Crichton were very clever in setting up primal, scary situations where you can't really see what's going on, but you can hear it.

"In the case of the raptor, my first idea of its breathing was to have these reptilian, hiss-like, high-pitched breaths," he says. "But that didn't work so well, especially for scenes in which you don't see it, because you have no sense of size. If you just hear this little hissing, you think a snake is coming at you. So we went to these more horse-like breaths and snorts, which have a resonance, a resonant cavity that from breathing alone gives you a sense of size: It's much bigger. In this movie, we had to take into account not only how a particular sound matched the picture, but how it would stand on its own. Same with T Rex. You hear him roaring in the woods before you see him."

The dinosaur sounds—the hisses, breaths, screams, clicks, roars and grunts, referred to as vocalizations—were created over a six-week period in the summer of 1992. Rydstrom researched and worked up a library of interesting vocal effects, most recorded new by himself and assistant Christopher Boyes. He traded videomatics of works-in-progress with Industrial Light & Magic as they

At the SSL 5000 in Mix E, Skywalker Sound, are (l to r) Christopher Boyes, Gary Summers, Gary Rydstrom, and Richard Hymns. Not pictured: Shawn Murphy. (r): Sound Designer Gary Rydstrom (below) Visual effects supervisor Dennis Muren at Silicon Graphics workstation.



PHOTOS: SEAN CASEY / © 1993 ILM

built the visual effects; sometimes sound led picture, as with the brachiosaurus' fluid head movement above the trees, and often picture dictated sound, as Rydstrom admits, "There were lots of cases where I had interesting sounds, but they didn't match visually." Either way, the animators had dinosaur vocals to draw to, much as you record the voice of Kathleen Turner before finalizing Jessica Rabbit.

But the question remains: How does Gary Rydstrom know what a dinosaur sounds like? "The first reference I think has to be other movies," he says, "because there's a certain expectation for what stand-

ard dinosaurs, like a Tyrannosaur, should sound like. If I had him sound like a big, squawking parrot, no one would buy it. With the other dinosaurs, it really came from how they moved, which is what [model makers] Phil Tippett and Stan Winston and all the people at ILM were trying to come up with. They all looked like lizards, but there seemed to be a lot of personality in movement. Would it walk like a bird? Would it run like a horse?"

Actually, the first step was research. Rydstrom and Boyes, especially Boyes, spent hours in the field chasing down unique animal sounds and recording them

to a Sony 2000 DAT machine. An individual dinosaur may be made up of 25 to 30 different animal sounds, with four to six playing at any one time. For example, a T Rex inhale may include lions and seals and dolphins, while the exhale might be whale blow-holes and elephants. "I never create something from nothing," Rydstrom says, "because I don't do synthesis. Everything comes from sounds in the real world."

In this case, the real word ranged from a macaw farm to a cattle ranch to a "retired lion farm" to Marine World. "At Marine World [in Vallejo, Calif.] the trainer had me stand to the side by a box," Boyes explains, "and one by one these sea lions marched right up and went through a repertoire of about 50 sounds—the most amazing, bizarre sounds. Each one was completely unlike the others. They each did a solo performance into the mic, and they were better behaved than most people I've recorded in ADR. We also did dolphins, killer whales, baby elephants and mating tortoises."

The lions from Marine World weren't so successful because they

mostly traveled in groups, so Boyes went to Ron Whitfield's "Big Cat" park to record an unusual territorial lion bark he heard about. A geese hiss, used as part of the raptor's agitated breathing, came from an angry goose. And the sound of a herd of dinosaurs fleeing T Rex, what Rydstrom refers to as his "wild west" scene, came from a mini-cattle roundup on a Marin County ranch.

A whole story could be written on the raw material that went into creating the dinosaur vocals and movements. One of the more-interesting situations involved the owner of a reptile shop who came out to the Foley stages at Skywalker Ranch with animals in tow. "He brought everything from monitor lizards and iguanas to bull snakes and a 20-foot, 180-pound python," Boyes says. "From the larger reptiles we got these sort of crinkly, weird skin movement sounds. We ended up Foley-ing a lot of the movement, but there it was. We also got incredible hisses, including one from a rattlesnake that I believe plays with the dilaphosaurs—flanged."

Boyes could be considered an all-purpose recordist, as he also recorded the vehicle sounds, the rain and handled all the Foley. Rydstrom, he says, likes to have one person involved with the effects all the way through to the final. He uses the Sony DAT in the field, with Sanken mics for general-purpose situations and the Neumann KMR-81 for a close perspective and tighter matrix.

"I try to saturate—I would say saturate the tape, but I guess it's 'use up as many digits as possible' on the DAT—because I find that the harder you hit it, the better it sounds," Boyes explains. "Obviously, you don't have as much forgiveness working with DAT as you do with analog, because if you distort it, it basically becomes a nonusable sound. But I find that in almost every case you should go for maximum signal on the DAT because it becomes much heavier and sweeter."

Counting all the effects, not just the dinosaurs, Boyes, Rydstrom and supervising sound editor Richard Hymns ended up with 50 one-hour DATs to sort through. For the dinos, Rydstrom then set about creating and combining on the Synclavier by sampling the sounds and developing a massive library—everything from 50 different isolated horse breaths to

screaming birds and elephants.

"I would then start playing with combinations, literally playing," Rydstrom says. "It's very easy on the Synclavier to instantly combine stuff, play it backward, play it at a different pitch, and start seeing that maybe if you add an alligator growl with an elephant trumpet and a camel, maybe that would be interesting. It's like cooking.

"You choose the ones you like and spread them out on the keyboard," he adds. "There are four levels on the keys of the Synclavier, and usually at no given time is a dinosaur made up of more than four

animals. A lot of times I put things together with the idea of having something with low end, mid frequencies and high frequencies. Or something with a strong attack and something with an interesting middle. I spent most of last summer finding these combinations, naming them, then storing them for future use. It was a very accessible library that was easy to edit with and easy to perform once picture came in.

"The most time-consuming dinosaur was the velociraptor because these vocals come out of the creatures' intelligence and personality," he continues. "T Rex's personality is



"The music business has really gone to the dogs. Time was when leftovers at the studio really amounted to something. Burgers, steaks, meatloaf. Those were the days! Now it's tofu salad and watercress. Pathetic. My Alpo is looking better and better. Well, at least the sounds are cool."

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pretty much hunt-and-kill, so it pretty much roars and sniffs. The raptor hunts in packs and has communication skills, so there has to be intelligence in its voice as well as scariness. Breathing is one animal, screams are made up of geese and dolphins. There's a penguin, an African crane, sea otters. The guttural clicking is a friend of mine, Dietrich, so there's some human stuff in there, too. The reason it's made up of 25 animals is that it does so many things. It would have been great to go out in the real world and find an animal that was 'the raptor,' but no animal is ever that interesting."

While the rest of the film was edited conventionally on mag, the dinosaur vocals were edited and premixed in the Synclavier, mainly to avoid the massive tape library that would have been needed for all the variations on mouth movements and breathing. "It's very easy with digital editing to choose the pace of breathing that leads into the next roar," Rydstrom says. "You have 'roar-inhale-exhale-inhale-roar,' so it fits like a jigsaw puzzle. Sometimes you type in the time code number and have it

happen at a precise time. And sometimes you perform it on the keyboard until you get a performance you like. And once I got a section I liked, I would mix it—pan it, add echo and mix it right there, because my room is both an editorial room and a full-fledged mix stage."

The editing and mixing of the dinosaur vocals took place from February to April while the editors worked on the rest of the units. But before that, in early January, Rydstrom, Hymns and ADR editor Laurel Ladovitch flew to Los Angeles for a meeting with Spielberg and a first look at the whole film. They sat at the KEM for an intense six-hour session, looking at basically a locked picture, sans many of the computer-generated images, and listening to the A track. They had a breakdown of each reel by scene description, and they furiously took notes—all the Foley, dialog, effects and ADR questions answered at once. It was, Hymns says, a grueling day.

They returned to Skywalker with a dupe of the film and ran it through the KEM the following day, at a much slower pace. Rydstrom and

Hymns took more notes and further defined their duties, deciding on Foley moments vs. effects moments and the like. They then split up and broke down the bigger categories into details and timings. Hymns spent the rest of January gathering specific material in tandem with Boyes, mainly focusing on jeeps, rain and ambiances.

When it's raining in the film, rain is the ambience. The sound team was lucky in that right when they began gathering sounds, California ended its seven-year drought and it rained for a month straight. Some nights Boyes slept with his DAT by the bed and a long mic cable, essentially waking up to press "record." He also recorded rain on a number of different surfaces.

"Since there are rain sequences that go on for a long time," Rydstrom says, "we tried to vary the types of rain so that it isn't 20 minutes of pink noise. I learned on *A River Runs Through It* that anything with water and rain becomes difficult. It eats up the high frequencies, and it's difficult to mix. So the key to making it interesting, to propel it for-

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ward and make it all work, is to be constantly changing it—from perspective cuts, or as you move to different locations, to have rain on wood, rain on cars, rain on pavement, rain on vegetation, rain on puddles.”

“One of the first things we did once the effects editors came on in February was sit down with the four of them at an editing station and play the available ambiences one by one,” Hymns explains. “I know that no editor is going to listen to 100 backgrounds for the first scene. They listen to them, hear the one they like and move on. We wanted to use all of them. We didn’t want the same ambience turning up in several different places, or the same ambience at all. As much as possible, we wanted the editors to pick up a new ambience for every scene and make combinations, laying as many as six or seven in a given scene instead of one.”

These are jungle ambiences primarily (though the park’s master control room also is prominent in the picture), and they came from all over the world—Sri Lanka, Indonesia, Costa Rica, Hawaii. According to Hymns, this is where you begin building the tension that made the book a page-turning, one-day read.

“In some scenes you start off with this little pretty thing, and you know it’s going to get bad,” Hymns says. “So you just creep one [ambience] down and introduce another that has something else in it. It could be a raspy frog, or it could be a nighttime insect thing with a little electronic weirdness to it. If you just gradually take the birds out, the tension is already there.”

Rydstrom agrees: “But the trick in making things quiet,” he points out, “doesn’t mean that you don’t play any sounds at all. When things are quiet in a movie, it means that you’re hearing details you wouldn’t normally hear. If you’re trying to build tension out in the woods before a dinosaur shows up, you have everything get really quiet, then you hear leaves hitting the electric fence, or you hear certain birds, or you hear animals way in the distance, or you hear winds whipping around. It’s sort of a hyperawareness, like a drug state. Suddenly everything is incredibly sharp and detailed, but low-level. Those moments are tense.”

And those scenes are difficult to

design. As most designers, editors and mixers will attest, it’s not the big car-chase, shoot-em-up scenes that are difficult—they play themselves. But when there are only a few sounds, and everything is exposed, the effects have to be spot-on. For example, there’s a scene where raptors are stalking children through a kitchen. The raptor footsteps and their claw clicks are all Foley, masterfully performed by Dennie Thorpe. And the children’s breathing stands out as an element of terror.

“I had to place myself in the head of the dinosaur for that scene,” Rydstrom explains. “It was my job to

want to kill the children—which is certainly not where the audience’s head will be—only because I had to come up with the vocalizations. But the sound of the actors breathing is just as effective, if not more, than anything I could come up with. I wish I could design that. The kids in this movie are really good screamers, and there’s nothing more horrific than a screaming child. I can come up with the best dinosaur sound in the world, and it can scare the pants off you, but the sound of a screaming child is going to be more effective.”

Most of the screams were recorded in New York and LA. and ac-



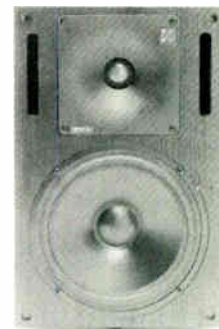
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ording to Hymns, the kids were terrific screamers. There were only 500 to 600 ADR lines, a tribute to a well-recorded production track. By contrast, *Backdraft* required 2,600 lines.

Jurassic is not a dialog-heavy movie, granted, and the production mix was delivered on DAT, with all the transfers taking place in-house. Ron Judkins recorded on location to the Fostex PD-2 time code machine and simultaneously to an analog Nagra. The Nagra reels were left in L.A. with Michael Kahn, the picture editor, so that he could work with last-minute changes.

When the sound editors came on in February, all the sound transfers were on the racks ready to cut. Pre-mixing began the last week of March and lasted about three weeks. The only real time crunch came in the final, and that was made easier thanks to the already-complete dinosaur vocals and the rather extensive work on the premixes.

"Instead of having all the effects on one premix, we have them on four, sometimes five, six-tracks," Hymns explains. "We generally put ambience on A, ambience-related

things such as individual birds or rain on D, my vehicle sounds on B, and the crashes and whatnot on C. The dialog will then be on two premixes, split into LCR, and the Foley will be on another.

"We found that even though we're using a little more premix stock," he continues, "we can avoid going back to the units for changes. The biggest nightmare for me is to try to keep a hundred units of effects in sync with an ever-changing picture. I can pull up a few individual units in an emergency, but I don't keep the whole hundred in sync any more, and I haven't for a long time. This way, if Steven says, 'The crickets are too loud,' they are on their own. If he says, 'The crash is too loud,' it's on its own. If he wants to hear more of the gear shift, it's on its own. That's the most important thing."

The premixes were finished on Friday, April 16, the same day Shawn Murphy flew up from Los Angeles with the music to join Rydstrom and Gary Summers behind the SSL 5000 for the final. Murphy recorded the John Williams orchestral score on the MGM (now Sony)

stage in Culver City, essentially making a live 5-channel submix that served as his premix. There was some interaction with the composer as the score was being developed, but for all intents and purposes, the final was the first time that the Skywalker team heard the music.

"This is a traditional and beautiful-sounding score," Rydstrom says, "and it creates a sense of awe that matches the classic beauty of the scenes. There's a certain majesty to it, and another part is very scary. It has to cover a broad range of emotions. Typically, music and effects people are in an unstated competition on individual scenes, but I've come to realize over the years that a good film score just makes everything I do sound that much better. And this is a very good film score."

Six days after starting the "first final," Rydstrom, Summers and Amblin Entertainment associate producer for post-production Colin Wilson flew to Paris with the complete film, minus a few visuals that were still coming in from Industrial Light & Magic. Spielberg flew in from

—CONTINUED ON PAGE 158

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Peter Gabriel's Explora



Brilliant

Media

for the

Real World



by Philip De Lancie

Half a decade ago, the most notable attribute of CD-ROM was its huge storage capacity. The ability to store the equivalent of hundreds of thousands of pages of text on a single inexpensive disc, accessed via a powerful database search-engine, was a dream come true for information-intensive businesses and governmental agencies. But while it was possible to accompany text with supporting graphics, significant limitations in both the CD-ROM drives and their host platforms (the computers to which the drives were hooked) made true multimedia delivery a difficult proposition.

In the last couple of years, many of the technical boundaries have been pushed back enough that some of CD-ROM's long-touted multimedia potential can begin to be realized. Better performance means improved

production values, which should in turn translate into new entertainment products and new markets. Computer- and video-game makers, drawing on their expertise in software pro-

gramming and interactivity, have been busy applying this theory. If consumer response to Sega CD is any indication, their efforts are likely to be well-rewarded.



A sampling of screens from an Explora prototype (clockwise from upper left): Bamboo harp from Madagascar from a section on musical instruments; drummers from Burundi at the WOMAD festival; a screen on the song "Digging in the Dirt" showing the music video with accompanying lyrics; and a menu of musicians from the Real World recording week.



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About HyperCard and QuickTime

HyperCard is a software tool for the Macintosh in which a system of virtual "cards," organized into "stacks," may be used to create an interactive database. HyperCard allows the creation of navigational links between cards that are activated by clicking on the screen or other user action. Sophisticated onscreen manipulation of the data stored in HyperCard is possible by writing "scripts" in the HyperTalk authoring language.

Since the data accessed in HyperCard may be text, graphics (static or animated) and/or audio, the program is a powerful authoring tool for interactive multimedia. External video files may also be imported and played in an onscreen window within HyperCard, normally in the form of QuickTime "movies." QuickTime is Apple's software-based system for integration and playback of time-related data—including video, audio and animation—on the Macintosh and Windows platforms.

As for the music business, the big players appear to be preoccupied with their traditional core markets, which dwarf the nascent CD-ROM trade. At the same time, significant barriers remain to the widespread dissemination of entertainment via CD-ROM. So there hasn't exactly been a stampede of major labels embracing the idea of record industry-oriented multimedia products. Even so, an advance guard of multimedia boosters is hard at work awakening the music industry to the potential of the new technology.

Current activity in this area is diverse, including a series of *Make My Video* titles for Sega CD (featuring artists like Marky Mark, INXS and Kriss Kross), a sort of musical Lego album from Todd Rundgren due out on CD-I, and reported interest in interactive multimedia on the part of Prince. Also in development is a title for a newly created multimedia division of Real World Records, Peter Gabriel's world-music-oriented label. The disc, entitled *Explora*, will be released this fall. Designed for the Macintosh and Windows platforms, it is expected to carry a suggested retail price under \$60.

The idea behind *Explora* originated with multimedia producer Steve Nelson, who runs San Francisco-based Brilliant Media. Nelson comes to multimedia with a background he describes as "eclectic." In college, he studied architecture, psychology and linguistics, each of which still influences his approach to interface design. He also took an interest in database programming. After graduation, he moved to Los Angeles and developed some entertainment-industry

credentials, working as a writer and director in the broadcast television and industrial video markets.

Nelson eventually combined his skills in programming and writing, leaving Los Angeles to build a career in software documentation in the San Francisco area. The move led him first to Claris, where he worked on HyperCard-based interactive help for the company's software products (see sidebar above), and eventually to projects for Apple and CNN, including an interactive newsweekly.

THE MUSIC-MULTIMEDIA CONNECTION

It was the various projects with Apple, says Nelson, that "really got me thinking about multimedia and gave me the skills to actually do something. So I started thinking about what is going to make the field take off. And I decided that music was going to be something important that multimedia could hit in a mass market."

With that in mind, Nelson began experimenting with multimedia albums. "I did a Peter Gabriel album without ever having met him," he says. "I picked him because of his association with technology, and the fact that his audience is the same as the owners of CD-ROM drives. And I love his music.

"I just took his stuff and made a prototype of what I thought a music album should look like," Nelson continues. "I did a sort of MTV on a disc thing, seeing what could be done to make multimedia that the mass market might appreciate. I took it around to several people who saw it and liked it, and one of them knew Peter and his manager, so he hooked me

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up with them. They were very interested, and it took off from there.

"The intention of *Explora*," says Nelson, "is to give a hands-on experience of the creative process of music, especially world music. A lot of it is, of course, about Peter and his recent album. But that ties in with all these musicians and influences from all over the world.

"The disc is your chance to wander around the studio and see what you find, or wander around the map of the world and see what you find in different parts of the world. You can see all the things that go into the making of an album behind the scenes, in recording sessions and the creative process of writing songs. Hopefully, through the interactivity, it will give you the experience of actually doing some of it."

This interactivity is what will distinguish *Explora* from the long-form-music-video genre. The user will be the navigator, deciding where to go and what to see and hear at any given moment. In keeping with the theme of exploration, not all of the user's choices will be evident at first glance. Unlike most educational, training or reference-oriented multimedia titles, where clarity is perhaps the most important consideration in interface design, parts of *Explora* will be more analogous to a treasure hunt, with a click here or there revealing hidden layers.

"We called it *Explora*, because we want people to have the experience of exploring this world of music," Nelson says. "Because of that, the interface is very graphical, and more cryptic than usual. There are some icons across the top that make it very easy to navigate around the main menu structure. But in general, you interact with the objects on screen directly, rather than having a lot of buttons and menus. And things are not always identified onscreen. You have to dig around a little."

Peter Gabriel's music from the album *Us* is one area for exploration. "There is a section about the album where every song is illustrated and talked about," says Nelson. The works commissioned by Gabriel from international artists for use in the audio CD insert booklet are the starting point for the illustration of each song, supplemented by additional artwork, some hidden below the surface. "When you come to an artist's work and click on it," Nelson ex-

plains, "things happen that you uncover on your own.

"There are other sections," Nelson says, "about the three songs that have videos: 'Steam,' 'Digging in the Dirt,' and 'Blood of Eden.' They have more depth, with parts about the making of the videos. Each one also has a unique part that talks about something to do with the development of the music or the visuals or the meaning behind the song. And then there are sections on Real World and the WOMAD (World of Music Arts and Dance) festival."

The section on Real World's annual recording week illustrates the variety and flexibility that interactivity allows. Each year, Gabriel brings the label's artists from their homes around the world for a week of cross-cultural pollination at the Real World recording complex in Bath, England. The massive jam session, with artists playing together in all different combinations of styles and instrumentation, is recorded and videotaped.

In *Explora*, users will be able to access these performances by clicking on any number and combination of artists' pictures on a menu screen. A QuickTime movie showing the selected configuration playing together will then appear in an onscreen window. Elsewhere in the Real World section, a click on an artist's instrument will bring out a movie showing how the artist makes the instrument himself. The user will also be able to "play" various instruments to see how they sound.

Another exploration is a self-guided tour of the Real World facility itself. Starting with debarkation at the compound's riverside dock, the user may wander about, opening doors of the various buildings and seeing what is inside. The section is a set of movies linked by decision points at which the user chooses which way to go via a compass represented at the bottom of the screen.

USERS AND PLATFORMS

A crucial part of planning what the content of *Explora* would be and how it would be accessed was to define who is the expected user. Reflecting the still limited number of multimedia-capable CD-ROM drives in the hands of consumers, Nelson says, "Our target audience is the people who have the equipment to play it. We hope that in the future this expands to a much wider audi-

ence. But for today, it is the people that have these systems. And maybe if we are lucky, a few people will be so excited about this thing that they will actually want to go out and buy CD-ROM drives, so we can actually expand the audience.

"This fall," Nelson says, "you are going to see hundreds of thousands of CD-ROM drives sold, and many computer companies are coming out with boxes that are much more targeted at the consumer audience." In Nelson's view, the computer-savvy consumers who will buy these drives are demographically compatible with the fans of Gabriel's music.

Further down the road, Nelson

**An advance guard
of multimedia
boosters is hard
at work awakening
the music industry.**

says, "The audience is going to change radically. It's going to move away from, forgive me, the sort of computer nerd audience to the average person in their living room where they have their stereo and TV set. That is when this will turn into a mass market. I see that happening within the next five years."

As the multimedia market grows, the channels available for distribution will evolve as well. But for now discs are marketed through a combination of mail order (publisher-direct and through distributors) and retail. The retail channel is far less developed and focused than that of the record and video industries, with some discs sold in software stores or by computer dealers. Are such arrangements appropriate for a music-oriented product like *Explora*?

"We have one of the major CD-ROM distributors," says Nelson, "so *Explora* will certainly be in all the places that you would expect to find a CD-ROM today. But we are also working on getting into all kinds of new places including record stores."

Initial versions of *Explora* are planned for both the Macintosh- (HFS format) and IBM-compatibles. The compatibles need to be MPCs, meaning they are running Windows and are equipped with sound and video cards conforming to the industry's

"Multimedia PC" standard. The Mac version will run on any color-capable model. The window size has been kept small enough to work even on Apple's 12-inch monitor or a PowerBook.

As for the drive requirements, Nelson says it will not be necessary to own one of the new generation of double-speed drives. "We are trying to hit everybody, so it will play on the older drives: any drive out there."

Nelson is coy regarding future versions for other platforms, including some of the stand-alone (TV-hookup rather than computer-hosted) machines that have been introduced or announced. "We are just going to focus right now on getting these first two versions out," he says.

"Obviously in the future we are going to want to develop for whatever platform is successful. It might be Sega-CD, 3DO or more Apple or Windows stuff. And more likely than not, it won't be CD-ROM for that long. It will turn into interactive television and other distribution mechanisms. The focus will be less on CD-ROM *per se* than on interactive entertainment in whatever form is best for getting it out to your audience."

PRE-PRODUCTION

As required by the multidisciplinary nature of multimedia production, Nelson has assembled a diverse creative team to bring *Explora* to life. The group for building the Macintosh version includes two production artists, an interactive programmer, a C-level programmer, two production assistants, a tester and a production manager to coordinate the whole process. Additional people will be brought onboard when the project is ready for porting into the MPC version.

The first phase of the team's work began with research. "I try to learn as much as I can about the clients and their needs," Nelson says. "For an entertainment project like this, you also need to look at what the artist has done and what kind of material (video, music, graphics, lyrics, etc.) is already available to work with. In this case we have an artist with a very well-established reputation and all kinds of very interesting material in his archives."

Brainstorming also plays an important role early on. Working with Gabriel's people in England, Nelson recalls, "we all sat down together and threw out hundreds of ideas. I sat down with Peter several times to talk

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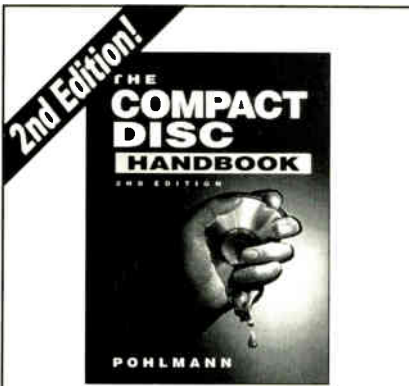
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*In Most Cases

about what he wanted to see. He was the driving force behind making this a hands-on look into the creative process.

"After we gather this immense pile of ideas and materials," Nelson says, "we make outlines. I use a program called *Inspiration* that has a standard text outliner, which you can flip into a networked tree structure to move things around and connect them in different ways. Another way is to put everything on Post-It Notes, put them up on a big board and start moving them around."

The point of all this, says Nelson, is to "look for patterns in the material—perceptual patterns or metaphorical patterns. Good interface design takes advantage of subtle connections that can make smooth transitions between all the pieces and provide a framework so people can understand the material better."

With an initial outline in place, Nelson and his team developed a prototype. "We shot some things at Real World," he says, "and took some of the existing materials and began doing interface mock-ups to see what ideas would work and what wouldn't. For the prototype, it's not important to have every instrument, for instance, in the instrument section. It's important to have one that you can go to and see how getting down and back through the menu structure works, and whether people get excited about it. Does it work conceptually, and is it entertaining? We continue to make those evaluations throughout the production process, with alpha testing and beta sites."

In the case of *Explora*, the prototype also served a less creative but equally crucial purpose. "We wanted to come up with a really good prototype that we could show to potential distributors," Nelson says, "because as a parallel track to production you need to work on funding the project and getting distribution for the discs."

As ideas tested in the prototype were edited and refined to create a working concept, scripting and storyboarding for the final production began. "Each screen had a sketch of how it would look long before we brought anything into the computer," Nelson says. "Ideally, you want to spend months, if you have them, doing all this planning. Then the actual production can go very quickly.

"If you just dive in on the com-

puter," Nelson continues, "it is going to take months to finish, because you haven't thought it through carefully first. Even when I think I've done enough planning, I always realize that I could have done more. You will be a much happier person if you storyboard down to the last possible detail."

PRODUCTION AND TESTING

After storyboarding, production began on some of the material created specifically for *Explora*. Video was shot for the studio tour segment, as well as interviews with Gabriel and others. The backdrops for many of the screens will be still frames from these videos, while others will use photographs shot separately.

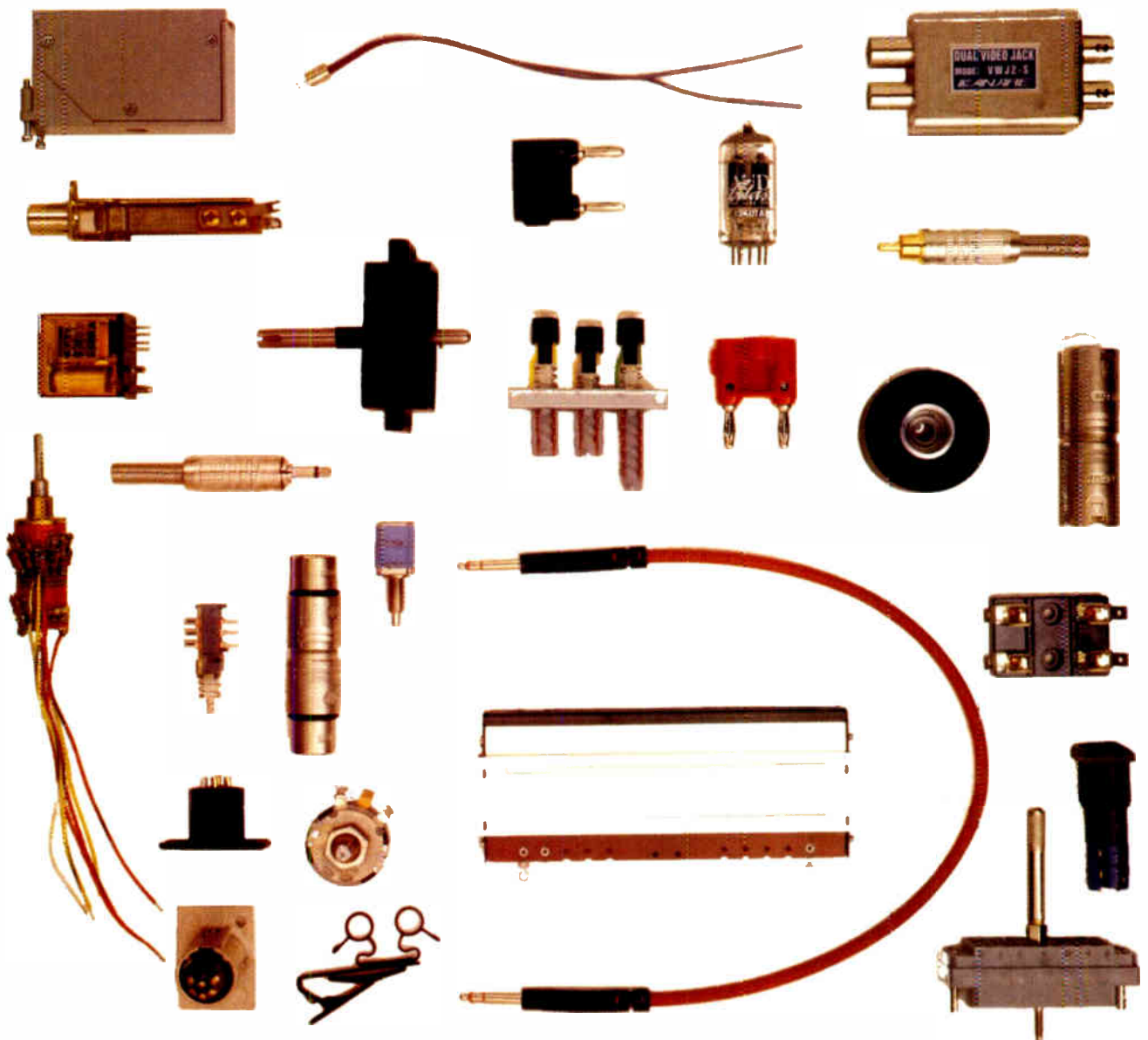
Most of the audio in *Explora* will

**"The audience will move from the computer nerd to the average person within five years."
—Steve Nelson**

either come from pre-existing audio sources (such as *Us*) or will be tied to pre-existing or newly created video elements. So little audio-only work was involved in the production phase.

As of this writing, the project is moving from production into post-production. All the various media elements, pre-existing or created for *Explora*, are prepared for use on the Macintosh development platform. That involves scanning photographs and illustrations and digitizing video. Using programs like Adobe Photoshop, scanned images are cropped, retouched, color-corrected, and filtered, where appropriate, to create special effects. Video elements have largely been edited on tape in England before digitization, but Nelson and his teams also use Adobe Premiere for further editing directly on the computer.

As for audio, some is already in the digital domain, while other elements need to be converted. "We get in all kinds of audio," Nelson says, "much of it on videotape, some on DAT. Ideally, we want to do everything at the the highest possible quality. We are dealing with playing back



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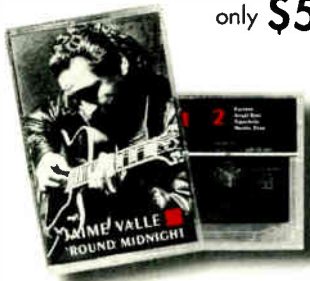
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8-bit/22kHz (sample rate) mono sound on the Mac, but there are ways to equalize it and process it so it plays back a little bit better through those tiny speakers. We do that in Sound Designer II, so whenever we can we digitize to 16-bit/44.1 kHz using the Digidesign Audiomedia board. Then we downsample and sync the sound back up with the video when we import it into a QuickTime movie."

Not all audio gets the Sound Designer treatment, however. "Depending on which computer we are working at and what the purpose of the audio is," Nelson says, "we may use the built-in sound on our (SuperMac) Digital Film card. And occasionally we use the built-in sound on the Mac or the MacRecorder system." Whatever the input route, the resulting sound files may then be edited for their intended role in the project.

"We have a lot of sound loops in *Explora*," Nelson continues, "that are taken from various sounds from around the studio and clips of songs. These audio clips are used for transitions (between screens) and also to provide some ambience on menus and other places where there isn't a lot of action going on. They will be played as QuickTime movies that have no video. You don't see a movie on the screen, but you use the same kind of QuickTime timing capabilities." Because QuickTime enables control over the time base of the sound, such audio-only movies can be used to make onscreen events occur at specific times in a song.

Once all the pieces are together and in the appropriate format, the authoring process can begin in earnest. "We take all the elements," Nelson says, "and combine them using our proprietary HyperCard-based authoring system, which is what drives *Explora*. All the interactivity is programmed in, all the elements are laid out on the screen, and all the aesthetic decisions that we made earlier are implemented. That goes fairly quickly, though someone using HyperCard without our system or using MacroMedia Director would be spending a lot of time programming all the elements, determining their timing and how they all hook up together."

When authoring of the initial version is complete, the project will move into the testing phase. "Our tester," Nelson says, "goes through every possible place on a disc in

every possible combination and tries his best to make it crash or not work. We will also be doing user testing, where we send the disc out or bring people in to play with it. We can pick a sample that represents who we are trying to hit when we market the disc." Because CD-ROM drives are so much slower than hard drives, the program will be recorded on CD-Rs to ensure that the testers are seeing what the end-user will see.

The user testing, a continuation of the evaluation process that began with the prototype, will allow user feedback to be incorporated into refined versions at the same time that bugs are found and corrected. After many cycles of testing and revision, when no further problems can be found, the program will go to the CD plant for mastering, replication, packaging and eventual distribution.

This basic outline of the production process would be pretty much the same for any interactive multimedia project. But certain aspects make *Explora* stand out for Nelson: "As an entertainment product, *Explora* has a very different focus from a lot of the other CDs out there. And because it is one of the first music projects, we are really pioneering something. We have to think about how we make music interactive in ways that are going to appeal to people."

Nelson sees parallels between this early stage of multimedia in music and the early days of music video: "It's even the same deal with the record companies and musicians. Some people get it, and they are right on top of this thing. Others are saying it's not going to happen. But look what happened with video: It took off like crazy." Nelson expects multimedia music to follow a similar course.

"I think interactivity will have a huge impact," he says. "Audio CDs will not go away, but this will be a whole new way for artists to present their work. When double-speed drives become prevalent, you will be able to have full Red-Book audio plus quality video running at the same time. So it may be that in the future audio CDs will come with a multimedia track built into them. I believe that Peter Gabriel would like much of what he does from now on to have these multimedia elements built in, and I think a lot of artists will go that way." ■

Phil De Lancie is a mastering engineer at Fantasy Studios, Berkeley, Calif.

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World Radio History

by Camran Afsari

BRIAN ENO

MIXING THE INGREDIENTS OF POP IN CULTURE'S CAULDRON

Brian Eno makes no secret of his trust in the oblique laws of constant mutation. Now entering his third decade of distinctive work, Eno has a seemingly boundless reserve of energy for the myriad projects he tackles, whether solo albums, collaborations, producing other artists, composing for film, lecturing, experimenting with video paintings or designing audiovisual installations. His governing aesthetic has remained consistent through the years: to superimpose unrelated ingredients of pop culture to create new music and art forms.

Eno rejects the absolutist notion that there are "correct" ways of doing things, preferring instead to revel in his own special definition of "pragmatism," which is simply, "learn and enjoy from all the *different* ways we can do things." Obviously, he must be doing something right: He has enjoyed both popular and critical success throughout his career—his Grammy for co-producing U2's *Achtung Baby* (with Daniel Lanois) is just the latest and perhaps most prominent honor to come his way.

His career started with a teenage interest in electronics. While studying at Ipswich Art School in England, he appropriated the only available tape recorder to capture (at low speed) the inherent resonance of a certain metal lampshade while a colleague read some poetry in the background. The education continued in later years when he became an experimental electronics dabbler/artist, in the avant-garde tradition of Andy Warhol, John Cage and Cornelius Cardew. Eno recognized and became fascinated by the haphazard nature of untraditional, nonclassical music when jamming with the Portsmouth Sinfonia of quasi-competent musicians—many years later this highly influential musician continues to say

that his own purely musical abilities are about as good as a 9-year-old's.

In 1971, he ran into an acquaintance on a train: Andy MacKay was an experimental saxophone player starting a band called Roxy Music. MacKay in-



vited Eno to play his band's neglected synthesizer. Not being a synthesizer player, Eno agreed, and for two notable albums he worked with the pioneers of style-conscious romantic art-rock. Onstage with Roxy Music he easily played the role of the glam-rock hero (he had more and longer hair then). And in the studio he began to establish his well-known technique of

PHOTO: PETER ANDERSON

using sensitive electronic treatments of instruments to decorate recordings.

Eno departed Roxy Music in 1973 to begin recording a string of solo albums. *Here Come the Warm Jets* and *Taking Tiger Mountain by Strategy* showed his ability to sing quirky, animated and energetic pop tunes. *Another Green World* and *Before and After Science* are immensely charming records made up of compositions that could emanate from real or imagined images of pastoral landscapes. They best exhibit Eno's trademark minimalist nurturing of a given musical moment: The music seems to effortlessly inhabit a space somewhere on the periphery of sound and silence, yet it is still completely engaging.

In 1975, he developed a set of cards called "oblique strategies"—over 100 possibilities to alleviate a state of musical uncertainty. Similar to psychoanalyst Carl Jung's belief in the Tarot for synchronicity and meaningful coincidence, Eno provided himself with a rather convenient method of making artistic decisions. The cards can provide specific technical guidance such as "consider a different fading system," all the way to the seemingly absurd "look closely at the most embarrassing details and amplify them." The fatigued engineer may prefer to pull the card that says "go outside and shut the door."

Also in the mid-'70s, Eno started exploring the relatively unknown territory of ambient music. His curiosity about this artform was piqued after he studied the passive ways in which people listen to music. He found, for example, that people would come home, put on a record, often at volumes that are unobtrusive, and then simply go about their various domestic tasks. The music itself was not (always) a focal point for the listener, and so it could be administered as a single component of the overall "landscape." Eno's ambient music series was designed to mesh with other attributes of any mood-altering environment—the temperature, the color of wallpaper or even a certain fragrance in a room. (Actually, Eno has long been a collector of perfumery materials.)

The malevolent reaction of the British music press to Eno's ambient recordings is part of what drove him to live in New York for five years in the

early '80s. Ironically, today "ambient house music" is quite the rage on dance floors in Britain. Bands like The Orb make quiet but danceable synthesized music that has been lauded by the same tough British press for its "Eno-esque drift." Needless to say, Eno feels vindicated by this turn of events.

The discovery of strange and interesting "accidents" is common in his work. In what seems to him a lifetime ago (1980), he collaborated with David Byrne to release *My Life in the Bush of Ghosts*. This album featured prerecorded Middle Eastern and North African vocal performances, fused to mainly Western musical elements, in particular electronic rhythms, to form an intriguing mixture of sounds and cultures.

As a producer, Eno has helped chart musical directions for some of rock's cardinal artists. In the late '70s, David Bowie was so inspired by Eno's *Another Green World* that he asked Eno to work with him: The results of the partnership were some of Bowie's most adventurous albums, *Low* and *Heroes* (both recorded in Berlin), as well as *Lodger*. Bowie once said of working with Eno: "It was a bit like being four years old again and having a rather fun uncle who could produce coins out of his ear." Eno became the "fifth" Talking Head for a couple of years, producing *More Songs About Buildings and Food*, the groundbreaking *Fear of Music* and *Remain in Light*. For the Akron spud boys known as Devo, he produced their 1977 debut, *Q: Are We Not Men? A: We Are Devo!* The same year he also produced Ultravox's first record. For U2, Eno and Lanois have shared the role of creative guru on three albums—*The Unforgettable Fire*, *The Joshua Tree* and *Achtung Baby*. About Eno, U2's Bono notes, "With him we discovered the spirit of our music and a new confidence in ourselves."

Until recently, the diversity of Eno's work left him with little time for recording his own material. In the past few years, he's been invited by universities to lecture on topics like high art vs. low art, and corporations have paid him handsomely for talking about subjects such as the future of culture. Still, last fall he put out his first solo album in seven years, *Nerve Net*, on his own Opal label, distributed by

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Warners. Not surprisingly, the CD is a conglomeration of genres. He's always enjoyed German electronic music, Miles Davis and Jimi Hendrix. On this recording, those influences are combined into a unique blend of jazz, techno-dub, hip-hop and post-funk. Guest appearances are by guitarist and longtime collaborator Robert Fripp of King Crimson, and Led Zeppelin's John Paul Jones, who adds his panache on the piano. Eno isn't known as an authority in dance music; however, a couple songs on *Nerve Net* are infectious enough to oscillate the hips of the most jaded rave dancer.

In 1985, he visited Moscow where he met painter Sergei Shutov. Eno was impressed by his work and pleased to find out that some of Shutov's paintings were made to the accompaniment of his records. Released since *Nerve Net* but conceived well before, Eno's current instrumental recording, *Shutov Assembly*, departs from jazzy influences and returns to a style more consistent with his previous ambient releases. This recording includes heavily treated synthesizer patches that are dense in texture, almost glacial in their speed and simultaneously haunting and attractive.

Brian Eno is a figure who could easily peak the reading on the proverbial "cool-o-meter." But he is cool with a difference; as he once said of U2, Eno is positive where cool is cynical, involved where cool is detached, open where cool is evasive. And his overall demeanor is broad-minded and modest. After I arrived at his retreat in a not-so-fashionable area of north London, with impeccable politeness he excused himself for a few minutes to go put the final touches to a letter he was composing for his godson. The adjacent room offered little besides a beautiful carpet, on which I sat counting the endless row of DATs on the marble fireplace, until we were ready to have a go at figuring some of it out.

Mix: What is your strategy for sound design? How did you approach programming synthesizers to get sound textures for the compositions on *Shutov Assembly*?

Eno: Most of the sounds are made using previous patches. When I decide what sort of a sound I'm looking for, I go to patches somewhere in that area and then modify them. I

rarely employ the same sound twice with this approach. I haven't used a "preset" sound for a long time—at least some kind of tweaking is always necessary depending on what the piece demands.

I think it's unfortunate that the people who build synthesizers never have enough time to program them. I was saying to Yamaha once that their mistake was in thinking that they are the ones who design these instruments, when in fact the designers are the people who use them. The manufacturers provide us with a box of possibilities—a sound kit. I'm generally critical of how difficult it is to access the various functions on these devices. Yamaha told me that 80 percent of

My preferred way
of working is to fiddle
about with a piece of
gear until I discover
something unique.

the synthesizers they receive for service haven't at all been reprogrammed. That's no surprise, because they are hard to program.

I made a suggestion for the developers to design an interface that uses a hierarchy of often-used functions. This will allow common functions to be easily accessible. They said that's great, but how would we know which functions are most used? I said first, by using a musical common sense. Second, I suggested installing a sound chip that would record the usage of the synthesizer over time. In a few years, you would have a history or picture of its operation, and so you would know which buttons were pushed most frequently.

Mix: How can engineers become experimental in their work? How might engineers get tangible results without getting too obscure or into "left-field" and risk wasting studio time?

Eno: That depends on the way engineers define their job. In the past, engineers had a very limited sense for their job: They made sure that clean, undistorted signals were recorded on tape. Early in recording history, these fellows were just a subset of the whole

recording process. In a way they were indifferent to the band; they were not even encouraged to be interested in the music itself. Here in England, the first engineers used to wear lab coats—their job was purely technical. So engineers expanded the definition of their work, beginning with: "I should be in record when the band is ready to record and not still pissing about with mic levels." [Laughs] By now, the best engineers have left the subset and come into the superset of the recording process: Their interest in the music is acute, and they are producers as well.

There are many levels at which an engineer can experiment. Twiddling the pots, boosting and fading tracks are authentic methods of experimenting. Or you could begin to experiment at the very deepest levels, such as German engineer Connie Plank used to. He would question just about every aspect of recording and consider how else it might be done. Connie invented the first automation I ever saw. He had the German optics company Zeiss develop a lens for a special camera that was installed in the ceiling above the console.

This lens was designed to take a photo of the console at the end of a session, which would later be used to make a transparency. The neat thing was the camera had a double function: It was a projector as well. So you could slide the transparency into it and project the original photo back onto the console. Then it was a matter of moving the faders and pots onto the projected shadows, which were the settings of your previous mix. This was quite cumbersome, but I thought it was a brilliant idea.

Connie set up an experiment with a special monitoring system as well. During the '70s, we were working at his studio outside Cologne in the German countryside. He built a little radio transmitter in the studio to broadcast on a specific frequency to a receiver he'd set up in his car. After a day's work, we would go out for a drive, and he'd leave the assistant behind and say, "Switch the tape on in about 25 minutes." So we're driving along, and suddenly the song would come up in the middle of our conversation. This was an incredibly useful diagnostic tool, because listening to a mix in that context—mono in a car, where you're used to hearing finished material—allowed us to immediately tell what doesn't

work and what needs to be changed. **Mix:** What is the difference for you between working purely technically or purely musically? How do you compromise in yourself the technical musician with the musical technician?

Eno: My preferred way of working is to fiddle about with a piece of gear until I discover something unique. It's exciting to find a great sound when you're just confronting novelty. I like to find out about things by actually using them. I'm really hopeless at sitting down and reading about how things work. Manuals are usually difficult to read. You have to flip into a different experiential mode to read them carefully. It's a distinct mindset to be studying line by line, understanding cause

The best experiment
with vocals is to
trick the vocalist
into thinking you're
not recording.

and effect, sequential, and so on. That's when it becomes purely technical. Sure you have to do it sometimes, but it doesn't always mix very well with the musical idea you have in mind. Many high-tech devices are designed for the Japanese who have the patience to read the manual for weeks even before they take the unit out of the box. But some people are lazier—won't read instructions—and want action quickly, and that's exactly the sort of manual that I want. I'm not interested in reading what isn't immediately necessary. I'd prefer equipment to be designed for people who are as impatient with the whole process of learning them as I am.

Mix: The manufacturers should write a technical addendum for users who want to look into advanced or esoteric features, and provide an "easy" manual for a quick start-up.

Eno: That's how the documentation for the Eventide H-3000 series is. I think the Eventide and its manual are fabulously designed. I've taken that piece of gear to studios many times, and I've found that other people can immediately start to work with it. They've built the unit using echelons

of functions, so the parameters you're most likely to change in a program are easily evident. In fact, I wrote Eventide a letter commending them on the design of this machine. Presuming they received the letter, they never replied. Maybe they thought I was trying to get a free unit [Laughs], even though I said I wasn't interested in getting another one.

Mix: How important to your ambient work is the psychoacoustic awareness that people don't always plant their ears in between the speakers of their stereo and give their absolute attention for the duration of the song?

Eno: I think most music, until very recently, was not aware of this. It was based on the old model that people would come home and plant themselves between speakers as if they were watching a movie. Engineers would set up a "stereo field" as if it were a picture to scan, with things on the left, over in the corner, in the middle, and so on. This was really for lack of any other paradigm to work from. Before, it was considered somewhat of an insult to the music if you didn't give it your full attention. So I said, well, let's forget about being insulted. People don't always listen so attentively; they use music in many different ways.

I've always said that thrash music and heavy metal are the closest relatives to ambient music because they both have a strong immersive quality to them through which the listeners can lose themselves. With metal, you walk into a musical landscape that's tremendously aggressive and as loud as possible. The narrative details are pretty irrelevant—it doesn't matter where the song is going or what it's saying—you just want to be inside it, and that's really the way ambient music is as well.

Mix: I sometimes listen to CDs with the random or shuffle function set on. Do you enjoy the different "feel" an album has when you hear songs juxtaposed in a unique order?

Eno: One of my themes these days is that artists will be offering people a bundle of possibilities they can sort out themselves, and not just one narrative for them to go through. Listeners will have control over the sequence and will act the role of a curator by programming only what they want to hear. In the future, blue-light CDs will have playing times of up to four hours. It's unlikely for most bands to make a CD with four hours of dif-



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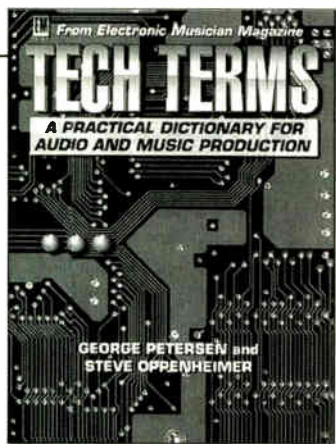
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ferent material. But what this does allow is a release with all the alternative songs and rough mixes and versions to be included.

It's rather like going to a great retrospective exhibition of some painter's work. You'll find the sketches and studies and the different versions of paintings, sometimes you'll even see other artists' copies of the painting. I really like this idea of a great big space filled with all the ideas that surround a piece of work. And often you'll find that you prefer certain phases to the finished work. It's similar to the way demos sound so good and have something in them that you can never capture in the final release.

So it would be neat to go out and buy a CD and for the first 40 minutes or hour it's just like an album. But then, you have six alternate versions of track 4 and rough mixes of the two earliest demos of track 6, one with a different vocal and so on. To me, this would be very interesting, especially if you're using shuffle.

Mix: From my understanding, you're not very keen on vocal recording. Do you prefer working with instruments and other sounds, or have you valued the results of any particular vocal experiment?

Eno: The best experiment with vocals is to trick the vocalist into thinking you're not recording. [Laughs] I'm always terrified of the moment I get into vocals with a band. Suddenly the door seems to shut on having a good time. It becomes an endless grind through listening to a thousand different versions of the vocal until everyone's exhausted and nobody can judge. In my experience, it's crucial to capture the vocal when it's still fresh in the mind of the singer. You can often hear this when vocalists are trying their first takes on a song; it can have a certain magic and you know it's the take you're going to use. With good singers, there's very little difference between one performance and the next. Good singers are good at it. They can go on all year doing different versions and some may be slightly better than others, but if they are good, then all the versions are usually acceptable.

I think there's a real problem when you give so much attention to just one aspect of the song; it creates an imbalance of emphasis. Sometimes you have a situation where an

instrumental performance has been kept because it's energetic, rough and full of strange and unusual creativity. And then on top of this you can add a perfectly tailored vocal, where every line has been taken from a different performance and added together. This always sounds bad to me, because I can hear a stylistic clash between the instrumental and vocal performances.

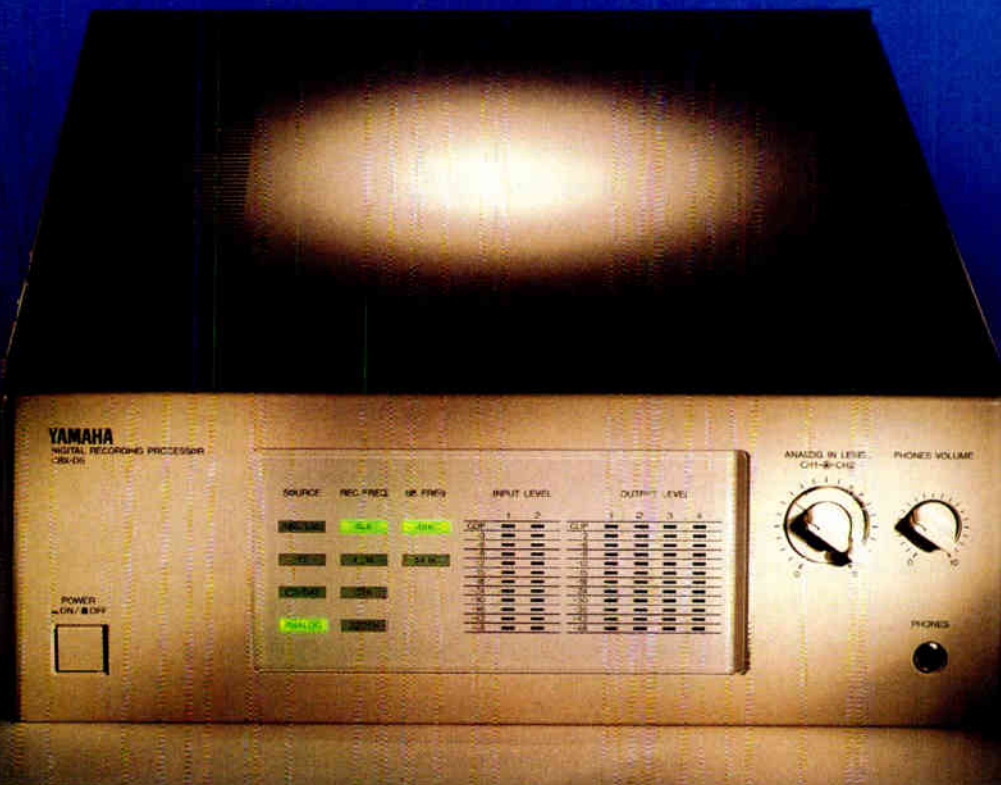
Also, preparing the session is an important aspect of vocal recording; I learned this from Dan Lanois. Engineers should always be set up and ready for a singer before they arrive, so as soon as the vocalist walks up to the mic and sings the first word, they think how fantastic it sounds and all they want to do is go straight into a performance. The first thing an engineer says to a vocalist should not be: [talks in a geeky voice] "Can you give me a sound on the mic please? What's the loudest you think you're going to be singing? A little reverb? A little echo? How are the headphones?" And all of that stupid nonsense. You should take care of setup with an assistant before the vocalist arrives. Get the proper levels, add whatever EQ and other treatments you have in mind so that it's ready. I think this can motivate the singer when she immediately hears herself sounding really fabulous and then just wants to sing.

Mix: Have you considered doing any live performances of your work, or is the studio the extent of your musical territory?

Eno: What I hate about gigs is the idea of people coming to a place for a short period of time, and in this short period of time you have to compress all these things that you've done into a show for them. I think I would be happy to perform if it's a different situation. Let's say I was in a loft in New York for two weeks. And for 10 hours or 12 hours a day there's always something happening; some of it live and some of it not so live. I would prefer to treat it like a museum or a gallery. Not like a gig these days where people pay far too much money and the artist has to do something super-special and highly concentrated. People should not be herded in and out. They can come and go as they please; it would be worth staying for just 20 minutes, or they would be welcome to stay as long as they like. ■

Camran Afshari is a freelance writer and recordist based in San Francisco.

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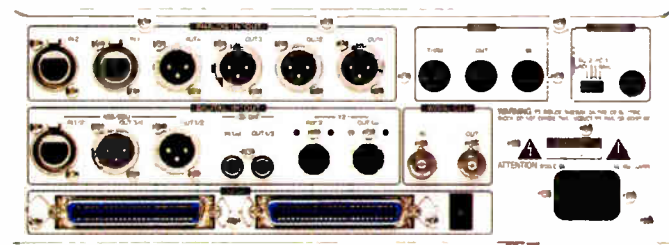
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C O A S T

L.A. GRAPEVINE

by Fred Jones

There was quite a bash at the Record Plant the other night. As part of the ongoing 25th anniversary celebration, they hosted a gala photo exhibition by none other than *Mix*'s own Mr. Bonzai! The display featured his extensive collection of musician photos and some wonderful shots of monkeys. The only trouble was in telling them apart in some of the photos. Oh well. Among the 200 or so luminaries from the recording scene who attended were Ed Cherney, Nicolette Larson, Russ Kunkel, Van Dyke and Sally Parks, as well as

—CONTINUED ON PAGE 155

Master multi-instrumentalist David Lindley and microphone-man/guitar player Stephen Paul record basic tracks for a Beachwood Records release at Built On Dreams (Studio City, CA) with custom modified microphones.



SESSION SPOTLIGHT

by Mel Lambert

DIGITAL POST FOR "FRIENDS & LOVERS"

Among this year's crop of new TV pilots was *Friends & Lovers*, a real-life drama series from Bunim-Murray Productions, the company responsible for MTV's *Real World*. The new show is designed along similar lines to *Real World*, and includes *cinema verite* glimpses inside the lives of featured families. The show is shot on Betacam and posted on D2 at Hollywood Digital. According to Andre Perreault, the facility's Audio Division Director, production audio from the *Friends & Lovers* shoot was recorded directly to the Betacams; during digital-to-digital transfers of audio and video to D2 work reels, the audio was resampled at 48 kHz, the D2 standard.

"We then performed the online edits in one of our D2 component video rooms," Perreault continues. "At the same time, production dialog and time code were retrieved from the Betacam reels and transferred digitally into our SSL ScreenSound at 48 kHz, for conforming to edited picture.

"We also transferred ambience from the Betacams directly into ScreenSound," he continues. "I could then begin my dialog premixing to a D2 workprint of the online edit, using time code references from the imported EDL.

"Meanwhile, our other ScreenSound handled music editorial and premix from CD and time code DAT libraries, as well as sound-effects assembly/premixing using an extensive library recorded on magneto-optical platters.

"Once the music and effects premixes had been built to picture, we transferred the *Friends & Lovers* pilot to the Scenaria room," Perrault adds. "The sound file elements and some automation data generated by the ScreenSounds were called up via SoundNet [file transfer and communications network]. Previously, the edited D2 video reel was transferred digitally onto the Scenaria's VisionTrak hard drive, to provide random access to both sound and picture.

"We could then mix directly to picture, using the Scenaria's built-in 38-channel digital console, integral 24-track audio recorder [laid out as three 8-track DME submixes], plus assignable digital EQ and dynamics sections. The final stereo mix was then laid back digitally at 48 kHz from the Scenaria to the D2 master for distribution.

"So, from Betacam reels through digital music and effects sources, the project was handled entirely within the digital domain," Perrault continues. "Aside from the quality difference in avoiding multiple generations of analog transfers onto and off tape, we were able to seamlessly access sound files via SoundNet without having to reload sound reels. That function alone saved us a great deal of time in preparing the pilot.

"Also, if we ever need to go back into the project and make any changes, everything is stored in what SSL refer to as Project Files. Total digital is the only way to go!" ■

C O A S T

SESSIONS & STUDIO NEWS

by Jeff Forlenza

NORTHEAST

Last month, I reported that Soul Asylum and producer George Drakoulias were working on a benefit album entitled *Sweet Relief*. Now Lou Reed has added a track to the benefit album, which he recorded and mixed at the **Magic Shop** in NYC. Here's a little more info on this interesting benefit album: The project on Thirsty Ear Records is a benefit for singer/songwriter **Victoria Williams**, who was diagnosed as having multiple sclerosis. The project includes a wide variety of acts—from Lucinda Williams to Michelle Shocked, Matthew Sweet to Pearl Jam—all performing songs written by Williams. For the Lou Reed sessions at the Magic Shop, Reed co-produced the Williams-penned tune with Mike Rathke, while Steve Rosenthal engineered and Joe Warda assisted... J. Mascis of Dinosaur Jr. was at **Wendell Recording Studio** (Wendell, MA) recording and mixing a song ("Keeblin") for his next release. Mascis self-produced the sessions for Warner Bros. with engineer Tim O'Heir and assistant Mark Allan Miller... The Smithereens locked out **Crystal Sound** (NYC) for several weeks to record their upcoming album for Capitol Records. The marathon sessions were engineered by Larry Burksbaum and assisted by Sean Coffey...

SOUTHERN CALIFORNIA

At Saturn Sound in Burbank, producer Scott Hakwith was mixing the latest Ramones release with engineer Trent Slatton... Redd Kross was at **NRG Recording** (North Hollywood) laying down tracks for an album on the PolyGram European label This Way Up. Kross produced with John Agnello co-producing and engineering. NRG house second, Wade Norton, assisted...

Stephen Paul started recording his latest release for Beachwood Records at **Built On Dreams**, the microphone-modifier/guitar-slinger's project studio in Studio City, which is equipped with an Allen & Heath CSM-32 console and Fostex 1-inch 24-track recorder. As would be expected, all the mics used were modified 1-microns. Paul produced and engineered the sessions with Scott Swink assisting. Guest musicians included the virtuosic **David Lindley** on violin, saxophonist Scott

—CONTINUED ON PAGE 157

N.Y. METRO REPORT

by Dan Daley

West 48th has radically changed in the last several years as music stores Manny's and Sam Ash branched out into pro recording and related equipment, challenging the status quo in New York. Now Sam Ash has acquired two more substantial spaces on

—CONTINUED ON PAGE 156



Blues great B.B. King brought some special players along with Lucille to Fantasy Studios in Berkeley, CA, recently when he tracked and overdubbed his latest MCA Records release. Guest musicians included John Lee Hooker, the Robert Cray Band, Joe Louis Walker, Roy Rogers and Kim Wilson. Eric Thompson engineered with Richard Duarte assisting. Pictured in the back row (L to R) are Eric Thompson, Nina Bombardier and Richard Duarte. In the front row (L to R) are Andy McKaie, Denny Diante and B.B. King.



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World Radio History

—FROM PAGE 152, L.A. GRAPEVINE

Warners' Bob Merlis.

While we're on the subject of the Plant, I received a letter from Ron Lagerlof of Visioneering Design Co., who informed me that I had inadvertently left out his name when covering the installation of the new rooms. I am sorry for this omission, and let me correct it here and now (as opposed to later and there) by reporting that Ron was involved in the Record Plant installation in various ways, including the monitors and electrical system.

We now go across town to Alpha Studios in Burbank where chief engineer Denny Shaw came up with a unique adaptation to their AMSV Calrec console. The new interface he developed includes all tape transport control, fader and mute automation functions normally found on SSL G Series consoles. This will allow the engineer greater flexibility and familiarity in perfecting a mix on this terrific-sounding console. They are so proud of this new interface that they would love to have engineers and producers give them a call to try a test mix.

Back in good old Hollywood, there have been some personnel changes at

Waves: Beth Merritt is now the studio manager, and Gary Littell moved over from SSI to join the engineering staff; they also opened Studio F for commercial production. And that's not all: Two of their AMS AudioFile Classics have been upgraded to AudioFile Plus 16-tracks, so that the 8-track Plus won't be lonely. Waves is also a founding member of the new Digital Patch network, and they have some *big* news.

As of now, Digital Patch and Entertainment Digital Network (EDnet) have joined forces to create the foundation of what will hopefully become a global digital audio highway. This system (in case you don't know about it) is a fiber-optic communication network capable of high-fidelity stereo transmission and reception of digital audio signals.

Digital Patch has been in operation for some time now at Waves in L.A., Howard Schwartz in New York, Chicago Recording Company, Digital Music in Toronto, Music Annex in San Francisco, Joe & Co. in London and Stellar Sound in Australia, to name just a few of the studios on the network.

The EDnet system was beta-tested successfully at Skywalker Ranch, among other facilities. EDnet has moved to its

own facilities in the heart of the advertising and multimedia district in San Francisco. For more information, turn to Chris Stone's "The Operator" on page 88.

And now for some "quick bits": Tri-Star Pictures has finished remodeling its four screening rooms on the Sony Pictures lot. This remodel included acoustic revisions to conform to the latest Dolby, ISO, SMPTE and THX standards. The sound system was designed by the Sony Post-Production Engineering group.

Also on the Sony lot, the Cary Grant Theatre was remodeled while maintaining a busy dubbing schedule. The trickiest part of the job was to update the interior without changing the famous acoustics. No small task. The acoustics consultant on both of these jobs was Smith, Fause & Associates.

Well-known mastering engineer John Matousek (formerly of Motown/Hitsville) has opened a facility in Hollywood called Masterworks. Michele Stone (formerly of EMI studios) has joined him as an engineer. They recently added a Marantz CD-Recorder so that they can offer single discs to go along with complete mastering for CD



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If you would like to have something included in this column, send it to me, Fred Jones, 859 Hollywood Way #128, Burbank, CA 91505. ■

—FROM PAGE 153, N.Y. METRO

Manhattan's Gear Street: the former Alex's Music and the former McAnn's Bar locations. According to Barry Horowitz, Sam Ash's senior director of operations, discussions are under way within the company to decide which departments would expand where, adding that the computer department probably would get a stand-alone location. Commenting on how the retail business on 48th Street has changed along with the technology, Horowitz says, "There's much more interdependency between departments than there used to be—between keyboards and MIDI and computers and recording."

Like a Phoenix from the ashes? Not quite. Lots of rooms, but smaller ones, is the motif for the new BMG Studios, which replaces the classic large studios left behind at RCA's old location on Sixth Avenue. The new facility, in a building purchased by BMG at 1540 Broadway, was expected to have opened in late May, although that may change, according to studio manager Don Frye, who acknowledged that construction was "way behind." Tracking and mixing were due to cease at the old site on March 31.

The new facility will open with seven identical tape-mastering rooms, two tape duplication rooms, a CEDAR suite, and one large and one small mix room. According to acoustician Francis Daniel, senior associate at Shen, Milson & Wilke, the primary design and consultation firm on the project, the large mix room measures 30x30 with an all-glass, primitive-root diffuser rear wall—offering a 30th-floor bird's-eye view of Manhattan and absorption below 50 Hz. RCA's Neve VR Series console is in the room, along with B&W 801 monitors loaded onto movable, noncoupled isolation stands.

Mid-sized Baby Monster Studios has done an in-house customization of its vintage 32-input Neve 8036 desk. Chief tech Dave Gravereaux removed the patch bay and redesigned the monitor section for in-line operation, opening up space for 24 more inputs and adding 28 API EQs in the process, as well as expanding the aux sends from four to eight per channel. "We were getting a lot of sessions lately that were more than 24-track," says studio owner Steve Berg. "This was an effective way of adding more inputs while still having a classic board." Baby Monster is also adding mastering capability with a Digidesign ProMaster system.

Platinum Island purchased a pre-owned Mitsubishi X-850 digital multi-track earlier this year, then updated the Flying Faders automation on the 8128 Neve console, according to studio owner Richie Kessler. The studio's SSL has a G Series automation update on order. And Kessler bought ten Sphere Eclipse EQs, which are divided between the facility's two recording rooms and one MIDI suite.

Reversing that high-tech trend, though, is Platinum's recent acquisition of a seriously vintage Ampex ATR-102 1/2-inch, 2-track deck, at least two decades old. The classic deck has already been used on a classic act: Deep Purple mixed to the deck recently. ■

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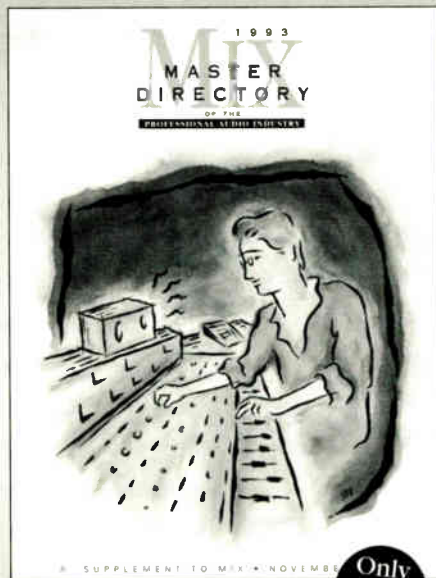
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Page and drummer Henry Newmark... Wendy MaHarry was at Blue Moon Studio (Agoura Hills, CA) doing overdubs for her A&M release with producer/engineer Dwight Marcus and assistant Joe Primeau...

SOUTHEAST

At Miami's Criteria Recording Studios, Gloria Estefan returned to track a Spanish-language release with the production team of Emilio Estefan, Jorge Cassas and Clay Oswald, and engineer Eric Schilling and assistant Mark Krieg... Also in Miami, Studio Center hosted Asia as they recorded tracks with producer Geoff Downes and engineer Chris Rutherford... Adolescent rappers Another Bad Creation recorded vocals for an upcoming Motown release at Atlanta's Doppler Studios with Dallas Austin's Production team (Tim Kelley and Bob Robinson) and engineer Neil Pogue. The song is tentatively titled "My First Kiss," and it was recorded on two Otari MTR-9011s...

NORTHWEST

At Coast Recorders (San Francisco), The Breeders, featuring Kim Deal, were in for six weeks with engineer/co-producer Mark Freegard and second engineer Andy Taub in Studio A as they tracked their latest for 4AD. Also at Coast, bass player Michael Manring tracked for Windham Hill with Tim Alexander of Primus on drums... Digital Underground was mixing some new tunes for TNT Records at San Francisco's Different Fur Recording with producer Gregory Jacobs, engineer Daren Harris and assistant Mark Slagle... And at Alameda Digital Recording (Alameda, CA), Bay Area rockers Ariel cut remixes from their *International World* CD for European release. J.J. Jenkins engineered...

SOUTHWEST

Lynyrd Skynyrd were at Rivendell Recorders (Houston) performing an acoustic set, which was engineered by Jeff DeVerter, for a live broadcast on Houston's KLOL (FM 101.1)... Contemporary jazz group Dr. Bombay recorded their debut album (on Indio Records) at Apache Tracks Studio in Tempe, AZ, with producer/engineer Steve Reid (of the Rippingtons) and assistant Scott Nowak...

NORTH CENTRAL

At Chicago's Soundworks Recording & Production, the Phantom Helmsmen

recorded and mixed a single, and Die Warzau mixed four songs... Rock legends Cheap Trick recently completed pre-production recordings for their upcoming Warner Bros. release, with engineers Jim Johnson and Mark Peabody at The Noise Chamber recording studio in their hometown of Rockford, IL...

STUDIO NEWS

Studio 19 in Nashville purchased the first Trident 90 Series console in the U.S. to replace their Trident 80B console, which will go next door to Studio 20. The new Trident will interface with the Studer recorder at Studio 19, which has a clientele that ranges from Garth

Brooks to Dolly Parton... The Russ Berger Design Group recently completed the Center For Music Business at Belmont University in Nashville. The facility will be available for student and faculty recording projects and will be used for classroom and laboratory instruction... Pro audio manufacturer Digidesign (Menlo Park, CA) installed a D&R Orion Series console into their in-house recording studio... The Walters-Stork Design Group completed the acoustic design of the 8,000-sq.-ft. audio recording and rehearsal complex at The Finger Lakes College in upstate NY. The facility includes an expansive performance area. ■



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Poland, where he's filming *Schindler's List*, and they met in a dub stage for a run-through. Spielberg talked into a dictaphone as the reels ran, noting changes.

It went amazingly well, Rydstrom says, and Spielberg's notes were very specific: taking music out or moving it to some other point; this effect should be replaced by something more like this effect later on; this T Rex vocal is really great, see if you can use it in this other scene. They flew back the next morning and checked off the changes one by one. Because they knew in advance that it would be a tight mix schedule, Skywalker installed Neve Flying Faders automation on the SSL specifically for this film. Fixes were made back in the original premixes, and the automation saved a great deal of time in translating the changes to the second final. Two weeks later the group flew back to Paris with the "final final," complete with final picture. Ten days after that, on May 18, the first print master was sent to the lab.

By all accounts, it was an unbelievably smooth post-production process, mainly because there were minimal picture changes following the initial January KEM screening in L.A. Everything was on-time and under-budget, and the editors even got to eat lunch. As Rydstrom says, "This really feels like a film made by people who have been doing it long enough and know their craft well enough that it's really efficient. Obviously, these are people who know how to make a movie, from pre-production, through production, and into post."

More than one person has said that this movie will do for computer-generated visuals what *Star Wars* did for the photo-chemical special effects process. And many people will judge this film on how "realistic" the dinosaurs appear on screen, not realizing, at least consciously, that sound contributes to the equation.

"I know what film sound people mean when they say that their job is 'to not be heard,'" Hymns says in summary, "and I agree with that to a point. But there's also a time when you want to be heard. I think when you have a visual of a dinosaur on-screen that lives, and is really there, your sound has to be equally astounding. Otherwise, people are

going to stop and think about it. You don't want them questioning how this was done until they're out in the car and say, 'Wait a second, these things don't live. How did they do that?' You don't want that going

on during the movie. I think the sound has to be balls-to-the-wall to match the visuals, and certainly for the dinosaurs that's the case." ■

Tom Kenny is a Mix associate editor.

DTS Digital Audio Playback on *Jurassic Park*

About 1,000 theaters were expected to be equipped with a special CD-ROM-based digital sound playback system in time for the release of *Jurassic Park*. According to Terry Beard, president of Digital Theater Systems (Westlake Village, Calif.), two replay formats are offered: DTS Stereo for 2-channel, matrix-encoded releases, with an additional subwoofer channel; and DTS-6, a 6-channel configuration offering LCR, split surrounds and subwoofer.

According to *Jurassic Park* sound designer and re-recording mixer Gary Rydstrom, mixing for the new format is no different than mixing for 70mm split-surround. "In the room format, you're listening to left-center-right and left-surround, right-surround," he says. "You have, essentially, a 5-track mix plus a boom channel, so it's six discrete channels. No matrixing or anything like that. The difference between this and standard 70mm Dolby is that there is some matrixing that Dolby does with 70mm where the low-end information on the split-surrounds is actually contained on a mono-surround channel. We're going to have a hard time when we finally come around to mastering this film for a traditional film optical, as opposed to what we're used to listening to, which is 20 dB of headroom and discrete channels, and really deep low end and everything else. There's so much of it that we're going to have to squeeze onto the regular optical track. It's frustrating. This movie in particular really needs that low end and that dynamic range if it's to be articulate. I mean, the

essence of the Tyrannosaurus vocal is that it's subharmonic, and it shakes your chest. That's the kind of thing that you would lose going to see this in a theater with a traditional sound system as opposed to the 6-track sound system."

A special time code stripe added to a conventional stereo optical print provides frame-accurate synchronization to DTS decoder units, which connect to the CD-ROM drives. According to Beard, extensive tests have shown that the extra time code stripe is transparent to all but the most misaligned projectors, insuring compatibility of the optical print with conventional systems.

Audio data compression on the CD-ROM discs is provided by Audio Processing Technology's apt-X 100 codecs. The data is received via SCSI and processed by the DTS/DTS-6 decoder units. Outputs from the decoder units plug into a movie house's existing cinema processor. No special conversions are required to replay DTS films.

The 2-channel system requires a single CD-ROM drive and DTS decoder; the 6-channel version uses two interlocked drives (which use the new double-speed Toshiba 3401B mechanisms) and a DTS-6 decoder that is capable of playing back 3½ hours of multi-channel audio. DTS is offering the two systems to theaters at an introductory price of \$2,500 and \$3,500, respectively. Beard expects to see 2,000 DTS-equipped movie houses by the end of the year, and 5,000 by the end of 1994. *Jurassic Park* is the first of a new generation of releases from Universal that will take advantage of this new technology, which Beard expects to compete favorably with the Dolby and Sony systems.

—Paul Potyen



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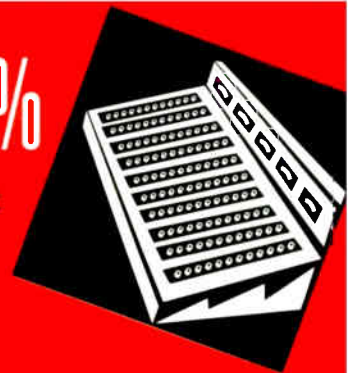
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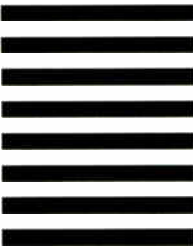


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RANDY ADAMS

Engineer & Producer

ADAMSOUND, 208 Moss Dr.; Cedar Hill, TX 75104; (214) 299-6465. **Specialization & Credits:** I specialize in organizing and recording large-scale live and studio productions, usually supervising audio-for-video, sound reinforcement and multitrack recording. From the initial planning to the release of the final product, your project will be in good hands. Some recent projects include the Alexandria Sanctuary Choir of Pathway Press, the James Robinson Bible Conference, the A/G Missions Project, the Freedom Concert, Hosanna/Integrity, Country Crossroads and many others. Also live mixing for special events and concerts, especially those featuring large choirs and orchestras.

RICHARD ADLER

Engineer

RICHARD ADLER RECORDING SERVICES, PO Box 21272; Nashville, TN 37221; (615) 646-4900; FAX: (615) 646-4900.

RICHARD ALDERSON

Engineer, Producer, Technician & Music/Computer Programmer
ALDERSON PRODUCTIONS, 95 Horatio St., Penthouse A; New York, NY 10014; (212) 691-0027; FAX: (212) 989-9794.

PHIL APPELBAUM

Engineer & Producer

THUNDER ORIGINAL, 5532 Amistad Rd. NE; Albuquerque, NM 87111; (505) 822-8273.

FRANK L. ARN

Engineer & Technician

BANTAM SOUND SERVICES, 11225 Magnolia Blvd. #308; N. Hollywood, CA 91601; (818) 907-5181.

EDDIE ASHWORTH

Engineer & Producer

BRUJD RECORDS, 2629 Manhattan Avenue #202; Hermosa Beach, CA 90254; (310) 318-1597; FAX: (310) 379-3758. **Specialization & Credits:** Izzy Stradlin and the Jujus Hounds, dada, Mary's Danish, The Charus, Jack's 'N' Joker, Dverpass, Great White, Missionarys, Geffen Records, IRS Records, Morgan Creek, SST, BMG, Capitol, Motherwit, Brujo.

BRITT BACDN

Engineer & Producer

6938 Rhea Ave.; Reseda, CA 91335; (818) 881-7308. **Specialization & Credits:** Former owner/manager/chief engineer (11 years) of Topanga Skyline Recording Co. Music director for Chad and Jeremy on British Reinvasion Tour 1986-1987. Albums: Bob Dylan, *Knocked*



ILLUSTRATION: BRAD HAMANN

Out Loaded, (CBS)(e); *Walking Wounded*, *Raging Winds of Time*, (Chameleon)(e); Steve Kujala, *Fresh Flute*, (CBS)(e); Fear, *New York's Alright if you Like Saxophones* (Slash)(e); Van Dyke Parks *Jump with Whoopie Goldberg*, (HBJ)(e); The Roadrunners, *Live* (Island)(e); Chicago, *16*, (Full Moon/Warner Bros.)(ae), TV/Radio/Films/Artist, etc: 3M "Steri St'ip Adhesive" (ce); AT&T "Pin Drop" (c); AT&T, "Card Shark" (c); *In Defense of a Married Man*; (Stan Getz)(e). Artists: Peter Cetera, Steve Vai, Whoopie Goldberg, Burgess Meredith, Ted Nugent, Robbie Benson, Dame Ma-got Fonteyne, Phil Hartman, Darryl Eilman; Producers: David Foster, Humberto Gatica, Davitt Sigerson, David Kahne, Jeff Eyrich; digital audio editor (Pro Tools and Sound Tools).

SUZAN BADER

Engineer, Producer & Music/Computer Programmer

D.S.M. PRODUCERS INC., 161 W. 54th St., Studio 803A 7 B; New York, NY 10019; (212) 245-0006; FAX: (212) 265-5726.

DEAN BAILIN

Engineer & Producer

4 CATS STUDIO, 325 W. 52nd St., Apt. 4H; New York, NY 10019; (212) 582-8663; manager: (201) 327-3698; FAX: (201) 327-5428. **Specialization & Credits:** 24-track 2" and 16-track 1/2", extensive MIDI setup, with large assortment of outboard FX, automated mix-down and digital editing with Sound Tools. Projects range from pre-production arranging to CD-ready masters. Full CD premastering. Specialized guitar preamps plus a large arsenal of synths and samplers are available. Vast professional experience as a synth/drum programmer and as a guitarist/arranger and songwriter. Is the featured guitarist on hit records such as *The Pina Colada Song* and *Him* for Rupert Holmes and numerous others covering many artists with a wide range of styles. Dean has produced many CDs and TV scores and a complete list of credits and equipment are available upon request. Primary objective is to aid artists in arranging/crafting their recordings to meet today's highest standards.



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STORM PRODUCTIONS. 10016 Balboa Blvd.; Northridge, CA 91325; (818) 886-3924.

GLENN E. BERKOVITZ, C.A.S.

Engineer
SPINNING REEL SOUND SERVICES. 11929 Windward Ave.; Los Angeles, CA 90066; (310) 313-2776 (L.A.); (914) 429-0493 (N.Y.); FAX: (310) 398-2776. Specialization & Credits: Specializing in audio—production and post-production—for film and television, I bring a thorough knowledge and complete technical inventory of analog and digital recorders and signal paths and a true love for the process to my work. Field mixing and production have been my mainstays. Now, Cyberframe, Waveframe and ProTools have brought me current within post-production processing. Together or separately, my production and post clients sound as good as they look—call them, and listen.

MICHAEL BITTERMAN

Engineer & Producer
MIDNIGHT MODULATION. 2211 Pine Ln.; Saugerties, NY 12477; (914) 246-4761. Specialization & Credits: Produced & recorded: *Woodstock-Moods & Moments*, *Woodstock Samplers*, *Five After Eight*, Denise Finley's *Company Wife*, *A Merry Meow Xmas*; engineered-NRBO, John Sebastian, John Hall, Jules Shear, Karl Berger, Jean Redpath, Priscilla Herdman. I own a 16-track digital studio, fully stocked with the best local Woodstock musicians.

ALLAN "BLAZE" BLAZEK

Engineer & Producer
PO Box 93265; Los Angeles, CA 90093; (310) 285-8490.

CARSTEN BOHN

Engineer, Producer & Music/Computer Programmer
BIG NOTE PRODUCTION. Schuetzenstrasse 89; W. 2000 Hamburg 50, Germany; (040) 850-1589; FAX: (040) 850-9490, 850-5102. Specialization & Credits: The most important service is the direct contact to all major German companies through 25 years in the business and personal experience from 6 years living and working in New York City, with Jan Hammer and others. Access to a top recording studio in Hamburg-Chateau Du Pape, 3 rooms with SSL G-Series, Neve Flying Faders, SSL E-Series, analog Studer 48-track, digital Sony 3348, own publishing and production company and label, Big Note Records, distributed by IMS/PolyGram (Germany). Get in touch!!!

RICHARD (RIC) BOWLS

Engineer, Producer, Technician & Music/Computer Programmer
IT'S ONLY PLASTIC, MUSIC. 600 E. Olive Ave., #109; Burbank, CA 91501; (818) 848-5059; (818) 901-6838. Specialization & Credits: Many years experience as engineer, synth-programmer and musician for records, television and film. Hundreds of credits. Records include Angel on PolyGram, Patti Austin, Black Tie featuring Randy Meisner and Allan Rich, Jacob's Ladder featuring Mike Guy and Chuck Wright, Gap Band, Oingo Boingo, Berlin, Donna Summer, Cher, Sparks, E.L.O., Michael Nesmith, Georgio Moroder, Lakeside, Diana Ross, Yarborough and Peoples, Denise Williams. Film work includes: *Darkman*, *Apocalypse Now*, *Halloween*, *The Fog*, *Robot Jox*, *Penitentiary III*, *Working Girl*. Television work includes: *War and Remembrance*, *MacGyver*, *China Beach*, *Star Trek: The Next Generation*, *Major Dad*, *Mission Impossible* and *Moonlighting*. Extensive sampling background over last eight years. Many Gold and Platinum record projects plus Grammy, Oscar and Emmy winners. Services: Built and/or designed several recording studios, MIDI studios, keyboard, guitar, bass, electronic drum and percussion rack systems for studio and touring musicians worldwide. Co-owner SENOIT Electronics, line of home and professional studio products. Teach at Grove School Technical Liaison for 1st International Music Festival from Beijing. Rates: Flexible, reasonable-to-exorbitant for all services, including production. Call for further details.

WAIN BRADLEY

Engineer, Producer & Music/Computer Programmer
MPL FILM & VIDEO (MEMPHIS). 781 S. Main; Memphis, TN 38106; (800) 467-5675.

TIMOTHY BRANNIGAN

Engineer, Producer & Music/Computer Programmer
BRANNIGAN MUSIC GROUP. 140 W. 55th St., Ste. 8-B; New York, NY 10019; (212) 307-5372; FAX: (212) 315-4723.

ALAN BREWER

Producer
BREWMAN PRODUCTIONS INC. 2121 Ave. of the Stars, Ste. 600; Los Angeles, CA 90067; (310) 551-5250; FAX: (310) 551-4144.

JAMIE BRIDGES

Engineer & Producer
340 Fillmore, Unit #1; San Francisco, CA 94117; (415) 552-4047.

HARRY BROTMAN

Engineer, Producer & Music/Computer Programmer
BROTMAN MUSICAL SERVICES. 19010 Avers Ave.; Flossmoor, IL 60422; (708) 799-7711.

CHRIS BROWN

Engineer & Producer
PERSON TO PERSON PRODUCTIONS. 342 Norfolk Rd.; Litchfield, CT 06759-0546; (203) 567-9012; FAX: (203) 567-7001. Specialization & Credits: On-location digital recording anywhere in the world. New on-location digital editing service utilizing Sound Tools, the premiere hard disk recording and editing system for the Macintosh. On-location "overdubbing": with unlimited available tracks and Mac instead of a digital multitrack. Person to Person Productions was founded in 1979; since then Chris Brown has produced and engineered numerous albums and CDs, as well as award-winning film, dance and television scores. These include fourteen albums for the Paul Winter Consort, including 3 Grammy nominees.

JEFF BRUGGER

Engineer & Music/Computer Programmer
HARD DISK CAFE. 432 Shadowood Pkwy., NW; Atlanta, GA 30339-2318; (404) 916-0520; FAX: (404) 980-9163. Specialization & Credits: Digital editing, CD premastering, radio production, music recording and Macintosh consulting.

SABRINA BUCHANEK

Engineer & Producer
Los Angeles, CA; (310) 822-5796; FAX: (310) 391-4620.

RICHARD JAMES BURGESS

Engineer, Producer & Music/Computer Programmer
7095 Hollywood Blvd. #104-345; Los Angeles, CA 90028; (213) 850-7337; 011 44 71-703-7677; FAX: 011 44 71-701-3216. Specialization & Credits: Producer, engineer, drummer, programmer. Credits: Spandau Ballet, King, Adam Ant, Five Star, Living in a Box, Colonel Abrams, Shriekback, When in Rome, Praise.

DOMINIC P. CAMARDELLA

Engineer, Producer & Music/Computer Programmer
SOUND DESIGN. 33 W. Haley; Santa Barbara, CA 93101; (805) 965-3404; FAX: (805) 966-9525.

CARL CANEJOY

Engineer & Producer
NEON CITY PRODUCTIONS. 627 Main St.; Simpson, PA 18407; (717) 282-0863; FAX: (717) 282-0362. Specialization & Credits: "Young Turk"—*Virgin N.E. 2nd Ave.* /Young Turk—"Tired of Laughing"—Geffen/Anthrax—"Spreading the Disease"—Island/Anthrax—"Fistful of Metal"—Megaforce/Anthrax—"Armed and Dangerous"—Megaforce/ Dreaming out Loud/ Neon City -St. James-Neon City/Roxx Gang-Love "Em and Leave "Em" Jailbreak-Neon City/Overkill-*Feel the Fire*-Megaforce/TT Quick EP-Megaforce/The Rods-The Rods-Arista/Wild Dogs-Arista-In the Row-Strapnel/The Rods Live-Combat/Let Them Eat Metal-Combat/Heavier Than Thou-Passport/Hollywood-Passport/Thrasher, Super Session-Combat/Violent Playground-Big Chief! Phil Arcadia-Chalice Evergreen/Rhett Forrester-Gone With the Wind-Shatter/Broken Dolls-Believe It or Not -Neon City/Apollo Ra-Ra Pariah-Shatter/Exciter Violence and Force -Megaforce/Savoy Brown-Live in Central Park/Helstar-Combat/Blue Cheer-The Beast is Back-Megaforce, Dreaming Out Loud-Then I Woke Up/Neon City. World-class production; sensitive to artist's goals. Publishing. Looking for strong new artists. Full in-house 24-track facility with lodging.

DAVE CARLOCK

Engineer, Producer & Music/Computer Programmer
CARLOCK PRODUCTIONS. 1013 Lions Park Drive; St. Joseph, MI 49085-1020; (616) 982-1000; FAX: (616) 982-1001. Specialization & Credits: My productions combine musical integrity & commercial sense. I make records with vibe, depth and, when appropriate, humor. When you work with me, you get a songwriter, guitarist, bassist, keyboardist, arranger and singer (3 octaves), who has much sequencing & digital editing experience as well as 10 years scoring experience. Though pop, rock, R&B & jingle/voiceover production is my forte, I'm also experienced in grunge, country, rap & contemporary Christian. Credits: writer/arranger/producer/vocalist for two songs on Columbia Records artist George LaMond's *Bad of the Heart*. Have worked with Relativity Records artist Brian Chatton & TM Records artist Vision A.D. Although my 24-track, 6-room studio & I reside in Michigan, don't be skeptical! Working with my New York managers has gotten me progressively closer to an artist deal. Ask about package deals for recording here on the picturesque Lake Michigan beach, or I can gladly come to you!

STEVE CARR

Producer
EMPATH PROD. 18704 Muncaster Rd.; Rockville, MD 20855; (301) 948-6715.

JIM CASEY

Producer
AUDIENCE PROJECTS INC. 2700 N. Halsted; Chicago, IL 60614; (312) 929-8499; FAX: (312) 348-1598. Specialization & Credits: Currently producing Four on the Floor for an independent release, co-produced by Blaise Barton. Call for info!

JOHN R. CASTELLANOS

Engineer & Producer
EAR CANDY AUDIO. PO Box 11175; Chicago, IL 60611-0175; (312) 847-3937; FAX: (312) 822-9189.

CALL CHRIS STONE FOR BOOKING INFORMATION

213-465-7697

ALEX CIMA

Engineer & Producer

1501 E. Chapman Ave. #100; Fullerton, CA 92631; (714) 680-4959. Specialization & Credits: Credits include releases on domestic and international labels, all TV networks, independents, plus audio logos, commercials, film trailers, music videos and special projects for major entertainment companies. Author of *Click Tables: In Beats-per-Minute and Frames-per-Beat* (available through the Mix Bookshelf. Recent release as artist, composer, producer is *Heartrise* (ON-LINE Records), now in over 50 NAC and contemporary jazz stations in the USA. Services include audio recording/production, music synthesis, project troubleshooting, consulting and the use of a proprietary computer program for proprietary computer program for video/film footage-to-MIDI sequencer synchronization.

JUDITH E. CLAPP

Engineer

ENTERTAINMENT MANAGEMENT INC. 223 W. Alameda Ste. 101; Burbank, CA 91502; (818) 567-0040 FAX: (818) 567-1682.

BILL COBB

Engineer, Producer, Technician & Music/Computer Programmer SHERWOOD STUDIOS. 2899 Agoura Rd. #299; Westlake Village, CA 91361; (818) 410-0589.

STEVE COCHRAN

Engineer, Producer & Music/Computer Programmer

DALIVEN MUSIC. PO Box 398; Nolensville, TN 37135; (615) 776-5686.

SCOTT COLBURN

Engineer & Producer

AUDIO INTELLIGENCE/CONSULTANT'S BREATH. PO Box 45066; Seattle, WA 98145-0066; (206) 789-9634.

DON COLTON

Engineer & Technician

O.R.C. R&O. 2701 E. Sunrise Blvd. #204; Ft. Lauderdale, FL 33304; (305) 564-2779; FAX: (305) 563-0684. Specialization & Credits: Specializing in the needs of recording studios and music professionals. Technical: service available for on-site repair and maintenance of all types of pro and semi-pro equipment. Installation, system design or redesign and on service contracts. Neve, Studer, Amek-TAC, MCI, Sony, Sound Workshop, Trident. 17 years experience. Engineering: sound reinforcement or recording, live or studio, your system or mine; 2 to 48 tracks, analog or digital, with or without Automation. Location all over south Florida. 20 years experience. References on request.

GEORGE COUNNAS

Engineer & Producer

AUDIO TECHNICAL SERVICES. 2363 Dahlia St.; Denver, CO 80207; (303) 388-8800. Specialization & Credits: Contributing over 20 years experience to this industry, I enjoy working with a wide range of musical styles, as well as sound sweetening. Let's face it, this a people business. Your projects deserve not only the best technical expertise in the the region, but also the confidence, as artists, that you are working with someone who can help you maximize your creative potential. A partial list of clients includes: The Pretenders, Camper Van Beethoven, INXS, Kip Winger, Fiona, Leon Russell, Fred Wesley, James Brown All Stars, Jimmie Waldo, John Clayton, plus the best talent in the region. Voting member of N.A.R.A.S. (Grammies).

DAVID DACHINGER

Engineer, Producer & Music/Computer Programmer

DEEPRODUCTIONS. PO Box 809; New York, NY 10024-0539; (212) 496-0049. Specialization & Credits: Services: Recording engineer/mixing, computer/MIDI programmer, composer of original music for radio, television and film, music producer; Records: Arnold Schwarzenegger's *Total Body Workout*, T.L.C. *Ain't Too Proud to Beg* remix, Celine Dion, *Was* (Not Was), Keith Sweat, Intro, Run DMC, Roberta Flack, Sheena Easton, Michael Bolton, LL Cool J, Father MC, Christopher Williams, Southside Johnny, Sly Stone, Ernie Isley, Third World, New York Voices, Stan Getz, The System, José José, Mijares. Television and video: Jane Fonda's *Workout Challenge*, 1993 Superbowl Pregame Show (NBC), PGA Tour '93 (NBC), NBA Game of the Week, Dangerous Propositions (Lifetime Network); Advertising: Kit Kat Bars, Burger King, TWA, Miller Beer, Dole Fruit, Sprite, Honeycomb Cereal, Pioneer Stereo, Macy's.

ROBIN DANAR

Engineer & Producer

SQUID PRODUCTIONS. 1689 1st Ave. #1; New York, NY 10128; (212) 289-5868. Specialization & Credits: Suzanne Vega, Laurie Anderson, B-52's, The Church, the Blue Nile, Spinal Tap, Raffi, Randy Newman, Linda Ronstadt, Ry Cooder, Willie Nile, Julee Cruz, Rockapella, Buster Poindexter, Garland Jeffries, Jules Shear, Grayson Hugh, Buckwheat Zydeco, Manhattan Transfer, Kids in the Kitchen, Uptown Horns, Crossfire Choir, Grace Pool, Shawn Colvin, From Good Homes, Walkers, Circus of Power, Childhood, Urban Blight, Lonesome Val, Joy Askew, Jan Barnett, Sylvain Sylvain, Richard Lloyd, Chris Stamey, Peter Holsapple, Absolute, Gianni Gabriel, Velvet Rhythm Wranglers, Second Self, Anna Domino. Squid Productions provides recording engineering and production services and live engineering and production services. Studio specialties have been providing big-budget sounds in low-budget situations. Live specialties have been coordination of shows, live mixing and remote recording internationally. Live mixes and multitrack recording and mixing have also been produced for MTV, Showtime, HBO, Westwood One, *Saturday Night Live*, *The Tonight Show*, WNEW-FM and other international radio networks. Will tour.

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GLOBAL MUSIC PRODUCTIONS. PO Box 92538; Tsim Sha Tsui,
Hong Kong; (852) 338 0420; FAX: (852) 338-0420. Specialization
& Credits: Producer and composer for regionwide jingles, including
Hitachi-Andy Lau, Wellcome Supermarket 1990 series, Beck's Bier;
Fairlight programming Teresa Carpio—If I Ever Needed Love . Middle
Kingdom, 1993 Asian Golf Tour Music, audio producer for MTV:
Asia, Prime Sports on Star TV.

GREGORY D. DENDY

Producer
JAZMIN PRODUCTIONS. PO Box 6367; Long Beach, CA 90806;
(310) 433-5546.

PETER DENENBERG

Engineer & Producer
ACME RECORDING STUDIOS. 112 W. Boston Post Rd.; Mamaroneck,
NY 10543; (914) 381-4141; FAX: (914) 381-4543. Specialization
& Credits: Producer/engineer and mixing on: Spin Doctors/
"Pocketful of Kryptonite"—Epic Records. Spin Doctors/"Homebody
Groove"—Epic Records, Henry Lee Summer/Columbia, Blitzspeer/
Epic Records, Silent Running/Atlantic Records. Engineer on: Com-
pany of Wolves, Gori Allen, Atlantic Starr, Dirty Cooks, DevonSquare,
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Vera, Cissy Houston, Management; Steve Moir Company, Kaylin
Frank (818) 995-8707.

MICHAEL DENTEN

Engineer, Producer & Music/Computer Programmer
DENTEN PRODUCTIONS—INFINITE STUDIOS. PO Box 1709;
Alameda, CA 94501; (510) 521-0321; FAX: (510) 521-0368.

ROBERT DIAZ/SARKIS NAJARIAN

Engineer & Producer
JAM FACTORY PRODUCTIONS. 3558 Dean Dr., Ste. A; Hyattsville,
MD 20782; (301) 559-0247; (301) 559-7587; FAX: call voice #.
Specialization & Credits: Dedicated to full artist development, com-
mercial music production and songwriting. Additional services in
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ing, digital multitrack recording/editing and MIDI. Professional
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Engineer & Producer
WIZARD MUSIC GROUP. 8033 Sunset Blvd., Ste. 358; West Hol-
lywood, CA 90046; (818) 905-1703. Specialization & Credits:
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BILL DOOLEY

Engineer & Producer
BROOKLYN RECORDING STUDIO. 8000 Beverly Blvd; Los Ange-
les, CA 90048; (213) 655-9200; FAX: (213) 852-1505.



AL EATON
El Cerrito, CA

AL EATON

Engineer, Producer & Music/Computer Programmer
ONE LITTLE INDIAN MUSIC PRODUCTION & RECORDING SERV-
ICE. PO Box 1491; El Cerrito, CA 94530; (510) 237-7583; FAX:
(510) 237-7583. Specialization & Credits: With a number of recent
RIAA-certified Gold and Platinum records to his credits, Al Eaton is
a songwriter (One Little Indian Music [BMI] & Another Little Indian
Music [ASCAP]), producer, arranger, musician, engineer, remixer
and studio owner who is dedicated to helping the client/artist reach
the pinnacle of his or her talent and getting that down on tape. One
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DAVID EDWARDS

Engineer & Producer
dB E PRODUCTIONS. 7221 Judson Ave.; Westminster, CA
92683; (714) 892-0877. Specialization & Credits: Live-to-2-
track and multitrack engineering/mixing, digital editing, audio
post, sound design for theater or film. Production, co-production
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ferent musical styles; specializing in recording live instrumenta-
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NICK EIPERS

Engineer
77 Northgate Rd.; Riverside, IL 60546; (708) 447-0308. Special-
ization & Credits: I focus on getting the best performance with
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JOHN ELLIS
Acton, MA

JOHN ELLIS

Engineer & Producer

PRISM SOUND, 6 Partridge Pond Rd., Acton, MA 01720; (508) 264-0068. Specialization & Credits: Music production & engineering for albums, demos and jingles. Berklee graduate. Session work: RTZ, Marty Bain, Northside Boys/Donnie Wahlberg, Lyle Mays, Torsten DeWinkel, Shockra, Chance to Love, Restless Souls, Pousette Dart Band, John Donelan Band, Sheldon Mirowitz, Shelly Miller, Play Rough, Classics for Kids. Services: 24-track recording facility: control room 17'x10'6", studio 12'x6'x14'9", iso booth 5'9" x 10'6". Machines: Dtari MX-80, Panasonic SV-3700, Yamaha C300 cassette, Tascam M3500 32-channel console. Monitors: UREI 809 Time Align, Yamaha NS10M, Tannoy 6.5. MIDI gear: Roland D50, JX3p, MT32, R8, Dpcode studio 3, Macintosh IIcx. Processors: Lexicon PCM70, LXP-15, (2) Alesis MIDiverb, (2) Quadraverb, 3630 compressor, Micro gate & limiter, dbx 166, (2) dbx 363x, (3) Roland SDE 1000, DigiTech IPS 33B. Aphex Aural Exciter type C, ADA stereo tapped delay, Hush IIcx, Yamaha REX 50, Kawai EQ-8, Ross 15-band stereo EQ. Microphones: AKG 414, Sennheiser 421, Audio-Technica Pro 25, Pro 4L, Shure SM57, 58, 87 etc.

RODERICK J. EVENSON P.E.

Engineer

CONSULTING ENGINEER, 6740 S.E. Catalina Ln., Milwaukie, OR 97222-1993; (503) 654-2636. Specialization & Credits: Electronic Systems & Circuits, specialized equipment for transfer of pre-RIAA curve standard groove recording; 78rpm & 16-inch transcriptions, processing for vector noise & other. Engineering services for remote recording classical music; Nagra-D & Sony DAT recorders, Neumann TLM-50 & 170 etc., Schoeps MK2S mics. Credits: Chamber Orchestra of America under Dleg Kovalenko, Portland State Univ. chorus & orch under Salvador Brotons, Portland Youth Philharmonic, Chamber Music Northwest, Eau de V Productions London, The Third Angle (Virtuosi della Rosa), etc. Albums: David York's *Mother of us All*, Jacob Avshalomov's *Up at Timberline* (PVP), etc. Broadcast of work by KBPS, KDPB & NPR.

DALE EVERINGHAM

Engineer, Producer & Music/Computer Programmer

AUDIO VISIONS, 6289 Clive Ave., Oakland, CA 94611; (510) 482-2338; FAX: (510) 531-9160. Specialization & Credits: Offering you over 11 years of full-time experience in all areas of recording and mixing. Complete project productions, record, mix & remix engineering, digital editing, audio/video sync and music composition. I have the skills necessary to complete your project successfully! Call me to discuss your CD, media or film project and find your Audio Visions. Gold and Platinum credits: Tony! Toni! Tone!, En Vogue, Boyz n the Hood, Too Short. Dther credits: Mazzy Star, Thomas Dolby, Eddie Money, Michael Cooper, Jazzy Jeff & the Fresh Prince, Spice 1, Souls of Mischief, Kenya Gruv, Pooh Man, Pharaoh Sanders, David Grisman, Voicestra, William Ackerman. Film/video: California Lottery, Levi 501s, Juice, Anheiser Busch, KPXX, KRDN, LucasFilms, NBC, Gallo, Lotus, Longs, AC Transit, Samtrans.

SHANE H. FABER

Producer

JEEP JAZZ MUSIC, 501 78th St. #3; North Bergen, NJ 07047; (201) 854-6266. Specialization & Credits: Jeep Jazz Music is a full-service music production company with a simple philosophy: EARS and EXPERIENCE make the difference! Shane Faber is the man behind the message and the "EARS" in particular. A gifted guitarist and keyboard player, he is equally at home on either side of the console, and a master at putting the "human feel" back in MIDI machines. Along with partner Mike Mangini, they have a publishing/development deal with Warner-Chappell Music and their own private 32-track facility Sound Doctor Studio, just minutes from midtown Manhattan. Produced: Digable Planets *Rebirth of Slick (Cool Like DAT)* Gold single

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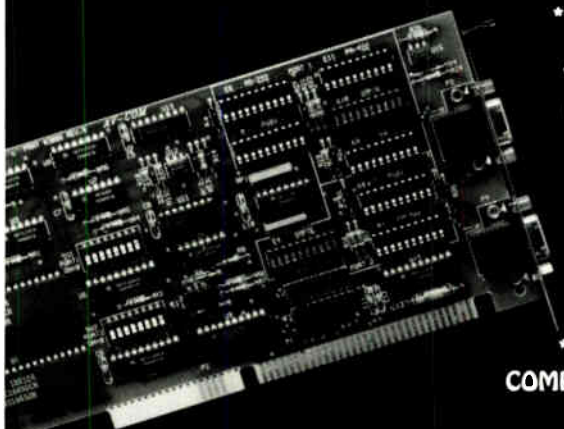
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and LP (Pendulum Recs.), mixed Grammy-nominated *Fly Girl*, Queen Latifah (Tommy Boy), cowrote *Shine On*, Degrees of Motion (Esquire/BMG).

BILLY FARMER

Engineer & Producer

TRAX RECORDING & PRODUCTION/TAMWOOD MUSIC BMI. PO Box 49231; Atlanta, GA 30359; (404) 634-9253. Specialization & Credits: Credits: Hokey Sloan, Red River Band, Takeover, Rocky Singley, Firewater, T-Bones, Donald Ray Lunsford/Union Worker, Buck & Tiny/Buck & Tiny's Country, Break the Silence, Kyle Ensley, Bullet Head, Area Code 404, Stuck Mojo, Billy Mashburn, Derek Daigle, Jimmy Amerson, Ragging Ann. Services: Development and production of writers and artists.

JIM FEMINO

Engineer & Producer

JIM FEMINO PRODUCTIONS. 429 S. Lewis Rd.; Royersford, PA 19468; (215) 948-8228; FAX: (215) 948-4175.

MICHAEL FREEMAN

Producer

PO Box 1308; Barrington, IL 60011; (312) 822-0305; FAX: (312) 464-0762. Specialization & Credits: Credits: Ralph Covert, The Bad Examples (Waterdog/CNR Records); Eleventh Dream Day (Amoeba Records); Eddy Clearwater, Magic Slim & the Teardrops, Carey Bell, Hubert Sumlin, Little Mike & the Tornadoes, Joanna Connor, Jim Thackery Band, (Blind Pig Records); The Reverbs (Metro America/Victor Japan); Paul Castain (Pet Sounds/CBS); The Service, The Hollowmen (Pravda Records); Candi Slaton (Source Records).

PAUL GERRY

Engineer, Producer & Technician

THE CUTTING EDGE. Box 217—Old Route 17; Ferndale, NY 12734; (914) 292-5965; FAX: (914) 295-2451 ext. 2473.

LOU GIMENEZ

Engineer, Producer & Music/Computer Programmer

THE BOILER ROOM RECORDING. 80. 54 20 9th St.; Hollis Hills, NY 11427; (718) 740-3940.

THOMAS E. GINGELL

Engineer, Producer, Technician & Music/Computer Programmer
MOON PRODUCTIONS & RECORDING STUDIO. 1885 Pomeroy Rd.; Arroyo Grande, CA 93420; (805) 489-8146.

TONY GIOVANNETTI

Engineer & Producer

DELTA PRODUCTIONS. 131 Varick St., Ste. 903; New York, NY 10013; (212) 473-5385; FAX: (212) 645-6412. Specialization & Credits: Specializing in total production services—sound reinforcement for large-scale events in alternative spaces. Recent credits for site-specific work include Wexner Center, Columbus, OH; "Union Station Dances," Washington D.C.; "Dance on the Beach," Coney Island; Philadelphia, 30th St. Station; Battery Park City, New York International Festival; State of Illinois Bldg., Chicago; Grand Central Terminal, NYC; "Dancing in the Streets" at South Street Seaport, NYC.

RENZO GIROMINI/BARBARA SUE ROSEN

Engineer, Producer & Music/Computer Programmer

BARZO PRODUCTIONS. PO Box 4872; Albuquerque, NM 87196; (505) 255-3225. Specialization & Credits: "Spots" audio production studio. Digital mastering, multitrack. Complete audio production services: industrial work, copywriting, remote recording, radio programming and audio consulting.

JOSIAH N. GLUCK

Engineer & Producer

1520 York Avenue #23F; New York, NY 10028-7012; (212) 249-8849; FAX: (212) 249-9670. Specialization & Credits: Over 12 years experience in a wide range of styles and situations for GRP, Elektra, Blue Note, Warner Bros., Polydor Japan, Windham Hill and Steeplechase Records to name but a few. Grammy Nominations for Engineering: Dave Grusin *Cinemagic*; various artists *Happy Anniversary*, *Charlie Brown*. Credits: (as producer and/or engineer): Patti Austin, George Benson, Judy Collins, Randy Goodrum, B.B. King (*Live At The Apollo*); Grammy winner, Best Traditional Blues Album, 1992), Billy Cobham, Diane Schuur, Kevin Eubanks, Dave Grusin, Jon Hendricks, Scott Cossu, David Benoit, Haram Bullock, Chris Connor, Dave Valentin and Eddie Daniels. Other services: Live-to-2-track recording; live location recording; Dolby Surround remixing; CD remastering. Television experience: music engineer for *Night Music*; production engineer/mixer for *Saturday Night Live*.

PAUL GOODRICH

Engineer, Producer, Music/Computer Programmer

AUDIO ARTS. 224 Sullivan St., E-41; New York, NY 10012; (212) 254-1027. Specialization & Credits: Credits: Michael Jackson, Yoko Ono, Southside Johnny, Buster Poindexter, Nona Hendryx, Heather Mullins, Frankie Knuckles, Drive, She Said, Rob Stevens, Freddy Bastone, Bob Riley, Taxi Productions, Maxi-Priest, Jungle Brothers, Ultra Nate, Bang Music, the NBA, Play it by Ear-The first CD Game, Blue Man Group, Razor and Tie Records, The Playboy Channel, Bristol-Myers, Pepsi, Random House Audio, Bantam Audio. Services: All aspects of production available from pre-production to post-production and everything in between.

DAVE GRANATI

Engineer & Producer

MULBERRY ST. RECORDERS (PITTSBURGH AREA). 409 Mulberry St.; Coraopolis, PA 15108; (412) 264-6649.

THOMAS J. HALL

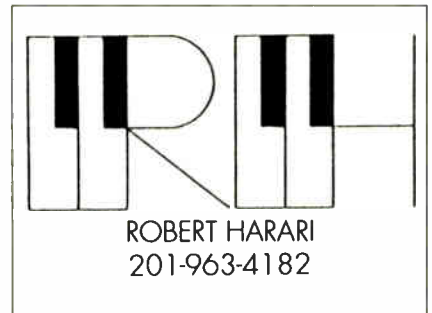
Engineer & Producer

TRIAD STUDIOS. 4572 150th Ave. NE; Redmond, WA 98052; (206) 881-9322; FAX: (206) 881-3645. Specialization & Credits: Credits: Queensryche, (Operation Livecrime, The Tramps of Panic, Empire, EP), UB40, Sir Mix-a-Lot, Kenny G., Slam Suzanne, Peter Collins, Mick Guzauski, Heir Apparent, Randy Meisner, Fifth Angel, Terry Brown, Autograph, Michael Powers, Phil Sheeran, Bloodgood, Roby Duke, Jim Stipech, Uncle Bonsai, Dan Dean, Ralph Towner, Bud Shank, Eric Tingstad, Paul Speer, Mark Lindsay, the Magical Strings, D.C. Lacroix, the Cedar Walton Trio and many others. Services offered: all facets of demo and album production, including pre-production, engineering, producing and watchdog supervision of disc mastering. I am sensitive to the artists' creative needs and strive for the best recorded performance possible in a comfortable, low-pressure atmosphere. Best known for my rock records. I'm creative with all musical styles. Am especially adept at bringing life to tracks in the mix. My rates are reasonable. Call me.

STEVE HALLMARK

Engineer, Producer & Music/Computer Programmer

HALLMARK PRODUCTIONS. 31320 Via Colinas, Ste. 118; Westlake Village, CA 91362; (818) 991-4857; FAX: (818) 707-2693.



ROBERT HARARI
Hoboken, NJ

ROBERT HARARI

Engineer, Producer & Music/Computer Programmer

HARARVILLE INC. 202 Eleventh Street; Hoboken, NJ 07030; (201) 963-4182; FAX: (201) 963-4182.



BRETT HARNETT
Alexandria, VA

BRETT HARNETT

Engineer & Producer

CONTOUR RECORDING (WASHINGTON D.C. AREA). 203 Yoakum Pkwy. #1626; Alexandria, VA 22304; (703) 751-3475; FAX: (703) 751-5469.

BRETT HARNETT

Engineer & Producer

MULBERRY ST. RECORDERS (PITTSBURGH AREA). 409 Mulberry St.; Coraopolis, PA 15108; (412) 264-6649.

Reelsound Recording Co.

MALCOLM H. HARPER JR.
Austin, TX

MALCOLM H. HARPER JR.

Engineer & Producer
REELSOUND RECORDING CO. 2304 Sheri Oak Ln.; Austin, TX 78748; (512) 472-3325; FAX: (512) 282-0713. **Specialization & Credits:** Remote engineer for TV, radio and live concert recordings. Owner of Reelsound Recording Co., a 42' Tom Hidley-designed remote audio tractor-trailer unit based in Austin, TX. Twenty-four years experience. Four Gold and one Platinum RIAA awards and four Ampex Golden Reel awards, and two Grammy nominations. Recent projects: Riverwalk "Live from the Landing"- American Public Radio, Texas Connection; TNN Network, "Selena," Emilio Navaira, Roberto Pulido and Gary Hobbs; live albums for Capitol/EMI Latin. George Jones, Tracy Lawrence and Pam Tillis in Concert; TNN, Stephen Curtis Chapman live broadcast. Call for credits.

STEPHEN A. HART

Engineer & Producer
HART PRODUCTIONS. 1690 Creekview Circle; Petaluma, CA 94954; (707) 762-2521; FAX: (707) 762-2521. **Specialization & Credits:** The focus is on international projects and mainstream pop. I am also interested in alternative artists of diverse cultural and musical origins. Hart Productions also maintains an office at Condulmer Studio in Venice, Italy. Tel.: 39(41) 457-370, fax: 39(41) 457-182. Album and single credits: David Bowie ('93), En Vogue, Marky Mark and the Funky Bunch, Vasco Rossi (Italy), Hammer, Jasmine Guy, Shiela E., Neville Brothers, Flora & Airtio, Steve Smith/Vital Information, UZEB (Canada), Jim Chappell, Christian (Mexico), Hsin-Lien Wang (Asia), Will Ackerman, Suzanne Cianni, Jennifer Taylor (France), Spinners, Fausto Leali (Italy), Paul Kantner, Pete Escovedo, Stein/Walder, Melissa Etheridge, Oscar Peterson/Joe Pass, McCoy Tyner, Andy Narrell, Stephan Grappelli. Other credits: Andy Summers, Branford Marsalis, Billy Idol, Huey Lewis, Queen Ida, Jan Hammer, Joe Satriani, Eddie Money, Grateful Dead, Carlos Santana, Micheal Hedges, John Denver, Jimmy Barnes (Australia), Journey. Film post credits: *At Play in the Fields of the Lord*, *Amadeus*, *Unbearable Lightness of Being*, *Dead Poets Society*, *Blue Velvet*, *Wildcats*.

GARY HEDDEN

Engineer, Producer & Technician
GHL AUDIO. 5216 Waddell Hollow Rd.; Franklin, TN 37064; (615) 794-0550; FAX: (615) 794-0017.

JAY HENRY

Engineer & Producer
VISUAL MUSIC. PO Box 86967; San Diego, CA 92138-6967; (619) 427-4290; FAX: (619) 427-0001. **Specialization & Credits:** Sixteen years experience in recording and broadcast industries. Has 17 Gold, 11 Platinum, 3 double-Platinum albums, 2 Platinum singles and 1 triple-Platinum album on MCA, Warner Bros., Columbia, Def Jam, CBS, Epic, Arista, Profile and Atco. Has worked on projects with Prince, F.S. Effect, Run DMC, LL Cool J, Al B. Sure, Heavy-D, Slick Rick, Guy, Teddy Riley, Living Colour, Jeff Redd, Shannon, Whodini, Bell Biv DeVoe, Public Enemy, Skyy, Defunkt, Immage, Alphonse Mouzon, Larry Coryell and Daniel Ponce. Software-based, audio/video pre- and post-production. Completed soundtracks include national promo videos for Calvin Klein, Oscar de la Renta, Perry Ellis. Full music production services for albums, singles and master demos including: multitrack lockups, studio and location production services for video and film, MIDI/SMPTE interfacing to video, film and live performance with MIDISCORE™, featuring Macintosh IIcx™ and Quadra computers. Sound Tools, sample library, sample editing, synthesizer and drum programming, custom signal processor software and unusual equipment rentals.

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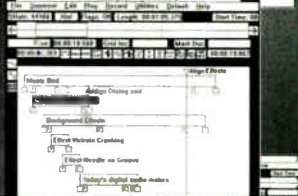
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DENNIS HETZENDORFER

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PROFESSIONAL AUDIO SERVICES. 8795 SW 57th St.; Cooper City, FL 33328-5930; (305) 434-1377. **Specialization & Credits:** Have worked with Bee Gees, Barbra Streisand, America, Julio Iglesias, Raul DiBlasio, Lynyrd Skynyrd, Eddie Money, Beach Boys, Eileen Farrell, and others. Owner and director of Recording Skills Workshop, a 4-week intensive training program for assistant recording engineers. Knowledgeable in the production and engineering of all styles of music. Bachelor of Music degree, University of Miami, 1976.

DAVID HEWITT

Engineer & Producer

REMOTE RECORDING SERVICES. PO Box 334; Lahaska, PA 18931; (215) 794-5005; FAX: (215) 794-3263.

SIMON HIGGS

Producer & Music/Computer Programmer

ROBERT SIMON PRODUCTIONS. P.O. Box 3083; Van Nuys, CA 91407; (818) 989-5638.

MAX HIGHSTEIN

Engineer & Producer

MAX HIGHSTEIN MUSIC. 5 Herrada Pl; Santa Fe, NM 87505; (505) 986-1055. **Specialization & Credits:** Specializing in NAC, contemporary folk, and world music. I offer full production, arranging and recording services at my 24-track studio in Santa Fe and at other locations. Making a great-sounding record should be an enjoyable, satisfying experience that doesn't have to cost a fortune if you do it right. I understand the needs of small labels to produce quality recordings that will stand well alongside the big-bucks products and still leave budget for marketing and promotion. Helping to create arrangements and performances that bring out the best in your talent and material, and drawing on a pool of top supporting musicians when needed, is what I do best. Credits include material heavily featured on NAC radio formats on an on TV's *Northern Exposure* including: Chance- *Something Ventured*; Lou Montgomery and Adele Getty- *Spiritual Healing*, *Jaguar Lodge*; Max Highstein- *Touch the Sky*, *Hondo Blaze*. Demo on request.

DANNY M. HILLEY

Engineer & Producer

F. I. R. S. T. ENGINEERING & PRODUCTIONS. PO Box 1121; Nashville, TN 37065; (615) 794-3660.

BOB HODAS

Engineer & Producer

PO Box 9485; Berkeley, CA 94709; (510) 649-9254. **Specialization & Credits:** Credits: Barbara Higbie, Doobie Brothers, Village People, Marty Balin, Amanda McBroom, Osamu, Mickey Hart, Will Ackerman, Casiopea, Schoenherz and Scott, Sayuri Ishikawa, The Pope, Modern Mandolin Quartet, Hearts of Space Records, Jim Chappell, Joan Baez, Anjani, the Movie Stars, Feron, San Francisco Gay Mens' Chorus, Jaron Lanier, Katrina Krinsky, Merl Saunders. Services: recording and concert engineering; album, film and demo productions; consulting.

JEFF A. HOFFBERGER

Engineer, Producer & Technician

J&J PRODUCTIONS. 136 N. Laclade Pl.; Atlantic City, NJ 08401; (609) 347-0051; FAX: (609) 344-4808. **Specialization & Credits:** House engineer, monitor engineer, production manager, stage manager. Currently touring with Regina Belle. Clients include: R&B—Boyz II Men, Atlantic Starr, Tony Terry, Johnny Kemp, Chuck Brown and the Soul Searchers, Starpoint, Juicy Fruit, The Orioles, The Clovers, SOS Band, Luther "Guitar" Johnson, the Uptown Rhythm Kings, Roy Buchanan, Experience Unlimited, Trouble Funk, The O'Jays. Sluggo. Rock—Jon Carrol, BoDeans, Kix, Marti Jones, Motorhead, Robin Trower, Megadeth, Flotsam & Jetsam, Leslie West & Friends, Blue Oyster Cult. Contemporary—Marvin Hamlisch, Henry Mancini Orchestra, Maureen McGovern. Country—Asleep at the Wheel, Sawyer Brown, Billy "Crash" Craddock, Rodney Crowell, John Schlieder, Randy Travis. Comedians—Danny Gans, Fred Travalina, Bill Cosby, Red Skelton, Wayland Flowers & Madame. Jazz—Jean Carnes, Betty Carter, Ahmad Jahmal, Al Johnson, Les McCann, Koko Taylor, Joe Williams, Little Howlin' Wolf. New wave/punk—The Call.

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JOE HOLLAND

Engineer, Producer, Technician & Music/Computer Programmer
WINDMILL PRODUCTIONS/WINDMILL STUDIO, 5611 N. 40th St., #10; Milwaukee, WI 53209-3958; (414) 535-0861. **Specialization & Credits:** Music production, engineering, MIDI programming and consultation for demos and album projects, from multitrack to DAT masters in my facility or will work in alternate locations. Specializing in but not limited to new artists. Acoustic, folk, blues, light rock, country rock, etc. My personal philosophy: openness to input from all participants creates a positive idea stream, making the process more efficient and the end-result fantastic.

GORDON D. HOOKAIO

Engineer, Producer, Technician & Music/Computer Programmer
GDH DIGITAL PRODUCTIONS, 4627 Coldwater Cyn. #116; Studio City, CA 91604; (818) 763-4853; FAX: (818) 763-3549. **Specialization & Credits:** GDH Digital specializes in audio sweetening for film and video. Our family of editors, composers, Foley artists, engineers and post supervisors will ensure that your project goes smoothly from start to finish. Video/film mix-for-picture, sound design, music editing and score recording include work for ABC, PBS, Nickelodeon, The Leo Burnett Agency, Miramax, Hemisphere Entertainment, Concorde Pictures, Flint Oille, Lara Classics, Sealy Mattresses, Panther Films, TSR Inc., Honeywell Corporation and Miroopolis. GDH also offers music engineering, production, digital editing and mastering for CD and project management. Over 15 years of music engineering including Steven Stills, Stevie Wonder, David Bowie, Phish, Jon Butcher, O-Positive, Jonathan Richmond, Allan Zavod. Books on tape clients include: Bantam, Dove, Applewood Books, with actors Ed Asner, Kirk Douglas, Lynn Redgrave, Richard Thomas, including books from Danielle Steel, Rosamunde Pilcher, Eugenia Price, to name a few. GDH Digital: Creative solutions to unique production problems.

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Producer
ROLLING ROAD PROD. INC. 11288 Ventura Blvd. Suite 434B; Studio City, CA 91604; (818) 506-0050; FAX: (818) 506-0059.

STEPHEN FITCH HUBERT (STEVE SPARKS)

Producer
SILENT PARTNER PRODUCTIONS. PO Box 2182; 307 N. 2nd Ave.; Sandpoint, ID 83864; (208) 263-8822; (208) 263-1531; FAX: (208) 263-8822.

DAVID IVORY

Engineer, Producer & Music/Computer Programmer
IVORY PRODUCTIONS INC. 212 N. 12th St., Ste. #3; Philadelphia, PA 19107; (215) 977-9777; FAX: (215) 563-3283.

JOEL JAFFE

Engineer & Producer
STUDIO D RECORDING. 425 Coloma; Sausalito, CA 94965; (415) 332-6289; FAX: (415) 332-0249. **Specialization & Credits:** Production engineering, music composing/sequencing credits include Lenny Williams *Laying in Wait*, Michael Cooper, MCA Triple M-A&M Records, Austin DeLowe-Demon Records, Greg Allman Band, Film soundtrack eng/mixer *Light Sleeper* Michael Bean/composer, The Call eng/mixer WEA Records, Paramount TV *Local Heroes*-David Keith, Ourocs-National Records, Dick Dale-Hi-Tom Herrold/Gordon Stevens-Jazz Records, Live WOR Germany, Tone Records, eng. TV composition, eng/production "Donner Lipchen", Network NBC TV "Word Play" composer, prod. eng/mixer. Production for all types of music. Will accept unsolicited or solicited projects.

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DIFFERENT FUR RECORDING. 3470 19th St.; San Francisco, CA 94110; (415) 864-1967; FAX: (415) 864-1966. **Specialization & Credits:** George Winston: *Summer*, Tuck & Patti: *Dream*, *Tears of Joy* and *Love Warriors*; Penelope Houston: *The Whole World*; The Royal Nonesuch: *No Such Animal*; Limbomaniacs: *Stinky Grooves*; John Gorka: *Jack's Crows*; Patty Larkin: *Tango*; Henry Butler: *Blues & More*; Windham Hill: *Winter Solstice I, II, III*; MCM & the Monster, Bobby McFerrin, Bucket Head, Too Short, Bobby Brown, Phil Collins, The Residents, Kronos Quartet, John Zorn, Robin Williams, Danny Glover. Movie soundtrack *1,000 Pieces of Gold*, TV Soundtracks, *Unsolved Mysteries*, *Charlie Brown*. Services: All that Different Fur Recording has to offer: Studer 48-track analog, Solid State Logic 4056E/G console, Sonic Solutions, large selection of microphones, digital/analog reverb and delay units, OATS, Yamaha C7 grand piano.

E. KEVIN JONES

Engineer & Producer
SOUND & SOUND ALIKE. 790 Riverside Dr., Ste. MP; New York, NY 10032; (212) 926-8294. **Specialization & Credits:** Lisa Lisa & Cult Jam, Hi Five, Melba Moore, the Boys' Choir of Harlem, the Family Stand, Surface, Ashford & Simpson, George Howard, Najee, Freddie Jackson, Living Colour, Diane Reeves, Eric Gable, Alex Bugnon. Services offered: live sound engineering, production management and full crew and technical contractor. Offering worldwide services and will fulfill all your production needs, including personal security, stage design and tour managing.

KAREN KANE

Engineer & Producer
17 Bodwin Ave.; Toronto, Ontario, ON M6P 1S4; (416) 760-7896. **Specialization & Credits:** Have been in the studio business since 1970, starting out in studio management. Have been engineering for 18 years and producing music for 10 years. Have extensive experience with on-location recording and live sound. Originally based in the Boston area, I've worked on over 100 album projects plus hundreds of EP's and demos including a demo by Tracy Chapman. Have had U.S. chart activity with cuts from *Virgo Moon* by artist Chad Mitchell (Silver City Records/Sony Music). Other albums I've worked on have been nominated for Boston Music Awards. Other credits include: Ann Earthing & the Planets (from Berlin), Twice Shy, Razy Bailey, Carl Kees, Doug Barr, April K., Close Enough, Fred Small, Southern Rail, the Chicken Chokers, Matt Glaser, Fior de Cana, Kay Gardner, Alix Dobkin, Linda Worster, Judy Fjell, Marcia Taylor, Larua Berkson, Suede, Robert Gass, Matt Johnson, Betsy Rose, Jay Smar, Wheeler & Carol, many more.

BOB KATZ

Engineer, Producer & Technician
DIGITAL DOMAIN, 309 East 90th St. B; New York, NY 10128; (212) 369-2932; FAX: (212) 427-6892.

HELEN KEANE

Producer
HELEN KEANE RECORD PRODUCTION, ARTISTS MANAGEMENT, 49 E. 96th St., Apt. 6A; New York, NY 10128; (212) 722-2921; FAX: (212) 722-8121.

PETER R. KELSEY

Engineer & Producer
14874 Tyler St.; Sylmar, CA 91342; (818) 367-4445; FAX: (818) 367-0343. **Specialization & Credits:** Credits include: Jean-Luc Ponty, Bill Ward (of Black Sabbath), Thelma Houston, Suzanne Ciani, The Fixx, Elton John, Graham Parker, Pebbles, Brian Eno, Linda Rondstadt, Slayer, Michael Stanley Band, Wall of Voodoo, Weather Report, Zawinul, Tribal Tech, 'Weird' Al Yankovic, Veronique Sanson, Mari Iijima, L.A. Cowboys, Kalapana; and in film and T.V. music: *Best of the Best 2*, *Street Knight*, *Poison Ivy*, *Extreme Justice*, *Bethune*, *Casualties of Love*, *Exclusive*, *Knots Landing*, *Homefront*, *Picket Fences*, *Thirtysomething*, *Mother Goose Rock N' Rhyme*. Services: music production, engineering and mixing.

JAMES L. KENNEDY

Engineer & Producer
HEART CONSORT MUSIC-BMI. 410 1st St. West; Mt. Vernon, IA 52314; (319) 895-8557.

RICHIE KESSLER

Producer
PLATINUM ISLAND RECORDING STUDIOS, 676 Broadway, Third Fl.; New York, NY 10012; (212) 473-9497. **Specialization & Credits:** Young producer with world-class recording studio at his disposal can provide studio & production services to select artists & groups. Most important requirement is that the music & concept be original. Objective: master recordings and record deals. Send material for consideration to Richie Kessler, c/o Platinum Island Recording Studios.



ROBERT LA SERRA
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ROBERT LA SERRA

Engineer & Producer
LA SERRA PRODUCTIONS INC. PO Box 453; Massapequa Park, NY 11762; (516) 798-2308; FAX: (516) 541-6264. **Specialization & Credits:** As a 25-year-old producer/engineer, La Serra is earning respect and gaining recognition in the music business. His most recent credits are production & engineering of 8th Angel's *Guilty of the Crime* (Onna Roll Records), engineering & remixing of Servants of Power's *50,000 Watts of Power* (Relativity Records), production & engineering of Wavelength's *Empty Spaces & X-Fade* (Warlock Records), productions & engineering of M.A.O.A.'s *Feel Like Jumping* and *Wet Dreams* (Nervous Records). La Serra and the La Serra Productions family are street-smart and pop-oriented, specializing in house, R&B, freestyle, hip hop, techno and, of course, pop. Combine the engineering and production specialties of Bobby "B-La" La Serra, the street knowledge and mixing talents of Victor "Vicious Vic" Ortiz, the magical keyboard playing of Mark "Mr. Melody" Leonard, and their home base of Strong Island Records, you could rest assured you'll have one slamin' track on your hands "Guaranteed Fresh."

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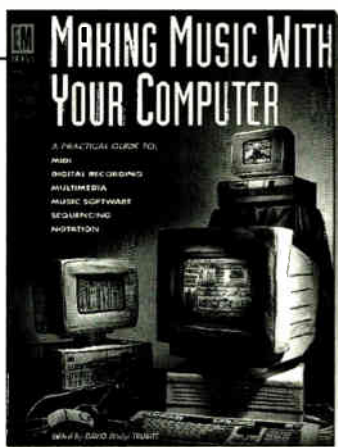
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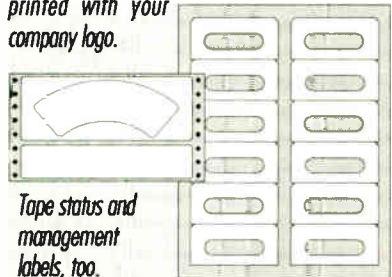
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ALAN LEININGER

Engineer & Producer
AIR LEININGER. 2506 Coolidge St.; Hollywood, FL 33020-2339; (305) 920-2998. **Specialization & Credits:** Location and studio recording, analog and digital. Experienced audio engineering, broadcast production and voice-over talent for diverse bands and advertising clients. Seeking acoustic acts for future projects.

JEFFREY LESSER

Engineer & Producer
JET LASER PRODUCTIONS. 232 Madison Ave.; Cresskill, NJ 07626; (201) 816-9144; FAX: (201) 816-0782. **Specialization & Credits:** Producer: Loudon Wainwright III, New York Voices, The Roches, Rupert Holmes, Barbra Streisand, Pat Travers, Head East, Sailor, Strawbs, Straight Lines, Sparks, Starcastle. Co-producer: Jeffrey Gaines, Darden Smith, Judybats, Jet Plane Jane, Medicine Men, Eric Bogosian, Timbuk 3, Kool & the Gang, Natives, Carboy, Won Ton Ton, Colourfield, Chiefs of Relief, Royal Crescent Mob, Will & the Bushman, Richard Barone, Louise Goffin, Mental as Anything, All About Eve, Earl Slick. Engineer and/or remix: Lou Reed, Deborah Harry, Ultravox, Missing Persons, Robert Palmer, Ric Dcasek, Dingo Boingo, Quarterflash, Renaissance, Blue Oyster Cult, Ruben Blades, Fernando Saunders, Climax Blues Band, Stylistics, Alice Cooper. Television: *Playboy*, *Candid Camera*, *Silver Spoons*, *Robert Klein Show*, *Ripley's Believe It or Not*, *Rock & Roll Tonight*. Tech specs: producer, engineer, mixer; SSL, Auto, Neve, live recording, electronic and sample MIDI recording, songwriter, vocal and music arranger. Comments: reviews submitted tapes, international reputation, extensive travel, expert in every aspect of records, film, video, radio, television and advertising.

STEVEN W. LEWIS

Engineer
CHICAGO DIGITAL AUDIO RECORDING SERVICES. 1770 W. Berteau Ave.; Chicago, IL 60613; (312) 348-1112; FAX: (312) 348-1182.

JESSE LOMBARDI

Engineer & Producer
26 Westminster Ave., Ste. #5; Venice Beach, CA 90291; (310) 392-2747; FAX: (213) 957-4355.

REGGIE LUCAS

Producer
REGGIE LUCAS PRODUCTIONS. 512 Paterson Plank Rd.; Jersey City, NJ 07307; (201) 656-7023; FAX: (201) 656-1192. **Specialization & Credits:** Grammy award-winning producer, Reggie Lucas has written and produced these recordings: Madonna's *Borderline*, Roberta Flack & Donny Hathaway's *Closer I Get to You and Back Together Again*, Stephanie Mills' *What Cha You Gonna Do, Never Knew Love Like This and Stephanie*. Lucas also produced songs for the Four Tops, Jennifer Holiday, The Models, Randy Crawford, Rebbie Jackson, the Weather Girls, and others. His current releases include: Nick Scotti's *Feel the Need and Life Is What You Make It*. Reggie Lucas owns the multiroom state-of-the-art 24-/48-track Quantum Sound Studio in Jersey City, N.J.

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AUDIO PRODUCTION SERVICES. 6951 Ranchito Ave.; Van Nuys, CA 91405; (818) 988-3271. **Specialization & Credits:** Warren Hill, Michael Boddicker, David Cassidy, Michael Jackson, Trevor Jones, Brian Eno, David Byrne, Machine Head, Dino Fekaris, Burt Bach-

arach, Barry Eastmond, Aretha Franklin, Dionne Warwick, Jane Fonda, Cynema, Ddin, Y&T, Kronos Quartet, Pat Gleason. Films: *Freejack*, *Starfire*, *F/X2*, *Arachnophobia*, *A Bird on a Wire*, *Black Rain*, *The Adventures of Milo & Otis*, *Her Alibi*, *Plague Dogs*, *Apocalypse Now*, Walt Disney Productions. Production and engineering with an ear toward the leading edge of tomorrow's music. I work with you from pre-production to the final mastered product. My goal is to stimulate the artist to ever greater creative heights and to realize their dreams by making them sonically and visually as exciting as possible. I'm interested in all new music, and I am always looking to stretch the boundaries of today's sound. Please call or write.

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New York, NY

TOM MAGUIRE

Engineer, Technician & Music/Computer Programmer
TMI ENGINEERING. PO Box 20363 London Terrace Station; New York, NY 10011-0044; (718) 935-0063; FAX: (718) 932-9167. **Specialization & Credits:** Technical consultation to engineers, producers, artists and record companies on recording technique, transfers, recovery of masters, equipment and studio selection, upgrades and tweaks, repairs, instrument and performance systems, computers and devices, studio design product development and legal compliance. Special services to: film, video, advertising, research, testing and similar project. Available as technical recording engineer for difficult sessions. Specialty: static and dynamic sound localization for music/samples/performance/film, TV. Black box devices designed & built. Specialized equipment located.

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Producer & Music/Computer Programmer
THE HIT HOUSE INC. PO Box 102; Bethpage, NY 11714; (516) 735-3452.

SCOTT MATHEWS

Producer
PROUD PORK PRODUCTIONS. 230 Montclair St.; San Francisco, CA 94110; (415) 648-9099. **Specialization & Credits:** Internationally acclaimed producer, Platinum songwriter, multi-instrumentalist and vocalist Scott Mathews has worked with the likes of (in alphabetical order) the Beach Boys, Rosanne Cash, Ry Cooder, Elvis Costello, Robert Cray, Sammy Hagar, John Hiatt, John Lee Hooker, Mick Jagger, Dr. John, Patti LaBelle, Huey Lewis, Van Morrison, Roy Orbison, Bonnie Raitt, Little Richard, Keith Richards, Todd Rundgren, Boz Scaggs, Barbra Streisand, The Waterboys, Bobby Womack, and the list goes on and on refusing to end. However, for the sake of printing cost, we'll leave it at that. Scott is currently accepting tapes with strong emphasis on vocals from singers, singer/songwriters and bands for production consideration.

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PYRENESS PRODUCTIONS. PO Box 13303; Portland, OR 97213; (503) 284-6155.

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MASTERMIX AUDIO. PO Box 924; Eatontown, NJ 07724; (908) 389-5958.

PAUL MCKENNA

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TUMAC ENTERTAINMENT CORP. 21652 Wholoto Trail; Chatsworth, CA 91311; (818) 341-6929; FAX: (818) 341-6032.

SEAN MCNAMARA

Engineer, Producer & Music/Computer Programmer
PERENNIAL PRODUCTIONS. Box 109, 73 Hill Rd.; Redding, CT 06875; (203) 938-9392.

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JOE MELCHIORRE

Producer
JEM CONSULTING INC. 1300 S. Ocean Drive; Unit 206; Jupiter, FL 33477; (407) 575-4178. Specialization & Credits: Music production & engineering in the south Florida area.

FRANK MERWIN

Engineer & Producer
A&F MUSIC SERVICES. 2834 Otsego; Waterford, MI 48328-3244; (313) 682-9025; (313) 669-3100; FAX: (313) 669-8720.

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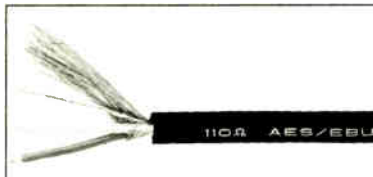
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Engineer, Producer & Technician
SHEFFIELD AUDIO/VIDEO PRODUCTION. 13816 Sunny Brook Rd.;
Phoenix, MD 21131; (410) 628-7260; (410) 666-0196 (phone/fax);
FAX: (410) 628-1977. Specialization & Credits: 1986 Grammy
nomination—Best Engineered Album, Michael Hedges, *Aerial
Boundaries*. 1986 Grammy-nominated album, Douglas Miller, *Un-
speakable Joy*. 1988 Grammy-nominated album, *Sweet Honey in
the Rock*. 1989 Grammy-nominated album *Seldom Scene*. Billy
Joel/Disney Productions, *Vigil*/Chrysalis Records, Barry Manilow,
Cindy Lauper, Aretha Franklin/Jerry Lewis Telethon, Billy Squire,
Mister Mister, The Hooters, Marilyn McCoo, Mary Chapin Carpenter,
Dionne Warwick, Shadowfax, Will Ackerman, Ella Fitzgerald, Oscar
Peterson, Bella Fleck and the Flecktones, the National Symphony,
Daddy Long Legs, ABC Sports, ESPN, CNN. Consoles: (2) SSL 4048
E/G. Tape machines: (2) Sony 3324, (2) MTR-90. Gear: AMS, Even-
tide, Lexicon 224LX, Sontec EQ/comp, Drawmer, Pro Tools, video
FX, audio/video online/offline, nonlinear editing.

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Engineer
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erdale, FL 33310; (800) 488-0875; FAX: (305) 741-6367. Special-
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tions, features, commercials, etc. Sync. playback for music videos,
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Engineer & Producer
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92659; (714) 494-0181; FAX: (714) 494-0982.

DAVE NODIFF

Engineer & Producer
NF/X DIGITAL. 6 Cunningham Dr.; Framingham, MA 01701; (508)
872-6843; (617) 292-8208.

DAVID NORMAN

Engineer, Producer & Music/Computer Programmer
GLOBAL ASSAULT MANAGEMENT. 639 Gardenwalk Blvd, Suite
1632; College Park, GA 30349; (404) 994-1770. Specialization &
Credits: Studio Engineer credits: AC Black (Motown Records),
Peabo Bryson (Sony Records), Juz Cause (Savage Records), Doc
Holliday (A&M Records), Candi Staton (Beracah Records); Live En-
gineer credits: Peabo Bryson, Arrested Development, Kris Kross, the
SOS Band, AC Black, Dick Clark Productions, Pacific Music Show-
case.

RICHARD OLIVER

Engineer & Producer
OLIVER PRODUCTIONS. New York, NY; (212) 255-5313 (NY);
(203) 968-1705 (CT) ans. machine. Specialization & Credits: En-
gineered Rolling Stones, Yes, B-2's, Ellen Foley, Fleshstones, Toots &
the Maytalls, Sting, Pagan, Sapphire, Nana & the Bushmen, Janis Ian,
Tabou Combo, Venus and many others in rock, pop, R&B, dance,
metal, hip hop, rap and orchestral genres. Film, music video and TV
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and Blondie. Also extensive commercials incl.: American Express,
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tal, lock-to-picture, MIDI, sequencers, outboard, editing, mastering,
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GOJO PRODUCTIONS/JEANNINE O'NEAL PRODUCTIONS. 195 S.
26th St.; San Jose, CA 95116; (408) 286-9840; FAX: (408) 286-
9845. Specialization & Credits: Chart-proven producer of country,
Mexican and pop music. Produces live/computer sequencing or
self-contained bands. Plays nine instruments. Played on Grupo Ven-
nus' latest Gold album, keys and guitars on Los Aquario Top 10 in
Billboard. Eddie "G" Greiner #13 on Indy country charts played most
of the instruments and produced. DJ Morgan Jaque Lynn-country
artists. New American Music Top 50 in Indy country charts, Duke
Alo'ilima latest LP *Moments Away* adult contemporary.

PAT ORTMAN

Producer & Music/Computer Programmer
EMPTY STREET PRODUCTIONS. 1405 Greenbriar Dr.; Cham-
paign, IL 61820; (217) 398-1775.

WILLIAM OVCA AND CARLOS VILLALOBOS

Producer & Music/Computer Programmer
BZIPP! TDOONS. 2609-C N. Greenview; Chicago, IL 60614; (312)
347-3770; (312) 525-3226; FAX: (312) 274-7732.

CHRIS PAGE

Producer & Music/Computer Programmer
PAGES PAGES PUBLISHING. c/o Barbra Reinecke; 14724 Ventura
Blvd, Ste. 501; Sherman Oaks, CA 91403; (818) 981-1770; FAX:
(818) 906-7261.

DAVE PALMER

Engineer & Producer
1643 Bloomfield Place Dr. #621; Bloomfield Hills, MI 48302; (313)
338-7046. Specialization & Credits: Earl Klugh Trio Vol. II with the
London Royal Philharmonic Orchestra, Emmy Award—Best Sound
Cinemax Sessions: A Session with Chet Atkins; Grammy Award—
Best Latin Recording, Eddie Palmieri *The Sun of Latin Music*; motion
picture music—*Perfect Couple*, *Health* Robert Altman; *Rich Kids*
Robert Benton. Partial album credits: *Blood, Sweat & Tears Live
BS&T More than Ever*, Jaco Pastorius *Jaco Pastorius*, Earl Klugh Trio
Vol. I, *Solo Guitar*, *Whispers & Promises*, *Life Stories*, *Wishful Think-
ing*, *Low Rider*, *Night Songs*, *Late Night Guitar*, *Heart String*, *Soda
Fountain Shuffle*; Chet Atkins *Sails*, *Street Dreams*; Al Dimeola *Land
of the Midnight Sun*, *Elegant Gypsy*, *Casino*, *Splendido Hotel* (co-pro-
duced); Alice Cooper *Welcome to my Nightmare*; Carly Simon *Carly
Simon*; Michael Urbaniak *Fusion III*; Lena Horne *Nature's Baby*; Paul
Winter Consort *Icarus*; Pattie Austin *In My Life*; Led Zeppelin IV; and
Jimi Hendrix *Cry of Love* (asst. eng.). Experience encompasses field
recordings, live remote recording, video recordings, advertisements,
former director of recording—Electric Lady Studio, NY.

JOHN PALMER

Engineer, Producer & Music/Computer Programmer
ANDRO-MEDIA PRODUCTIONS, MEGAWAVE CORPORATION. 682
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5180; FAX: (303) 494-0879.

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373-1026. Specialization & Credits: 15 years experience in profes-
sional studios, working with producers such as Bob Ezrin, Dave
Stewart, Michael Ross, Dwight Marcus, Joe Vannelli, Chris Tan-
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RICK ROONEY

Engineer & Producer

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BOB ROSA

Engineer & Producer

BOB ROSA PRODUCTIONS INC. 143 Fingerboard Rd.; Staten Island, NY 10305; (718) 876-9266; FAX: (718) 876-9266. **Specialization & Credits:** Independent engineer, producer, mixer, remixer. Credits include: Paula Abdul, Stevie B, Afrika Bambaata & Soul Sonic Force, George Benson, Michael Bolton, Betty Boo, Boogie Boys, Toni Braxton, C&C Music Factory, Mariah Carey, Cheap Trick, Cover Girls, D-Project (Japan), Taylor Dayne, Renee Diggs, Dino, Celine Dion, Duran Duran, Sheena Easton, the Family S'and, the Fat Boys, Fleetwood Mac, Force MDs, Penny Ford, Aretha Franklin, Freeze, David Grant (UK), Debbie Gibson, Daryl Hall, Whitney Houston, James Ingram, Freddie Jackson, Janet Jackson, Mick Jagger, Grace Jones, Shirley Lewis, Lisa Lisa & Cult Jam, Trey Lorenz, Monie Love, Madonna, Martika, Stephanie Mills, Michael Monroe, New Order, Noel, the Ocean Blue, Tommy Page, Pau' Pesco, Pet Shop Boys, Planet Patrol, Prince, Lou Reed, Evan Rogers, Run-DMC, Seduction, Seikima-II (Japan), Shannon, SoHo, Starpoint, Britt Savage, Sly Fox, Stealth, Donna Summer, Sweet Sensation, The System, Tony Terry, Stevie V., Warrior Soul, Freedom Williams, Vanessa Williams, Zebra.

JAY ROSE

Engineer & Producer

JAY ROSE'S DIGITAL PLAYROOM. 20 Marion St.; Brookline, MA 02146; (617) 277-0041; FAX: (617) 232-8669. **Specialization & Credits:** Creates commercials, film sound, and multimedia tracks exclusively. Winner of over 150 top awards as designer, director or editor, including multiple Clio, Andy, Dne Show, Emmy, Hollywood R/TV, Hatch and New England Broadcast awards. Edits and mixes in own workstation-equipped, multitrack digital project studio (featured in February '92 *db Magazine*). Also mixes and engineers at major New England 24-track facilities and directs in NY and L.A. Credits include thousands of radio and TV commercials (McDonald's, NYNEX, Blue Cross, Group W), network promos and openings (NBC, Showtime, Discovery), multimedia (IBM, Boston Symphony), documentaries and home videos (MGM, Parker Brothers). Also award-winning advertising writer and contributing editor for *Desktop Video World*.

MIKE ROSEMAN

Engineer, Producer & Music/Computer Programmer

SAUNA STUDIO. 4514 215th Pl.; Bayside, NY 11361; (718) 229-4864; FAX: (718) 229-4864. **Specialization & Credits:** Music production and composition for commercials, records and video. Pre-production including MIDI programming, arranging, sampling and custom sound design. Wide range of vocal talent available. Credits include rock, dance and R&B records, TV documentaries, numerous radio and TV commercials and radio specials. We deliver musicianship combined with technology, custom-tailored to your project and your budget.

BARRY RUOOLPH

Engineer & Producer

5627 Irvine Ave.; North Hollywood, CA 91601; (818) 985-1855. **Specialization & Credits:** Engineered for Hall & Dates, Lynyrd Skynyrd, Rod Stewart, Waylon Jennings, Jessi Colter, Al Wilson, Johnny Mathis, Juice Newton, El Chicano, Shalamar, Dynasty, Lakeside, D'Bryan, Don Cornelius, Rosie Gaines, James Last, John Prine, Roy Buchanan, Stanley Clarke, Natalie Cole, Tony Williams, Levon Helm, Steve Cropper, Cate Bros., Duck Dunn, Keith Moon, Cher, Andy Prieboy, Wall of Voodoo, Jamie Glaser, Robyn Smith, The Rockmelons, Dazz Band, Maurice White, Philip Bailey, Jermaine Stewart, Jermaine Jackson, Robbie Nevil, Jon Bon Jovi, David Kahne, Richard Scher, Steve Diamond, Jeff Pescetto, Steve Dubin, Christopher Bond, Josquin des Pres, Yves Chovard, Gary Stockdale, Tommy Faragher, Lotti Golden, Arthur Baker, Paul Young, Najee, Wendy Moten, Jack Wagner, Prida N' Politix, Boy Howdy, D'Jays, Chris Farren, David Pack, Curtis Stigers, Glen Ballard, Cliff Magness, Wilson Phillips, Lucero, Rocio Banquells, Rafael Perez-Botija, Dina Carroll, Mick Jagger, Puff Johnson, Patti Austin, Tracie Spencer, Dr. Jam, Madness 4 Real, Solid Productions, Jeremy Jordan.

WILL SCHILLINGER

Engineer, Producer & Technician

WILBUR SYSTEMS LTD. 159 W. 4th St., Ste. #10; New York, NY 10014; (212) 727-3450; FAX: (212) 727-3450.

TONY SHEPHERO

Engineer & Producer

FATHER TIME PRODUCTIONS. 114 Burning Tree Dr.; Hermitage, TN 37076; (615) 883-3379.

BERESFORD SINCLAIR

Engineer, Producer, Technician & Music/Computer Programmer

SINCLAIR BROS. PRODUCTION. 2425 Cranston Dr., Ste. 31; Escondido, CA 92025; (619) 738-8851; FAX: (619) 695-9194.

HUSTON SINGLETARY

Producer & Music/Computer Programmer

HUSTON MUSIC PRODUCTIONS. 6145 Northbelt Parkway; Norcross, GA 30071; (404) 409-1897. **Specialization & Credits:** Extensive music production experience has helped Huston in putting together the ultimate production facility. Offering full in-house pro-

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Sausalito, CA

BOB SKYE

Engineer, Producer & Technician
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WALTER N. SOBCHAK

Engineer & Producer
1 Norseman St.; Toronto, ON M8Z 2N9, Canada; (416) 232-9528. Specialization & Credits: Album/Single credits include: Oream Warriors, HDV, Organized Rhyme, Maestro Fresh Wes, Sturm Group, Barenaked Ladies, Welt, Paul Raven (Killing Joke), Michie Mee and LA Luv, Scott B. Sympathy, *Coupe de Ville* Soundtrack, Monster Voodoo Machine, Fifth Column. Assistant engineer on *Dirty Dancing* Soundtrack. Jingle and television credits include Citibank, MuchMusic and CBC Journal. 24-track studio centrally located in downtown Toronto with vintage Neve 8014 console, standard AMS and Lexicon gear, Sony DRE-2000, Studer Dyaxis digital audio workstation, UREI, Orange County, SSL compressors and much more.

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PATCH-CORD SERVICES. 1943 Pine St.; Redding, CA 96001; (916) 246-2305.

JAY STEINHOOR

Engineer, Producer & Music/Computer Programmer
BASEMENT BOYS INC. 510 Jasper St.; Baltimore, MD 21201; (410) 383-8437; FAX: (410) 383-2210.

SCOTT STEVENS

Engineer & Technician
33 Milton Ave.; Summit, NJ 07901; (908) 273-2699.

TOM STILES

Engineer & Producer
T.S. AUDIO. 8315 Lake City Way NE #199; Seattle, WA 98115; (206) 524-1389. Specialization & Credits: T.S. Audio is a collaboration of artists and live audio specialists, grounded in classical stereo techniques, seasoned in all aspects of performance and festival production, and committed to cultural diversity. We serve the total spectrum of musical styles in performance, broadcast and studio projects. We provide a clear channel of creative communication for voices of passion and excellence (Bobby McFerrin, Karla Bonoff, Edvige, Sluson Botti, Nusrat Fateh Ali Khan) leading voices of the gay and lesbian community (VenusEnvy, the Flirtations, Seattle Men's Chorus) and the voices and rhythms of a cultural crossroads (six Seattle festivals featuring international artists from Abana Bu Nasery to Takemitsu to Zakir Hussein). Our technical strategy involves the careful detection of complex wind patterns, the inspired jiggling of billions of electrons, and the relentless manipulation of miles and miles of plastic-bound rust.

BOB STONE

Engineer & Producer
12439 Magnolia Blvd. #206; Valley Village, CA 91607-2450; (818) 779-7633; FAX: (818) 909-4673. Specialization & Credits: Platinum/Gold award-winning multitrack production, recording and remix for *Thank God It's Friday*, *The Whispers*, *A Night at Studio 54*, *Mickey Mouse Disco*, Shalamar, Yarbrough and Peoples, Donna Summer and Frank Zappa. "Last Dance" and *Jazz from Hell* won Grammys for the artist. CD digital re-mastering for all Zappa catalog re-issue. Numerous TV, film and commercial credits from *The Archies* to *Pea Wee's Playhouse*. Production studio with recording and DAT editing facilities available. Many Billboard #1 dance remix hits. Extensive digital and remote recording experience. Member of NARAS and AES. Project rates, will consider spec. only on submitted demos. Superior-quality sound and production for your projects.

CASEY STONE

Engineer
ROCK SOLID AUDIO. 4651 Cahuenga Blvd., Apt. 205; North Hollywood, CA 91602; (818) 559-3952.

JOEL STONER

Engineer & Producer
1567 Fair Ave.; Simi Valley, CA 93063; (805) 581-1962; FAX: (805) 581-6359. Specialization & Credits: Fast. Multi-Platinum. Records/Film/TV Michael Jackson, Fishbone, Warrant, Susanna Hoffs, Roberta Flack, Michael W. Smith, Jade, Murray Attaway, Kazu Matsui/David Lindley. Coke, Pepsi, Budweiser, *Groundhog Day*, *Ferngully*, etc.

RON STREICHER

Engineer & Producer
PACIFIC AUDIO-VISUAL ENTERPRISES. 545 Cloverleaf Way; Monrovia, CA 91016; (818) 359-8012; FAX: (818) 357-0602. Specialization & Credits: Ron Streicher has an international reputation for live-to-stereo audio projects on location and in studio. As owner of Pacific Audio-Visual Enterprises, he provides cost-effective, quality-oriented services, specializing in basic, time-proven production techniques—without unnecessary fuss or gimmickry. The result: a successful job, on-time and within budget. With a lifelong background in music presentation, Ron is qualified to serve as a music consultant as well as engineer on any project: location or studio recording or broadcast, live concert, sound reinforcement, music and performance coordination, audio systems design and consultation, lectures and seminars on recording techniques. Credits: codirector and faculty member of the Aspen Music Festival Recording Arts Institute; audio consultant to the Mann Music Center productions of the Philadelphia Orchestra, Metropolitan Opera, New York City Opera; location recordings in Moscow of the Bolshoi Theatre Orchestra for the U.S. tour of the Moscow Ballet; recording and production of the Los Angeles Philharmonic Orchestra and numerous other music concerts and dramatic productions broadcast over National Public Radio, American Public Radio and PBS networks; record projects for Angel, Protone, RCA, CMS Desto, Oiscovery, CRI, SAZ and others.

JOHN A. STUART

Engineer & Producer
STUART AUDI SERVICES. 342 Main St.; Gorham, ME 04038; (207) 839-3569.

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ARCH THOMAS

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821 S. Orleans Ave., Tampa, FL 33606; (813) 854-8152.

BILL THOMAS

Engineer & Producer
BILLY TEE PRODUCTIONS. 1293 Atkins Wy.; Boulder, CO 80303; (303) 494-6927.

RISTO TOLONEN

Engineer, Producer & Music/Computer Programmer
FINNSOUND. 276 W. 2000 N., Ste. X; Layton, UT 84041; (801) 776-9173; FAX: (801) 268-8262.

CURT TOTA

Engineer & Producer
HIGH POWER PRODUCTION. PO Box 2668; Oarion, CT 06820; (203) 656-2408. Specialization & Credits: *Madhatter, Secret Smile, Nightfall, Toy Maker, Tim Janis & Mayhem, Steve Richards, The Tracks, Live At Dr. Bob's, Monkees, Mick Taylor, Cozy Sheridan, Catie Curtis, Ian Matthews, Vance Edwards, Joe Perry, Jack Bruce, Ads & Industrials: Noxema, Bain de Soleil, Proctor & Gamble.* We offer up to 56-track digital (or analog) recording and specialize in new, unsigned acts of all styles, as well as established artists. We also specialize in advertising and industrial projects. We work on the SSL 6000 G-Series, so no project is too big or too small.

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AFFINITY PRIVATE MUSIC, DIV. OF OMEGA ORGANIZATION INT. PO Box 33623 MD; Seattle, WA 98133; (206) 364-7881; FAX: (206) 784-9827. Specialization & Credits: Film-scoring, adult contemporary, new age, world, electronic, folk, classical, jazz & esoteric new genres. Award-winning producer since 1978, well-connected internationally. Worldwide airplay and sales. Professional composer/engineer since 1970. Many commissioned works. Clients: Paramount Pictures, Disney, Tangerine Dream, Seattle/Boise Symphony Orchestras, Affinity, ABC-PBS-CTV, Emmy Awards, five federal governments and over 400 others. Services available: complete 48-track digital music recording, film composing/scoring, extraordinary event/tour production, laser

light show, lighting design, sound, photography, mobile recording. Detail: we produce & collaborate with selected artists/record companies, at all appropriate levels of involvement, guidance, development—primarily with artists recording in our studios. Serene recording environment with every technical/musical facility, processing, samplers, synthesizers, percussion, exotica. Currently producing five albums. We look forward to optimizing your project with excellence you'll always remember. Thank you.

BRIAN A. VESSA

Engineer, Producer & Music/Computer Programmer
BV PRODUCTIONS. PO Box 3272; Santa Monica, CA 90408-3272; (310) 826-5902. Specialization & Credits: Credits: four Gold albums, including José José and Juan Gabriel; Michel Rubini's *Secret Dreams* and Brett Perkins' *New Accelerated World*. Fox TV, *In Living Color*. Films: Michael Mann's *Band of the Hand, Manhunter*; Imperial Entertainment feature and soundtrack, *Nemesis; Friday the 13th Part VIII*; Don Johnson video feature *Heartbeat*; Disney's *Not Quite Human II*; NBC's *Crossing the Mob, Moving Target, Hands of a Stranger*; CBS's *Too Good to Be True, Unholy Matrimony*; USA Cable's *Silhouette, The Fear Inside, The Haunting of Sara Hardy*; HBO's *The Edge*. Numerous commercials, trailers and industrials. Music production and engineering, Synclavier, music editing, video sweetening and film post-production. I have over 16 years experience in the professional audio field, 25 years as a musician and a degree in electronics. I enjoy being involved with the creative process of music in all styles and capacities, being equally comfortable with acoustic and electronic production techniques.

DUSTY WAKEMAN

Engineer & Producer
DUSTY WAKEMAN PRODUCTIONS/MAD DOG STUDIOS INC. 1717 Lincoln Blvd.; Venice, CA 90291; (310) 306-0950; FAX: (310) 578-1190. Specialization & Credits: Services: producer/engineer/musician with 24-track Neve/Studer recording studio. Credits: Lucinda Williams *Sweet Old World*, Dwight Yoakam *This Time*, Tom Russell *Box of Visions*, LaGuardia (Spain) *Contra Reloj*, Somebody's Darling (Norway) *Somebody's Darling*, Bonedaddys *Jungle/Jungle*.

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ANDY WARWICK

Engineer
N. Hollywood, CA 91601; (818) 508-8691.

JOE WEED

Engineer & Producer
JOE WEED PRODUCTIONS. PO Box 554; Los Gatos, CA 95031; (408) 353-3553; FAX: (408) 353-3388.

JHON C. WILLIAMS

Producer
ALTERNATE WAVE PRODUCTIONS. 6201 Sunset Blvd., Ste. 13; Hollywood, CA 90028; (800) 439-3066; (213) 687-4027.

SUSAN G. WINTHROP

Engineer & Producer
WINTHROP PRODUCTIONS. 156 W. 94th St.; New York, NY 10025; (212) 662-8685; FAX: (212) 749-8387.

MIKE WOLF

Engineer & Producer
STUDIO 5109 PRODUCTIONS/MUSIC BOX STUDIO. 1146 N. Western Ave.; Hollywood, CA 90029; (213) 462-7761; FAX: (213) 254-9938.

HENRY YODER

Engineer, Producer, Technician & Music/Computer Programmer
HEARTSONG PRODUCTIONS. 311 Sautter Dr.; Coraopolis, PA 15108; (412) 457-2430; FAX: (412) 457-2431.

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MIX READER SERVICE

For more information about products & services in MIX:

1. See the opposite page for a listing of Reader Service numbers for advertisers in this issue.

2. Circle the Reader Service numbers that correspond to each advertisement or editorial item in which you are interested. (Maximum of 20 numbers.)

3. Complete all information on the card below. Please check ONE answer for each question unless otherwise indicated.

4. Mail card postage-free!

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MIX Reader Service

P.O. Box 5069, Pittsfield, MA 01203-9856

Issue: *Mix*, July 1993 / Card Expires: November 1, 1993

Name _____ Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone (____) _____

1) Your company's primary business activity (check ONE):

- 01 Recording studio (including remote trucks)
- 02 Independent audio recording or production
- 03 Sound reinforcement
- 04 Video/film production
- 05 Video/film post-production
- 06 Broadcast/radio/television
- 07 Record company
- 08 Record/tape/CD mastering/manufacturing
- 09 Equipment manufacturing (incl. rep firm)
- 10 Equipment retail/rental
- 11 Contractor/installer
- 12 Facility design/acoustics
- 13 Educational
- 14 Institutional/other (please specify) _____

2) Your job title or position (check ONE):

- 15 Management—President, owner, other manager
- 16 Technical & Engineering—Engineer, editor, design engineer, etc.
- 17 Production & Direction—Producer, director, etc.
- 18 Sales & Administration—Sales rep, account executive, etc.
- 19 Artist/Performer—Recording artist, musician, composer, other creative
- 20 Other (please specify) _____

3) Your role in purchasing equipment, supplies and services (check ONE):

- 21 Recommend the purchasing of a product or service
- 22 Specify makes, models or services to be purchased

- 23 Make the final decision or give approval for purchase
- 24 Have no involvement in purchasing decisions

4) Your company's annual budget for equipment, supplies and services:

- 25 Less than \$50,000
- 26 \$50,000 to \$149,999
- 27 \$150,000 to \$249,999
- 28 \$250,000 to \$499,999
- 29 \$500,000 or more

5) Purpose of inquiry:

- 30 Immediate purchase
- 31 Files/future purchases

6) Where you got this copy of MIX:

- 32 Personal subscription
- 33 Recording studio/production facility
- 34 Audio/video retailer
- 35 Newsstand
- 36 From a friend or associate

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004	029	054	079	104	129	154	179	204	229
005	030	055	080	105	130	155	180	205	230
006	031	056	081	106	131	156	181	206	231
007	032	057	082	107	132	157	182	207	232
008	033	058	083	108	133	158	183	208	233
009	034	059	084	109	134	159	184	209	234
010	035	060	085	110	135	160	185	210	235
011	036	061	086	111	136	161	186	211	236
012	037	062	087	112	137	162	187	212	237
013	038	063	088	113	138	163	188	213	238
014	039	064	089	114	139	164	189	214	239
015	040	065	090	115	140	165	190	215	240
016	041	066	091	116	141	166	191	216	241
017	042	067	092	117	142	167	192	217	242
018	043	068	093	118	143	168	193	218	243
019	044	069	094	119	144	169	194	219	244
020	045	070	095	120	145	170	195	220	245
021	046	071	096	121	146	171	196	221	246
022	047	072	097	122	147	172	197	222	247
023	048	073	098	123	148	173	198	223	248
024	049	074	099	124	149	174	199	224	249
025	050	075	100	125	150	175	200	225	250

7) Where your audio-related work takes place (check all that apply):

- 37 Commercial (public) production facility
- 38 Private (personal) production facility
- 39 Corporate or institutional facility
- 40 Remote or variable locations

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MIX Reader Service

P.O. Box 5069, Pittsfield, MA 01203-9856

Issue: *Mix*, July 1993 / Card Expires: November 1, 1993

Name _____ Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone (____) _____

1) Your company's primary business activity (check ONE):

- 01 Recording studio (including remote trucks)
- 02 Independent audio recording or production
- 03 Sound reinforcement
- 04 Video/film production
- 05 Video/film post-production
- 06 Broadcast/radio/television
- 07 Record company
- 08 Record/tape/CD mastering/manufacturing
- 09 Equipment manufacturing (incl. rep firm)
- 10 Equipment retail/rental
- 11 Contractor/installer
- 12 Facility design/acoustics
- 13 Educational
- 14 Institutional/other (please specify) _____

2) Your job title or position (check ONE):

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- 17 Production & Direction—Producer, director, etc.
- 18 Sales & Administration—Sales rep, account executive, etc.
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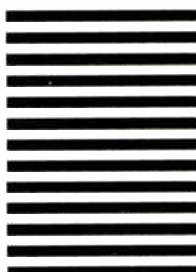


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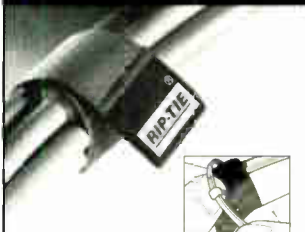
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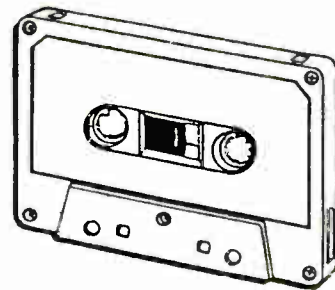
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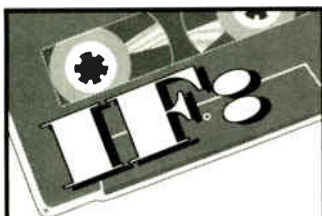
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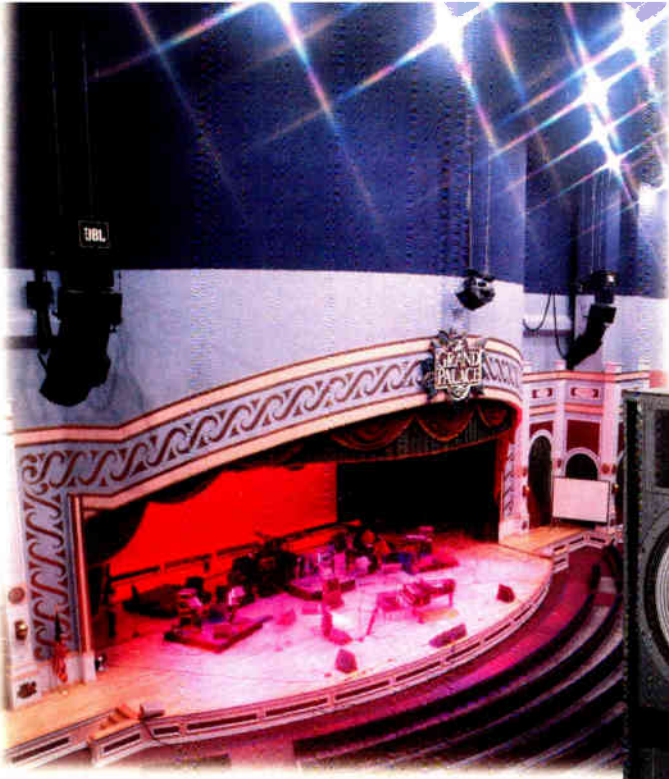
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