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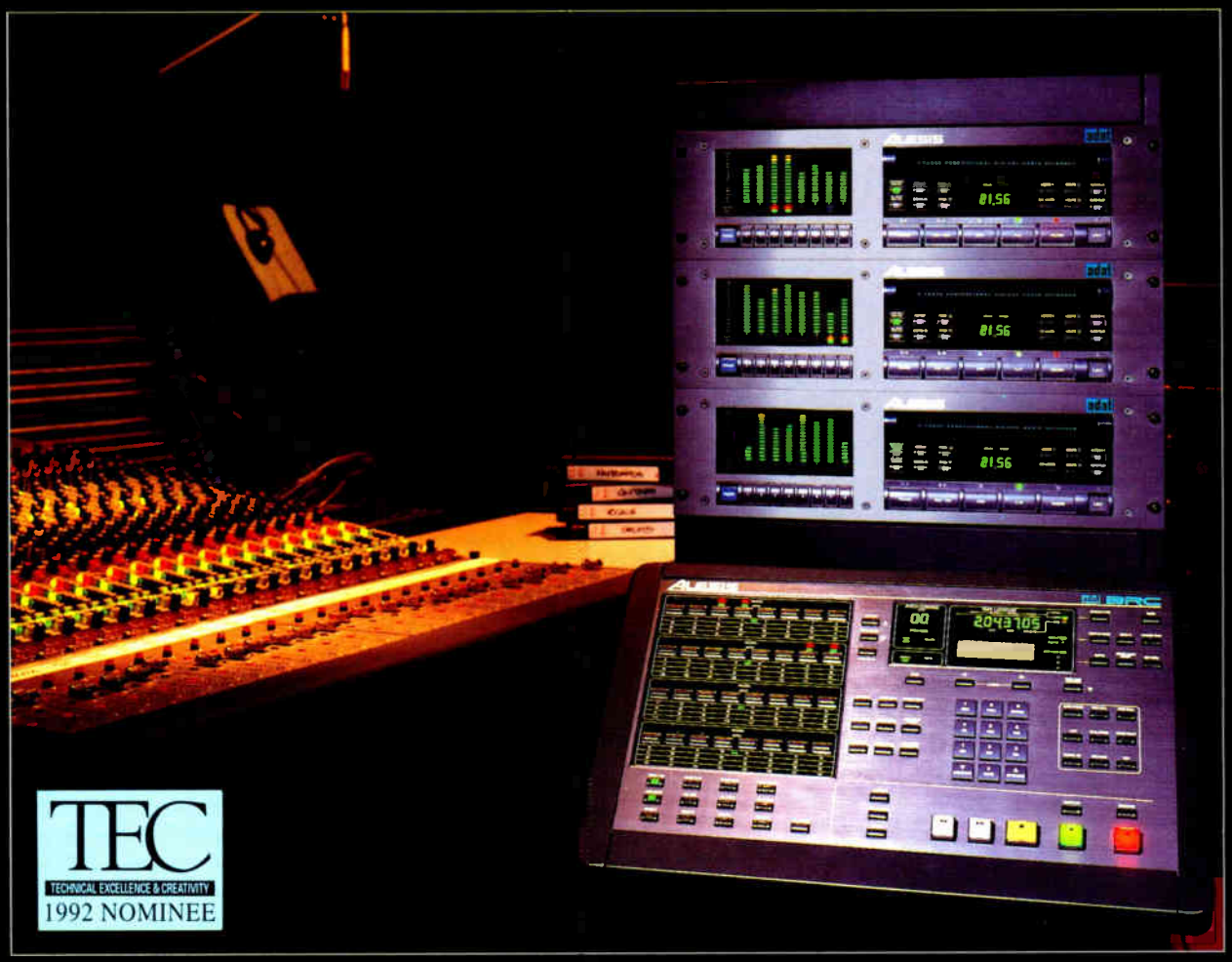

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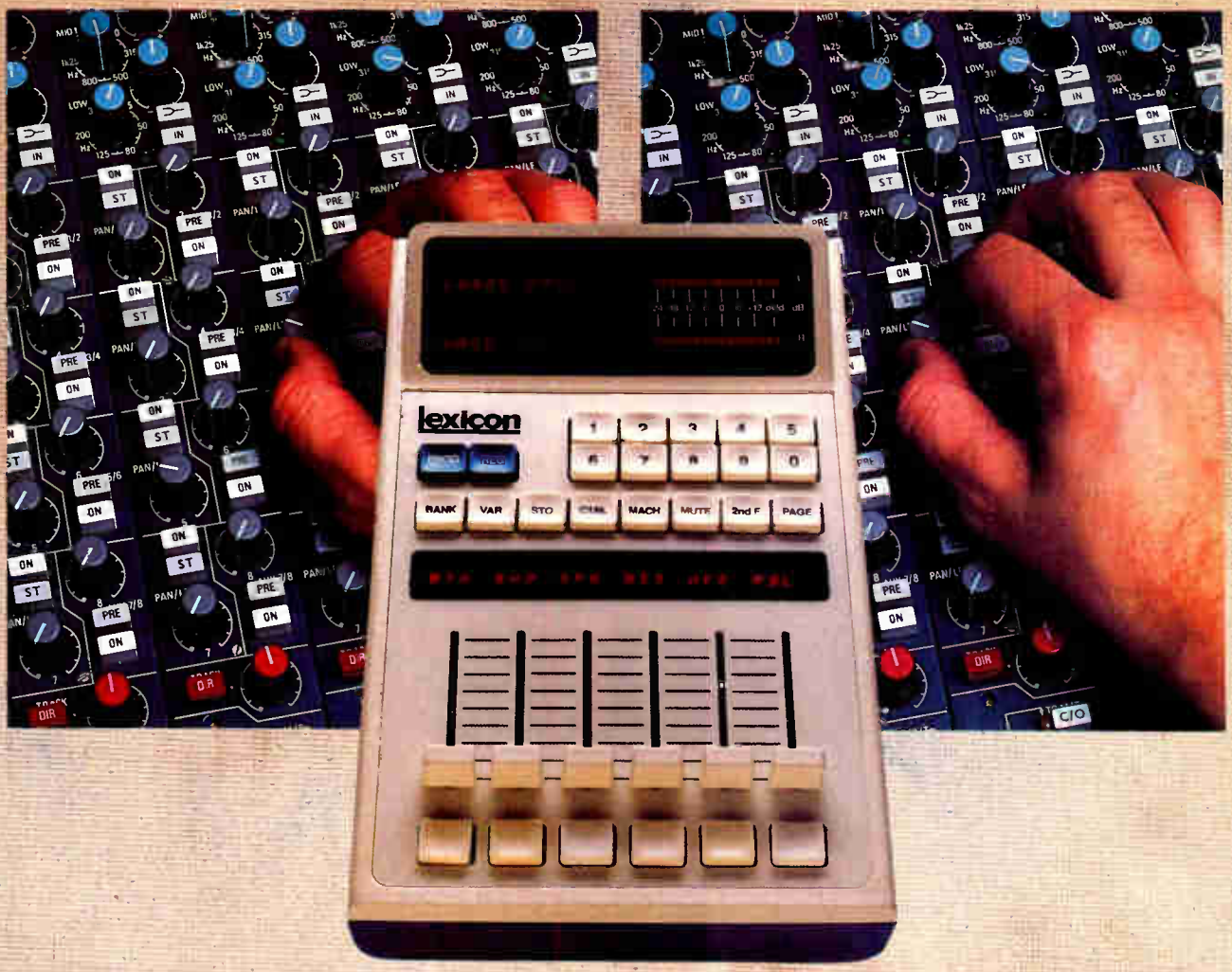

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PROFESSIONAL RECORDING • SOUND AND MUSIC PRODUCTION
JULY 1992, VOLUME 16, NUMBER 7

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Cover: Producing in the digital future has as much to do with the human mindset as it does the equipment array in the modern recording studio. Joseph Drivas' photo/artwork on our 15th anniversary cover reminds us of how evolving technology must serve the user, and how an adept and educated engineer can work magic from brilliant technology. **Photo:** Joseph Drivas/Image Bank.

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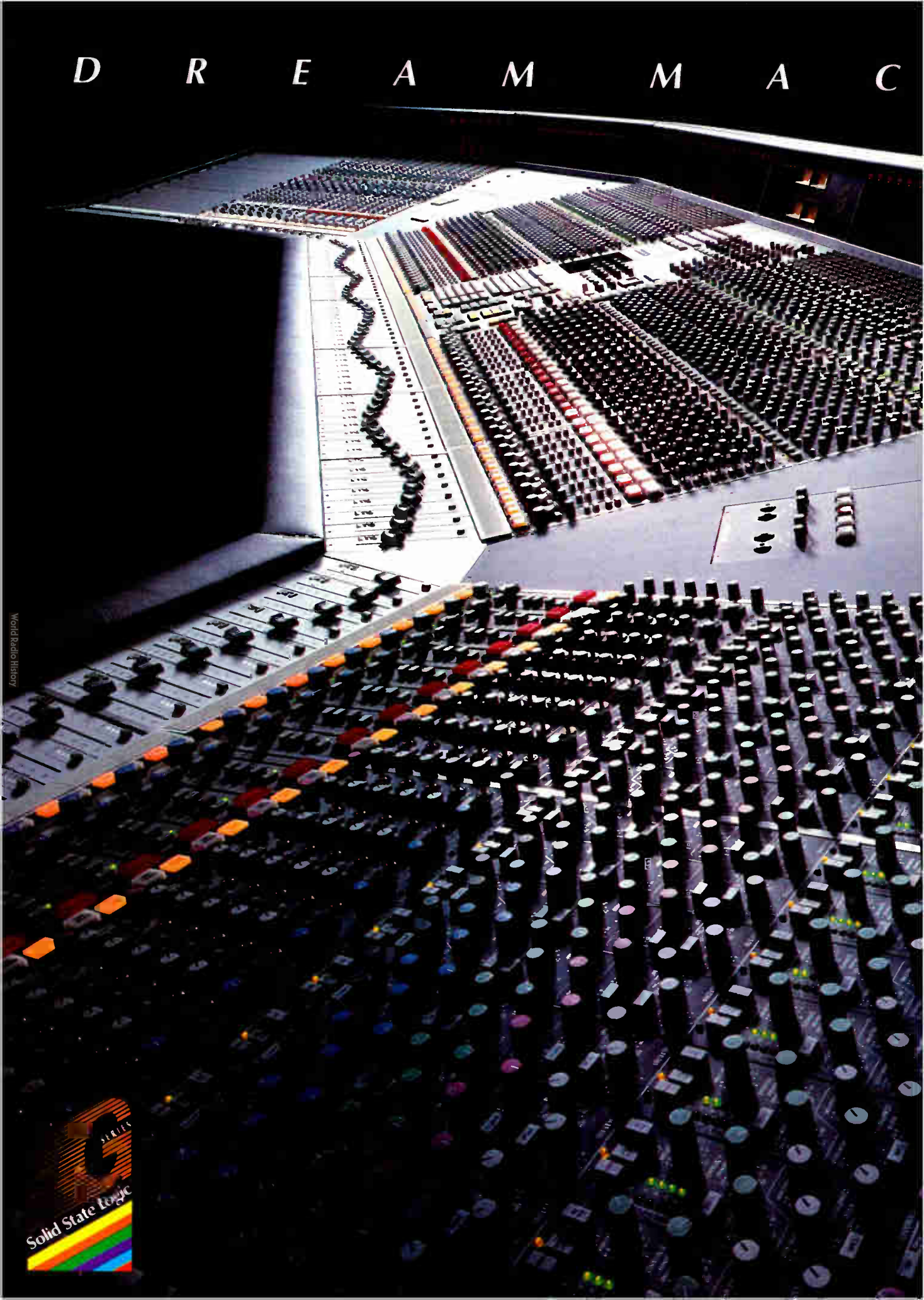

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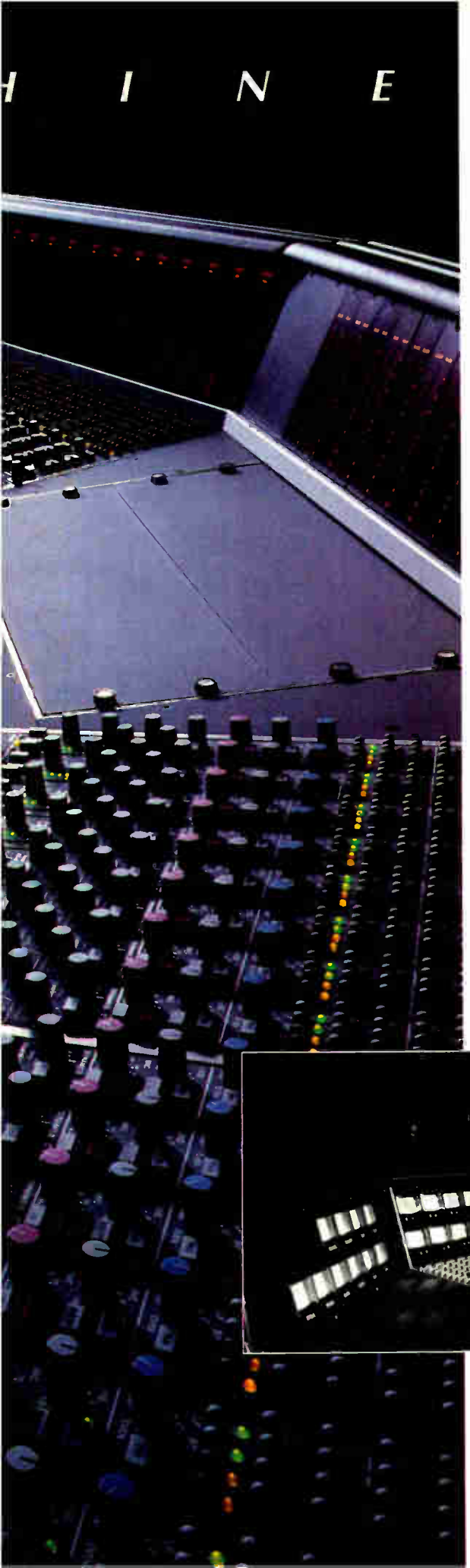

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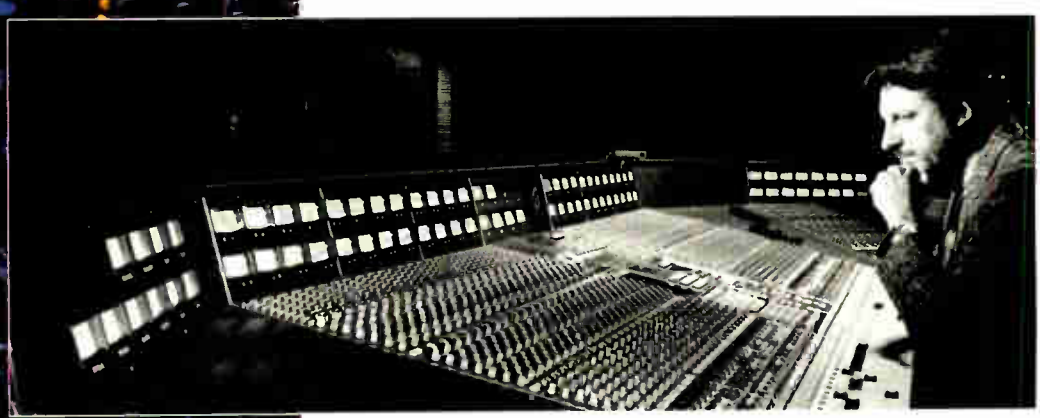

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FROM THE EDITOR

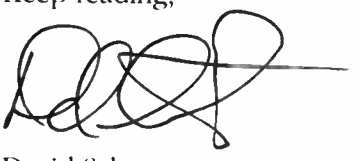
It's hard to believe that it's been 15 years since we started putting out this magazine. You old-timers may remember our early days as a tabloid-sized directory. It took a couple of years before our occasionally published regional directories of recording services and products would metamorphose into the slick magazine you hold before you.

Back then, the magazines read by creative audio types were *Modern Recording*, *Recording Engineer/Producer* and *dB*. While *Mix* was starting to become the place people looked to for information about recording studios, *Modern Recording* was the pathway into the world of "semipro" recording, a niche that would soon regroup itself into what are now the home and project studio markets.

dB and *RE/P* had been duking it out for several years in the pro audio arena before *Mix* came along. *dB* had a loyal following for its broad-based approach to professional applications in recording, broadcast and sound reinforcement. But it was *RE/P* that was getting the lion's share of the attention at the time, first under the editorial leadership of a talented engineer named Tom Lubin and then, in the early '80s, from a brilliant British engineer/journalist named Mel Lambert. Mel had been the guiding editorial light at the esteemed English trade journal *Studio Sound*, and he brought to *RE/P* a world-class sensibility and a technical depth that allowed the magazine to ride high and mighty throughout much of the decade.

Those of you who know Mel only through his "Juxtapositions" column in *Mix* may not be aware of his broad editorial skills or his varied technical and journalistic background. So when Mel proposed the idea of putting together a special issue with us on "The Digital Studio," we saw it as a chance to tap into his vast perspective on studio operations as well as a perfect way to present a futuristic, yet timely, theme as the centerpiece for our 15th anniversary issue. We hope you agree.

Keep reading,



David Schwartz
Editor-in-Chief

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CURRENT

Computer Control Developments at NSCA

The National Sound & Communications Association held its annual show April 27-29 at the Anaheim Convention Center. As with previous NSCA exhibitions, all manufacturers were put on equal footing on the show floor, each occupying small, spartan booths. Demos took place mainly in off-the-floor hotel suites, and we'll look at product announcements next month in the "Live Sound" column.

One of the more interesting bits of news was the continuing development of computer-control standards for sound reinforcement equipment. The AES Working Group is moving forward with its efforts to build a public-domain protocol, though a Pandora's Box has already been opened with the announcements of competing control systems.

As anticipated, QSC and Rane demonstrated working hardware and software communicating over Lone Wolf's MediaLink network. Rane showed its NEQ 28 and NEQ 56 1/3-octave graphic EQs—single- and dual-channel devices, respectively—which have bare front panels, as all settings are handled by a remote computer. QSC demoed software that allows the control of an EX Series amp's front panel settings while also monitoring the amp's status.

Lone Wolf's MediaLink and Intelix's MindNet are the two primary systems being explored by the AES group. However, Rane and QSC are hoping to lead by example rather than wait for the standards process to run its course, hence their demonstrations. Product from each company, making use of the new technology, is expected later this year.

Crest was also on hand to demonstrate the latest in its NexSys control system—featuring MIDI, which has often been downplayed (or outright avoided) in this industry. In the demo suite, NexSys software and hardware controlled a rack of amps and a wide range of MIDI processing gear.

Crown is steaming ahead with its IQ System, broadening its scope beyond just amplifier control. One of the more interesting demos showed several SMX-6 multiplexers reconfigured by dragging little mixer boxes around a Mac screen to create a variety of input channel/output bus combinations. The units also can be programmed to perform limiting, auto-leveling and compression functions.

The biggest Crown IQ surprise, however, was the announcement by TC Electronic and White Instruments that they will provide IQ-compatible gear of their own. This development and the Rane/QSC/Lone Wolf demos are significant in that they demonstrate multivendor support for two non-public domain networking schemes. Until this point, strong multivendor support only existed for non-proprietary systems.

So, the list of control networks you should expect to see in the field includes Crown IQ, Lone Wolf MediaLink, Intelix MindNet, Crest NexSys, PA-422 and MIDI, for starters. A proposal for a link between MIDI and PA-422 was submitted to the AES group by Charlie Richmond of Richmond Designs. NexSys talks MIDI, MediaLink can do PA-422 and MIDI, and MindNet has a PA-422 link. However, having first-hand experience with translating between differing data formats, I can assure you that actually implementing a system spanning multiple network protocols won't always be fun.

These developments can be considered good and bad news: The breadth of the systems is growing, but it looks like things will get more confusing before they fall into place.

—Rudy Trubitt

New OMF Standards Spotlighted At SPARS Workstation Conference

Some 200 industry professionals gathered in Los Angeles during mid-May for the fourth annual SPARS business/technical conference, "Audio Workstations: The Audio Solution for Video Post-Production." Some 11 manufacturers, including Akai Digital, AMS/Siemens, Digidesign, Fairlight, New England Digital, Otari Corporation, Roland Corporation, Solid State Logic, Sonic Solutions, Studer-Editech and WaveFrame, gave succinct, 20-minute presentations of their latest offerings. The remaining time was devoted to hands-on demonstrations.

Because of time constraints, the majority of the formal presentations were necessarily focused, covering the primary differences between competing designs and user interfaces, and showing how digital audio workstations can extend the creativity envelope in a growing number of audio and audio-for-video applications.

On the second day of the conference, Mack Leathurby, newly appointed audio product manager at Avid Technology, provided a valuable overview of the firm's new Open Media Framework proposal. As Leathurby explained, OMF is designed to allow various media, including sound files, graphics, data, video, film and other multimedia elements, to be freely exchanged between systems.

In just the few short months since Avid's official unveiling of

—CONTINUED ON PAGE 12

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INDUSTRY NOTES

JBL Professional (Northridge, CA) reports many new hires: Dr. **Arnie Dahlke** is now director of training and human resource development, **Bob Ofenstein** is product manager, **Michael Paganini** is applications engineer, **Chris Foreman** is manager of the company's **Kearney Operation** (Kearney, NE) and **Thomas Combs** is customer service administrator. JBL employees promoted include **Ted Telesky** to director of product development; **Steve Bartlett** to electronic systems development engineer; **Hector Martinez** to marketing manager; and **Bill Threlkeld** to marketing communications manager... **Soundtracs** (Surbiton, Surrey, England) expanded its staff with the addition of **Peter Jostins** as technical sales manager; **Ian Lovelock**, FCMA FCIS, as management accountant; and **Christine Hale** as purchasing manager...**Mark Lever** joined **WaveFrame**, Boulder, CO, as VP of sales...**Adamson Acoustic Design**, of Pickering, Ontario, announced two new appointments: **Andy Lam** joined as electrical engineer, and **Paul Bauman** will serve as chief engineer...**QSC Audio Products** moved its manufacturing, administration and corporate offices: 1675 MacArthur Blvd., Costa Mesa, CA 92626-1468. The new phone number is (714) 754-6175; the new fax is (714) 754-6174. Also at QSC, **Randall Curlee** was named marketing manager for the company's pro power amps...**Mark W. Perry** joined **Silicon Graphics'** (Mountain View, CA) board of directors after serving with the company in various roles for the past seven years...**Broadcast Television Systems** moved its North and South American headquarters to 94 W. Cochran St., Simi Valley, CA 93065. The new phone number is (805) 584-4700...Arlington, VA-based **Circuits Maximus Company Inc. (CMCI)** chose **Marc Krushinski** as operations manager...Dallas-based **Lester Laboratories** appointed **Gary Rilling** VP of sales and marketing, **Dan Alvarado** VP of manufacturing, **Paul Trimble** director/market development, **Sandy Knowlton** materials manager, **Robert Hubertus** senior digital engineer and **Chuck Stark** VP of finance. In other Lester Labs news, **New West Audio** was named sales rep for Southern California, Arizona, Hawaii and Nevada (Las Vegas)...**Carl Malone** launched a new company, **CM AUTOmation**, which manufactures and distributes high-end pro audio products; for more information, call (213) 224-8048...**ESE** (El Segundo, CA) promoted **Bill Kaiser** to general manager and **Brian Way** to director of marketing and sales...England's **Focusrite Audio Engineering** chose **SG Audio** (Chicago), **Audio Systems** (Seattle) and **Richard Audio** (Quebec) to handle sales of Focusrite's signal processing modules...**Media Technologies Ltd.** (Ronkonkoma, NY) named RPS Communications as its PR, marketing and ad agency. Media Technologies was appointed technical support group for DCC manufacturers by Philips Electronics N.V...Acoustical and audio-visual consulting firm **Thorburn Associates** was formed in Castro Valley, CA. The company's phone is (510) 886-7826; fax is (510) 886-7828... **The Music Network**, a company that wants to link together the various facets of the recording industry, was formed in the San Francisco Bay Area by **Phil Groves**. For more information, call (415) 453-5881... **Erikson Pro Audio** (St. Laurent, Quebec) can now be reached on CompuServe (ID# 755430,3357)...The **UCLA Extension** announced some upcoming classes: Bernie Grundman's "Music Mastering," July 11-12; and "User Interface Design for Interactive Multimedia Systems," September 28-30. For more info on the first class, call (310) 825-9064. For details on the second, call (310) 824-1047...**Duquesne University** (Pittsburgh) is offering a "Special Topics in Music Technolgy" course July 6-10. Call Larry Allen at (800) 274-2588. ■

—FROM PAGE 10, CURRENT

OMF at the April NAB Convention in Las Vegas, virtually all workstation manufacturers have secured a copy of the initial proposals and are responding with ideas of their own. Leathurby says that the OMF structure should be agreed upon by late summer, and that we might expect file and media exchange to become a reality very soon now, news that was warmly applauded by the SPARS audience. Work was also well in hand, he continued, on Avid's OMF Engine, a common software platform for media integration that will be supported via freely published interfaces for translating between proprietary files storage and data formats.

Further details of the OMF proposal—and background information about the need for and directions our industry is taking toward interchange formats—can be found in "Universal Connectivity: Current Progress Toward Standardized File Exchange and Media Formats," in this issue.

—Mel Lambert

Mix Announces TEC Awards Sponsorships

The Mix Foundation for Excellence in Audio and the publishers of *Mix* magazine have announced a preliminary list of sponsors for the eighth annual Technical Excellence & Creativity Awards, to be held at the Westin St. Francis in San Francisco on October 2.

As of press time, 17 companies had committed resources in support of the TEC Awards, either as a Platinum Sponsor ($10,000), Gold Sponsor ($7,500) or Silver Sponsor ($3,000). The money raised from sponsorships is used to produce the TEC Awards and to support organizations involved with hearing research and audio education.

Platinum Sponsors include Act III Publishing (parent company of *Mix*, *Electronic Musician* and Mix Bookshelf), Ampex Re-

—CONTINUED ON PAGE 190

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Welcome to The Future

A Guide for the Perplexed in the Land of Digital

by Mel Lambert, Coordinating Editor

Welcome to this, the 15th Anniversary Issue of *Mix* magazine. For this special occasion, I was asked by *Mix* editors to put together a unique collection of feature articles exploring *the* emergent technology of the '90s.

In practically every facet of the recording, production and live sound industries, digital systems are letting us produce cleaner, clearer, more transparent-sounding product. And for many of us, current-generation random-access editors and workstations allow us to be more efficient and creative in the production process.

But successfully making the digital transition is not without its difficulties. The tried-and-true techniques that we grew up with during the halcyon days of analog just don't hack it in the digital domain. Coming to terms with these differences can be a time-consuming job.

To help reduce the learning curve, we have focused our attention in this special issue on providing hands-on, relevant information for current and potential users of digital systems. The feature articles that follow should supply answers to some of the more fundamental questions being asked by those who are new to the subject, as well as provide additional information for the digital literate. In essence, we want to bring you all up to speed with the technical and operational parameters of emergent workstations, hard disk editors, and digital consoles, recorders and processing systems.

The articles are divided roughly into two types. The first group is more tutorial in nature and covers such subjects as why (and how) to transition from analog to digital; optical storage technologies; serial transport control from digital audio workstations; current progress toward standardized file exchange and media formats; digital technology developments for live sound reinforcement; synchronization issues for all-digital studios; and virtual studio user interface topologies.

The second category of articles looks at some practical, hands-on aspects of digital technology. Dan Daley interviews users and facility owners who made an early commitment to digital; Iain Blair visits Sony Pictures' new Culver City film and video production facility; and film sound engineer and mixer Chris Munro recalls his own experience in selecting digital technology while setting up an all-digital editorial facility in England.

And finally, we look at two dramatic new developments from Neve and Solid State Logic: the innovative Capricorn all-digital music recording console, and the Scenaria post-production mixing system.

As complete as we'd like this information to be in allowing readers to make intelligent decisions about digital technology, we cannot hope to cover everything within the pages of one issue. In addition to the coverage that *Mix* provides on an ongoing basis, access to some basic reference books can be valuable. Here are some well-written sources of additional wisdom:

- *The Art of Digital Audio*, by John Watkinson (Focal Press, 1990; second edition).
- *Audio in Digital Times: Proceedings of the AES Seventh International Conference* (Audio Engineering Society, New York, 1990).
- *Digital Audio Operations*, by Francis Rumsey (Focal Press, 1991).
- *Principles of Digital Audio*, by Ken Pohlmann (Howard W. Sams, 1989; second edition).
- *Tapeless Sound Recording*, by Francis Rumsey (Focal Press, 1990).
- *The AES/EBU Interface Conference* (Audio Engineering Society, New York, 1990).

These and other books are available through the Mix Bookshelf, (800) 233-9604 or (510) 653-3307.

Finally, the following AES Standards contain useful information about connecting and operating digital equipment: "AES3-1992: Recommended Practice for Digital Audio Engineering—Serial Transmission Format for Linearly Represented Digital Audio Data" defines the parameters of this industry-wide digital I/O format; "AES10-1991: Recommended Practice for Digital Audio Engineering—Serial Multichannel Audio Digital Interface (MADI)" describes a technique for carrying up to 56 channels of AES3-compatible data over a single coaxial cable or fiber-optic link; "AES11-1991: Recommended Practice for Digital Audio Engineering—Synchronization of Digital Audio Equipment in Studio Operations" describes techniques for reliable, trouble-free transfer of data; "AES17-1991: Standard Method for Digital Audio Engineering—Measurement of Digital Audio Equipment" describes various techniques for specifying and verifying the performance of digital hardware; and "AES18-1992: Recommended Practice for Digital Audio Engineering—Format for The User Data Channel of The AES Digital Audio Interface" describes a method of formatting the user data channels to carry auxiliary information. The AES can be reached at (212) 661-8528.

Read on...

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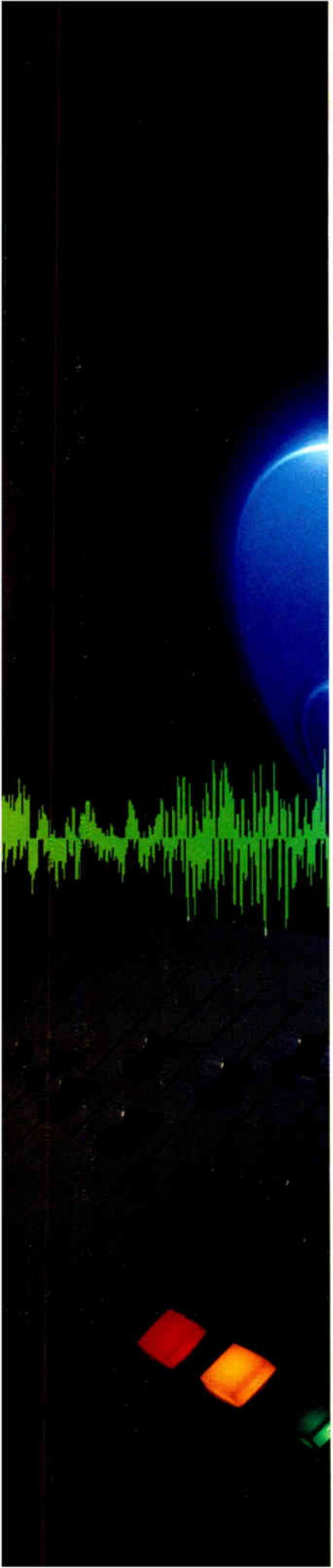
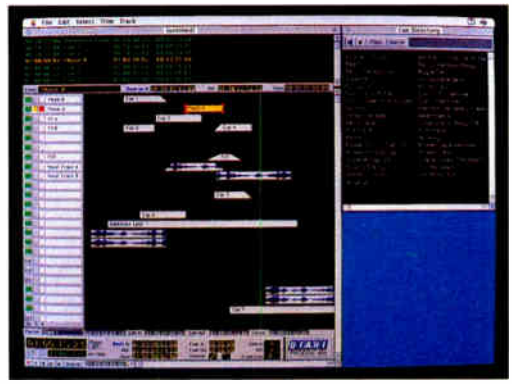


There are a lot of multitrack digital audio workstations out there, but only one with Otari's name on it.

Right now, it seems like everyone is building audio disk recorders. The difference is, we'll still be building them three years from now.



ProDisk's new Graphical User Interface for Digital Editing (guide™) combines several windows into an intuitive, easy-to-use display. Far from just an EDL list, the relationship between all tracks is shown.

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by Stephen St. Croix

VIRTUAL STUDIO USER INTERFACE TOPOLOGIES

FOCUSING ON THE PIEZOELECTRIC PERIOD IN EASTERN AUSTRALIA

Mel Lambert made me do this instead of my regular column. I'm not at all sure just *how* he got me to commit to this, but it probably has something to do with the fact that the two of us used to hang out in London pubs a long, long time ago and watch wimps eat ham sandwiches off the floor. An experience such as this cannot easily be forgotten.

This article replaces my regular "Fast Lane" column this month, much to the dismay of my cats, who are usually invited to help me write. That collaboration (they walk on the keyboard, and I have to start words with the letters they leave behind) will be missed by me, but on the other hand, the coherency factor may rise considerably. Just this once. Here we go.

For me, synchronicity is one of the most fascinating aspects of life on Earth. Just now, as I was composing this text, a very impressive, *commercially available* virtual reality game appeared on TV. I had no idea that abuse of technology had advanced this far. This was a two-player game, with each human standing in a sort of bucket that no doubt houses coils to aid in sensing the person's position and orientation. Each player wore a back-

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5. Is there Truncate Fade-in and Fade-out for "clickless" start and end points?

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8. Does it have realtime audio digital stereo output versus standard digital I/O only for backup?

9. Does it have Note Number Exclusives for cutting off one sample with another?

10. Does it have an RGB or composite monitor output?

11. Can you combine the velocity-switching, mixing and crossfading of up to four samples on one key?

12. Can you expand the memory with standard Macintosh SIMMs?

13. Does it have an "Undo" or "Recover" function?

14. Is there a mouse port for fast and easy programming and editing?

15. Does it have realtime "Scrubbing" for locating edit points easily?

16. Does it have four-stage rate and level envelopes?

17. Does it have Templates for setting up TVA and TVF envelopes quickly?

18. Is there a comprehensive, world-class sample library available from the manufacturer?

19. Does it have Normalizing?

20. Does it have a Digital Filter with +/- emphasis for permanently "EQing" samples?

21. Is there Auto-looping?

22. Is there realtime aural feedback when looping, and is it easy to do?

23. Are there multiple LFO parameters and waveforms?

24. Is there an Alternating Loop mode?

25. Can you load or save Performances (multi-timbral setups)?

26. Is there matrix modulation in the Patch Control page for flexible control routing?

27. Does it have Analog Feel to make certain Patches sound less "sterile?"

28. Does it have accurate Phase Lock or will it lose stereo imaging when active?

29. Does it have digital Compression and Expansion?

30. Does it have Wave Draw allowing you to actually redraw the waveform?

31. Does it have an Insert function for splicing data into the middle of other data?

32. Does it have an Area Erase function for erasing data but leaving the space (time)?

33. Does it have a sample Mix function with a delay parameter?

34. Does it receive Polyphonic aftertouch?

35. Are there different Velocity Curves available?

36. Is there an Index and Jump function for accessing any page in the sampler easily?

37. Are there "Select" windows for finding and assigning samples, patches, etc. quickly?

38. Is there a Volume ID with view field or similar cataloging system?

39. Does it have a 48kHz sampling rate through the digital and analog ins?

40. Is there an "Auto-patch" feature which automatically makes full-blown patches from your samples in a matter of seconds?

41. Does it have resampling, including the ability to resample an entire Performance?

42. Does it have a pre-trigger parameter so as not to lose the attack of your samples?

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pack and a *very* cool helmet—which would undoubtedly scare the hell out of small children and most dogs—and carried a joystick. As they played, they looked up and down, pointed their joysticks at empty space, and saw *each other* on a multilevel 3-D playing field.

The goal was, of course, murder, but waddya gonna do; you gotta sell these things. Each player saw his own hand (holding a disrupter pistol) in a *real-time*, solid-plane, 3-D color world, and as we tapped into both optical feeds, we watched them walk about, looking up and down, searching the other levels, running through portals, up and down stairs, pointing and shooting, watching *each other* move and hide. Impressive.

What does all this noise have to do with the subject at hand? Well, quite a lot, actually. One of the requirements for this assignment was that I should consider the viability of an "ideal" control surface for digital audio workstations. This was giving me a lot of trouble until I took it literally. Ideal?

Ideal can be only one thing: a true and total commitment to virtual reality. This means you, a very nice chair, a display system using 3-D glasses (suspended particulate interactive holography might be a viable option here), non-intrusive position-sensing technology and a couple of speakers (Frederico Speecari lives on), all in an ideal, empty, acoustically optimized room.

You *will* have to actually move your hands and arms around in space to get things done (I mean, those cranial induction interfaces won't be very popular once customers get headaches from going through airport security), but you can set the controls as close as you want, and you can make the buttons move when you are within two inches of them once you get good. Why actually *reach* all the way when your intent is obvious?

Verbal commands can change envi-

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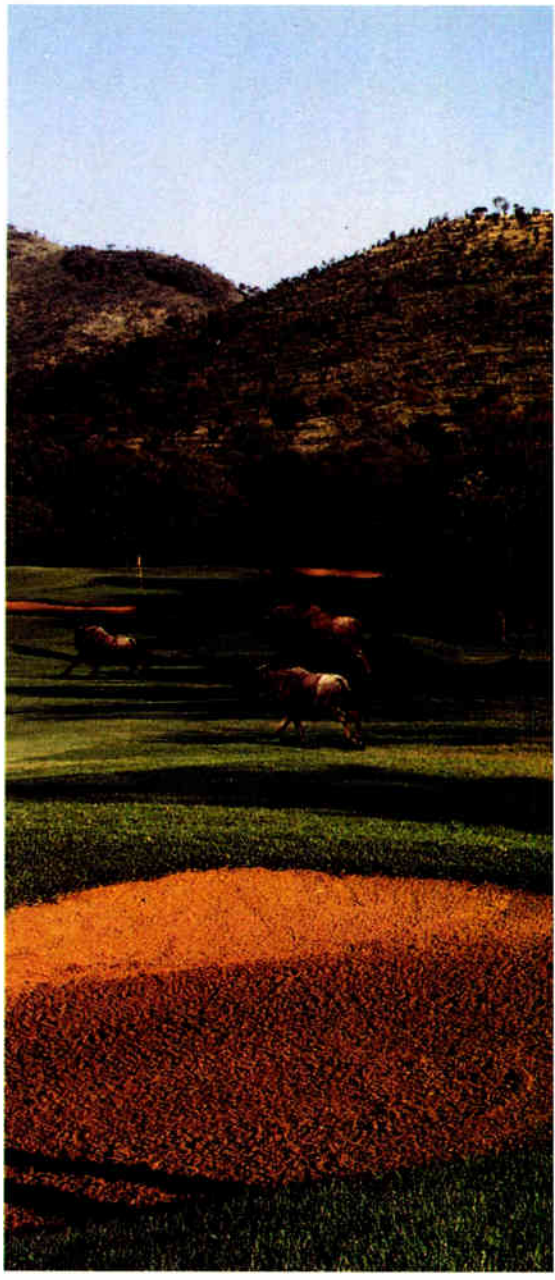

MANAGING DIRECTOR: ANDRE PERREAULT. BOP RECORDING STUDIOS. MMABATHO. BOPHU

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ronments, and you can grow more EQ where you want it—that snare track just might need one more band than you have set as default per track. You can add more sends, more returns, more reverbs, more subs; more, more. Not only will equipment use be virtual, but the configuration itself can be continuously altered. You will be powerful. It will be fun. Only the rich and famous will be defined as "you."

With the wave of a hand, your patch bay can be displayed as a...patch bay. Or maybe a schematic, with red gozintas and blue comesoutas. Or maybe digital streams with clock rates superimposed.

Whatever you choose, they will never crackle or pop, and you will never spend another minute wondering if the right channel of the number 12 stereo return seems to be down 1 dB or deciding which connector might have a bit too much oxidation on it. Oxidation, dirty pan pots, even harmonic distortion and other analog artifacts will be a part of the optional "Blast From The Past" package, sold more as a nostalgic detective game than as a real work tool.

All frames shall sync. All soft clocks shall resolve. All invisibly, all automatically, without questions. Sixty-seven-second spots will convert themselves to flawless 58s with the blink of an eye.

Alternate vocal takes will float over each other like the layers of some sky-born cake. Reverbs will finally give way to the real thing: true room simulation. These spaces will define themselves as perfectly clear 3-D shells, with your tracks placed inside them. Walls, ceilings and furniture may be added and moved at will. Rooms within rooms. Virtual microphones whose characteristics may be altered as you see fit.

All this must happen. It *will* happen.

But, since it won't happen by next Monday, I guess we had better examine trends and options that might.

Where I'm Coming From

As some of you may know, one of my recent designs was the Symetrix DPR

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human interface. That project included all conceptual work (what should an interface actually *control?*); the interface drivers (what is the control logic, the procedures?); and the interface shell (the environment that the user is actually exposed to—look and feel).

I took on the project because my contract gave me complete creative control. At that time, I was becoming deeply disenchanted with all of the other interface schemes used for existing "workstations," "virtual studios" and "disk-based recording systems." This was an opportunity to "do it right."

One inescapable fact emerged as I began to integrate my design. It takes an incredible amount of raw speed and power to make an interface that feels good to the user. If you don't have the horsepower to make the interface (and the machine itself) react *instantly* to user demands, those demands become merely user requests, and the system feels like frustrating sludge. Techies take note: I'm talking a minimum of *several hundred* real VAX MIPS!

What are these design goals? Many people seem to think that this is a tough question. It's not. The goals for human interface are simple. It's *implementing* them that most companies find impossible. The human interface must be:

A) sexy enough to attract people (after all, it doesn't make a bit of difference how cool your new workstation is if nobody takes it home);

B) powerful enough to do the jobs mixers do now, only better (more accurately, more precise repeatability) and faster;

C) capable of solving problems that exist in previous technology's approach *without introducing new ones*;

D) structured to give the engineer more true *creative* power and to make it so easy to store, sync, punch and match multiple-take segments that the engineer *will*. It must also be structured to make available entire new types of creative tools.

Will familiarity breed contempt? The trick here is to make the interface cool-looking, fun-to-use and helpful, without torturing the user later. You want the shortest possible learning curve so that the customer can begin immediately to produce usable end results. This means that the system must gently help the new user make the right decisions; it must provide guides to the functions someone might want next; and it must answer questions properly and immediately when they arise.

On the other hand, it absolutely *cannot* become ponderous once the user becomes familiar with it. It cannot slow down the user in any way. Button sequences that may have been helpful in the beginning will probably become inefficient and unnecessarily tedious once the user becomes adept.

This may seem as if the short-term and long-term goals for a modern human interface system are diametrically opposed, incompatible with each other. Indeed, judging from current efforts, it seems that they *are*. Well, they are *not*; it just hasn't been done right yet. There *is* a way. It has to be intuitive, even intelligent; it cannot be designed by design engineers who don't have the faintest clue what the real-world users actually need, and it can't be designed by real-world mix engineers who don't have a clue what kind of machine they would actually be controlling.

An "ideal" control surface for DAWs means a total commitment to virtual reality.

Should it have a million knobs that you can assign to a million functions? Nope, that's not it. A pen and graphics tablet alone, or the world's largest screen, aren't right either. Light pens and touchscreens are wrong, because humans can't hold their arms up in the air to point to a vertical surface for more than one or two minutes.

It can't have trackballs (fully half of potential users can't deal with them); it can't have a mouse (where would you put the stupid thing in a real-world studio environment?). Actually, it can't even be a computer.

Does Not Compute

That's right. Most of today's top mixers have already learned to mix and actually feel *negative* about having a computer (and its associated relearning period) brought into their already functioning environment. They simply don't see why they should tolerate several months of reduced productivity for the dubious reward of operating a new hyper-tech system that only offers a few improvements and several backward steps. Only the most optimistic, far-seeing and brave—or the most interested in technology for technology's sake—buy the currently available systems.

I view the entire world of virtually interfaced equipment as divided into three categories: equipment with its own built-in screen and data-entry devices, such as a Yamaha SPX or Quantec QRS; little toy hard disk recorder/editors that use pop-in hardware cards for existing computers like the Mac or even MS-DOS machines; and real, dedicated mainframe systems (which normally use a Mac solely for human interface).

The dedicated rack machines do a job for a buck, and so be it. The toy recorder/editors are so clumsy and slow, so crippled by the severe performance restraints placed on them by the fact that they are only little plug-in cards, that it is amazing that anyone would buy them and wait so long for each request to be processed.

Don't get me wrong. These things are so cheap that they currently outsell the big machines by many times. In fact, they sell like crazy in spite of their impressively inferior response time and audio quality. I guess it proves that many are willing to overlook (or put up with) bad performance if it is cheap enough. I mean, Hyundais outsell Ferraris, don't they? Interesting, since those who make their living driving (when the machines change from toys to tools) don't buy the Hyundais any more. If you buy a Ferrari this year, how many decades will it be until you need a replacement? How many months for the econocar?

Really BIG Engines

It is only the third category that I care about for this article: the big machines, the ones that have to be done right, the ones that will eventually determine the direction in which recording technology itself will move.

What are these immediate directions? None of this re-assignable hardware garbage for me. I'm not too interested in staying stuck with knobs and dials, and I'm definitely not interested in having these knobs change their function, their very identity, every few minutes.

I see no real reason to hold on to an obsolete and inapplicable interface concept, to attempt to force a physical

—CONTINUED ON PAGE 200

World Radio History

by Ken C. Pohlmann

OPTICAL STORAGE TECHNOLOGIES

For most folks, the first glimpse of an optical audio disc came a decade ago, when the compact disc was introduced in Europe and Japan in the fall of 1982, and in the U.S. in the winter of 1983. In the ten years since then, the CD has transformed the music business. The neighborhood record shop now has relatively few records (and no LPs) but instead carries mainly discs and tapes. Sound effects records are gone—replaced by CDs. And cars, once exclusively the domain of tape, have become disc havens. In short, wherever music is reproduced, the compact disc has made its mark.

In the recording studio, these ten years have seen the onrush of digital audio tape recorders and peripherals—mainly stimulated by the need to boost professional recording quality to CD-quality—but optical discs themselves have not made significant inroads in the studio. True, a Synclavier operator may rely on a WORM disc recorder for sound libraries, and computer hackers may enjoy the convenience of CD-ROM databases, but the studio is still primarily a place where flux changes on tape or hard disk play the major role.

Yet by all indications, the next ten years will be significantly different from the previous ten. Whereas the '80s saw overwhelming consumer acceptance of the optical audio disc, the '90s may see the same acceptance in the studio. Specifically, CD-compatible, write-once (CD-R) recorders have broken through price resistance levels and will quickly become ubiquitous in recording studios. Likewise, CD-incompatible, erasable optical disc recorders have already won wide acceptance. Subsequently, erasable CD-compatible (CD-E) recorders should appear, at moderate price points. Finally, at the end of the decade, we can expect to see the emergence of multitrack optical disc recorders. Optical disc may soon become a major force in home and professional studios, displacing older technologies and achieving even greater success in terms of creative flexibility, but only if we put on neck braces to prevent whiplash from the major technological acceleration that will occur.

The task of modifying the original CD specification to permit CD-R recording required almost as much ingenuity as the invention of the original CD. In particular, the development of low-cost data encoding circuitry was trivial compared to the problem of developing a new disc. To be playable on standard CD players, a recordable disc must employ the same optical principles as standard CDs. In particular, the medium must meet the minimum 70% reflectivity standard of CD, but it must, of course, be recordable. A heat-mode recording material developed by Taiyo Yuden achieves 73% reflectivity by backing the recording layer with a gold layer.

A CD-R disc looks like a regular CD but is distinguished by its top gold layer and the blue dye recording layer (which appears green because of the

World Radio History

gold layer). A CD-R disc also contains two additional areas within the inner data circumference. The program calibration area (PCA) is used by the recorder to make a test recording to determine optimal laser writing power. The program memory area (PMA) stores a temporary table of contents until the recorder writes the final TOC.

The recording mechanism itself is cunningly simple. A writing laser with 4 to 8 milliwatts of power passes through the polycarbonate substrate, and heats the recording layer to 250 degrees centigrade. It melts, and the polycarbonate layer swells, creating a pit. To read data, the same laser, reduced to 0.5 milliwatts of power, is reflected from the pit, and its changing intensity is monitored. To increase compatibility among recorders and players, CD-R discs are manufactured with a spiral groove to guide the recording laser. In addition, the 0.6-micron-wide track is physically modulated with a 0.3-micron-wide sinusoid with a frequency of 22.05 kHz; this allows the recorder to control disc rotation speed. Also, the excursion is frequency-modulated with a ±1 kHz signal in order to create an absolute time-clocking signal.

With some CD-R recorders adhering to the Orange Book I standard, you must record through an entire disc without pause. When the end of the disc is reached, the recorder records a table of contents (TOC) in the lead-in portion of the disc, so a standard player can read the disc. However, Orange Book II recorders allow tracks to be recorded one or a few at a time. A partially recorded disc may be played on the CD-R recorder, but cannot be played on a regular player until the final TOC is recorded in the disc lead-in area. Some recorders let you mark an unwanted track (such as a false start) and delete it from the TOC so the CD-R player will skip over it (however, regular CD players will play the track).

Both discs and recorders have entered the marketplace. Discs cost about $35 to $40 apiece in small quantities. They are generally available in three playing times and two diameters: a 3-inch 18-minute disc, and 5-inch 63- and 74-minute discs. A number of companies are making CD-R recorders. A good representative is the Marantz CDR-600; it is an Orange Book II model, with track-editing capabilities and low-bit A/D and D/A converters, as well as optical and coaxial digital inputs and outputs. Even more importantly, the CDR-600 does not contain SCMS circuitry.

Other CD-R recorders are available from Carver, Denon, Digidesign, Gotham Audio, JVC, Kenwood, Optical Media International, Otari, Pioneer, Sonic Solutions, Studer and Yamaha. Of course, when shopping for a CD-R recorder, make sure it is indeed a CD-R (CD-compatible) recorder and not an incompatible WORM recorder. CD-R recorder prices vary widely, from $7,000 to $20,000 (the Marantz is $7,000) and are dropping like flies. How far will they fall? Let history be your guide. The reading laser in first-generation CD players cost $300. Now it costs $18. Whatever the eventual price, the availability of low-cost CD-R recorders for both consumer and professional is already assured.

CD-E erasable recorders have been shown in prototype form, but formal introduction will probably be delayed for five years or more. For profit motives, it will be wiser to sell CD-R re-

"I mean, this **always** happens, you get a cut that everybody **finally** seems happy with and **maybe** you allow yourself two breaths without **screaming**, but noooo, the C.D. or the client or the Director or whoever starts talking about **audio post** and pretty soon you're supposed to deliver the **moon**. Only it's gotta be done **tomorrow** cuz they've got an **air date** the day after and everybody turns and looks at you like the **miracle** they just asked for is **no big deal**. Sometimes I could just **kill**."

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corders into market saturation before beginning the selling cycle again with CD-E recorders. In addition, CD-E will be delayed by the advent of the MiniDisc, a magneto-optical technology that will have to churn through the marketplace before CD-E can be launched. CD-E recorders generally employ magneto-optical (MO) recording, in which data is stored via changes in light polarization rather than intensity. Thus, CD-E discs would not be playable in CD or CD-R machines. (However, CD-E machines could be built to play CD, CD-R and CD-E discs.)

A more immediate application of erasable optical disc technology such as magneto-optics is in non-CD-compatible formats. Many disc formats have already proliferated, but many MO manufacturers adhere to an ISO and ANSI disc format in which a two-sided, preformatted, 5.25-inch CAV disc holds 650 MB of data (325 MB per side). This yields about 30 minutes of digital audio per side. Data transfer rate is typically about 1 MB/second. Data compression techniques increase playing time and effectively increase the transfer rate. However, larger-capacity MO discs (1 GB) and drives with multibeam heads (transfer rates greater than 15 MB/second) are already available, but 1GB formats may not conform to industry standards because of the proprietary media employed.

When purchasing an MO drive, the platform-compatibilityquestion should loom largest in your mind; look for drives that are as transportable as possible. For example, the hammerDisk MO drives from FWB Inc. (San Francisco) contain installation software that generates SCSI partitions for multiple operating systems. The hammerDisk 600S is compatible with NeXT, PS/2, AT, RISC 6000, Sun and AppleShare networks. The other question is disc size and capacity; 5.25-inch/650MB is a standard, but mini MO optical drives are also available, using 3.5-inch discs that store 128 MB of data. For example, the REO-130 by Pinnacle Micro (Irvine, CA) is a SCSI device with 28ms access time, and with interface kits it can operate with Mac, Sun, DEC and DOS systems. The downside: These drives may not be compatible with future 3.5-inch standards.

Finally, if your applications call for both the innate security provided by WORM discs and the flexibility of MO discs, you may want to consider a drive that permits both types of recording. These hybrid multifunction devices use MO technology to write both MO and WORM (non-CD-compatible) media; the permanency of the data is determined by the kind of disc used. For example, the Pioneer DE-U7001 conforms to ISO standards and is compatible with other Pioneer 5.25-inch drives but records both WORM and MO discs: the DC-502A dye-polymer WORM disc or the DEC-702 MO disc, both with storage capacities of 654 MB. The downside: Some multifunction drives use a format different from that used in other MO drives.

The standards problem plagues the optical disc industry. There are a number of available disc formats, incompatible in terms of disc diameter, construction, recording and playing method, and file format. This is inevitable because of competition among developing manufacturers and the need to address individual application demands, as opposed to generic universality. The CD-ROM industry has tried to address this standardization problem with its agreement on the ISO-9660 file structure. When a disc adheres to this format (as well as other Yellow Book standards), it may be used on different types of computers (IBM, Macintosh, etc.). However, more specialized software such as search engines may not be universal, thus all-important search and retrieval operations will not always work in every environment. U.S. government intelligence, always hungry for new ways to digest information, has proposed the CD-Rx search and retrieval standard to overcome this problem. However, even given the best standardization efforts, there is no question that because of the diverse applications of optical disc recording, many disc types will proliferate. The audio industry will never enjoy a universal optical disc format.

Optical disc recorders will find many applications in the home and professional studio.

The future of optical disc recording is far from clear, but history teaches us several important lessons. In the earliest days, music was recorded directly to cylinder or disc. The need for longer recording times and editing prompted the development of magnetic tape. Increased complexity in post-production and the need for larger capacity of online program necessitated the move to hard disk. The trend is clearly toward quicker access and greater capacity. Optical disc is certainly attractive in these respects but is hardly an easy winner. A 1GB hard disk costs only about $2,000, and its access times are far shorter than for optical disc. In addition, hard disks are small and light on power consumption. Over the last decade, hard disk performance has increased by a factor of three—that's impressive, but relatively puny compared to the 1,000-fold increase in CPU power over the same time.

Optical disc can offer even cheaper cost per bit, and optical discs are more reliable in harsh environments (i.e., recording studios) and are relatively unaffected by heat, vibration and magnetization. In addition, optical discs promise longer life than magnetic tape or disk; for example, conservatively, an MO should last ten years and a CD for 100 years. Even more important, optical discs are removable—a critical advantage over hard disk, which requires data to be loaded and unloaded. Given sufficient access times and capacity, it is removability that makes optical disc the pragmatic choice. Digital audio is relatively data-hungry—more so than word processing, for example, and less hungry than digital video. But data capacity requirements are sufficient to make removable media a necessity. Hard disk works only when offline data is stored someplace else, on another medium—and when file size is greater than a gigabyte. That is ultimately unworkable. With optical disc, the storage medium is also the working medium, and ultimately, that is how it must be.

Without question, optical disc recorders will find many applications in the home and professional studio. Both 2-track and multitrack optical recorders will increasingly and inexorably take market share from tape and hard disk recorders. However, that transition will take decades, with manufacturers simultaneously developing magnetic and optical recorders to meet diverse market needs, at diverse price points.

—CONTINUED ON PAGE 200

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The Top 500

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THIS WEEK	LAST WEEK	WKS. ON CHART	TITLE / ARTIST	DRUM PRODUCTION
1	2	208	HONEST SNARE / HR-16	ALL WOOD-BRASS RIM
2	NEW ▶		STUDIO TOM / BRAND NEW D4	16" MAPLE TOM w/VERB
3	NEW ▶		BIG "O" / BRAND NEW D4	DOUBLE HEAD KICK w/VERB
4	5	52	RIM SHOT ROOM / SR-16	BRASS PICCOLO w/VERB
5	10	156	BIG FOOT / HR-16:B	SINGLE HEAD 26" MAPLE
6	NEW ▶		SLAM / BRAND NEW D4	POWER TOM w/VERB
7	23	156	COMBO SNARE / HR-16:B	PICCOLO PLUS WOOD
8	NEW ▶		BIG BALLAD / BRAND NEW D4	WOOD SNARE w/BIG VERB
9	NEW ▶		FAT CITY / BRAND NEW D4	SUPER FAT SNARE
				ARTICULATED HI HAT

THIS WEEK	LAST WEEK	WKS. ON CHART	TITLE / ARTIST	
302	NEW ▶		RAW HIDE / BRAND NEW D4	CUSTOM S
303	450	52	HI ROOM TOM / SR-16	10" MAPL
304	NEW ▶		WET HALF / BRAND NEW D4	HALF OPEN HA
305	327	52	RIM 2 CENTER / SR-16	ARTIC
306	123	208	DOUBLE HEAD	DOUBLE HEAD KI
307	223	15(		
308	401	5'		
309	NEW			
310	175	1		
311	NEW			
312	171			

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At the Digital Crossroads

In most technical endeavors, synchronicity lurks just around the corner. While the team responsible for this special issue of *Mix* was finalizing the various feature articles, news reached us of two innovative developments. In the space of just one month, Siemens and Solid State Logic made major new product announcements that promise to revolutionize a variety of functions within recording and production facilities.

In this necessarily brief overview of Siemens' Neve Capricorn digital recording console and the SSL Scenaria digital post-production mixer, I will provide a glimpse into the creative power offered by these two remarkable developments.

Neve Capricorn Digital Recording Console

Neve has been producing digital consoles since the early 1980s, first with the groundbreaking DSP-1, a dozen of which were installed in European facilities. It was followed by the DTC-1 transfer console, currently used in a variety of CD mastering and production studios around the world.

Capricorn, however, is totally new. Based on an all-digital, fully assignable, distributed-intelligence design, and making use of proprietary ASIC technology, Capricorn has been designed specifically for multitrack music recording, overdub and mixdown. Plans for the near future include enhanced output and monitoring assignments for multichannel video and film-

by Mel Lambert

World Radio History

SSL SCENARIA

style mixing.

Capricorn's totally assignable control surface is designed to make a large number of simultaneous functions available. As project leader Paul Lidbetter acknowledges, "Today's recording engineers are *very* familiar with analog console topologies, and they need to be able to reach for the appropriate control without calling up an array of confusing video screens or banks of knobs. With Capricorn, which has been in continuous development now for five years, we supplied simultaneous channel faders, EQ, aux send and other essential controls. Engineers can make the natural transition from analog to digital without becoming intimidated by a change in the way they like to work at the console.

NEW DEVELOPMENTS IN ALL-DIGITAL CONSOLES & FULL-FUNCTION WORKSTATIONS

"Once the user spends just a couple of hours using a Capricorn board, the sonic advantages of digital become immediately obvious," Lidbetter continues. "Not only that, but the concept of an entirely 'soft' signal path allows Capricorn to be reconfigured easily and quickly. Every front-panel setting can be stored and updated every video subframe, for total dynamic and/or snapshot automation."

In essence, Capricorn comprises an array of assignable channel strips, plus a central Assignable Facilities Unit and monitor section. Channel strips can be added in banks of 24, for a total of 120

NEVE CAPRICORN

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simultaneous control elements; in practice, because each strip is totally assignable, most users will probably specify two banks of 24 strips. (Larger-format, film-style consoles designed for use by up to three operators might be another matter, however.)

Of course, there is no correlation between the number of channel strips and the console's input/output configuration. Any frame size can control and operate any system size; the physical number of analog/digital inputs and outputs, functional EQ and signal-processing blocks are defined by the amount of hardware contained within Capricorn's equipment rack. A choice of 44.1 and 48kHz sampling rates is offered.

Functions such as EQ, aux sends and insert points can be allocated to a particular strip and adjusted from the channel itself or, more likely, from the central Assignable Facilities Unit. Each strip is equipped with four dedicated rotary controls (in reality, shaft encoders with skirt-style LEDs to show current settings) that can be assigned to control a number of different signal parameters. For example, one setting might assign these controls as an indi-

AMS Logic 2 and Yamaha DMC1000 All-Digital Consoles

While the Neve Capricorn and SSL Scenaria are remarkable developments, we should not overlook two other firms that are currently offering all-digital designs.

The AMS Logic 2 is an all-digital, dynamically automated console with a "familiar, analog-style control surface," designed for film/video post-production and large-scale music recording. Each assignable channel strip controls four completely independent mono/stereo paths; a fully configured board can handle up to 512 signal paths. Virtually all channel parameters, including read, write, update and isolate for fader and mute, are dynamically automated, with up to 48 fully automated aux sends.

An electronic matrix provides individual assignment of A/D inputs and outputs to any channel strip, group or main output. Signal processing is handled by a 4-band parametric EQ section with 2-band filters, plus a full-function dynamics section per channel strip. Depending on the Logic 2's intended application, additional input strips can be added in buckets of 8 or 16 channels.

In the near future, AMS plans to offer a central Assignable Facilities Unit that can be used to set up individual or grouped channel-strip parameters from the central mix position.

The first Logic 2 to be installed in North America was delivered to Editel/Chicago in late January, for use within a new Lakeside-designed, two-room complex for TV commercials, music recording and music-video projects.

The Yamaha DMC1000 is an all-digital, 8-input/stereo console designed for music recording and mix-to-picture projects. Three additional stereo inputs are available for effects returns, along with eight tape-machine returns. All eight input channels feature 4-band EQ and three aux sends (two mono, one stereo). Multiple units can be cascaded together to provide additional inputs and outputs. Up to 370 ms of delay are available to compensate for inter-microphone delays.

All primary inputs and outputs

—CONTINUED ON PAGE 38

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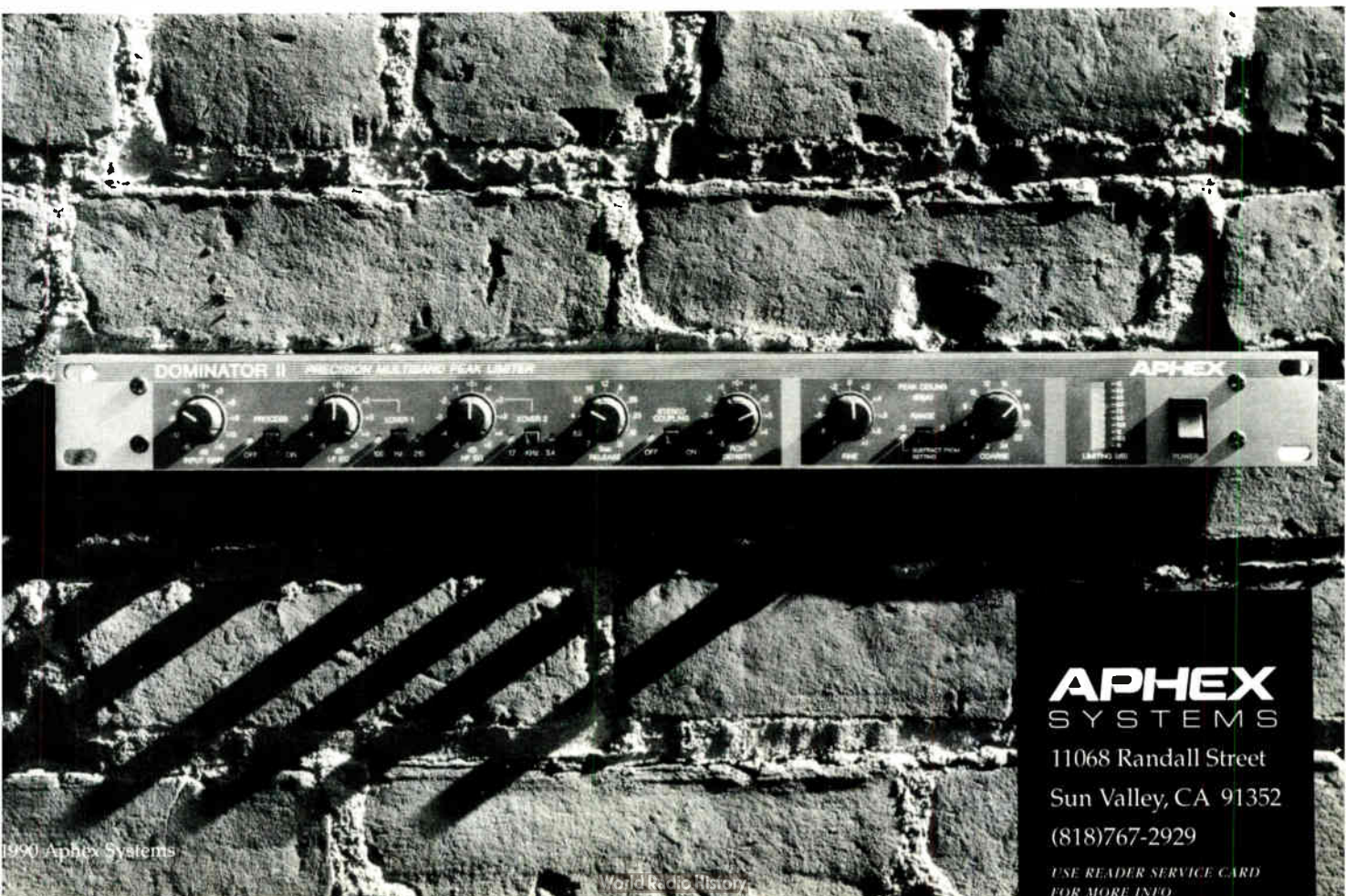

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vidual EQ section or bank of auxiliary sends. All channel faders are motorized for instant visual indication of previous mix levels and balances; the system includes the functional equivalent of a Flying Faders automation package.

A typical Capricorn configuration accommodates up to 32 analog mic/line inputs; 24 digital inputs (from DAT recorders, processors, effects units, etc.); 64 MADI-compatible inputs (tape-machine returns); eight analog and 16 digital insert returns; 96 EQ/filter elements; 96 dynamics elements (limiter/gate/expander/compressor), with dedicated side-band EQ; 16 freely assignable groups; 32 insert points; 48 MADI-based outputs; 16 analog/digital aux sends; eight analog cue outputs; eight analog and 16 digital insert sends; four analog talkback sends; and two stereo analog/digital monitor outputs.

Both mono and stereo paths are available via any channel strip, controls being automatically linked for stereo paths (including EQ, mic gain, etc.). Each strip can be labeled via a four-digit alphanumeric display. Any of the following can be assigned to a channel strip: input, monitor (as tape-return path), subgroup, main output, auxiliary master, or VCA group master. Thus, any combination of split, in-line or pseudosplit console layouts can be set up from the master control section, with inputs assigned to convenient channel locations across the console. As the session progresses, inputs whose input levels and EQ settings will remain fixed—drum or vocal submixes, for example—can be assigned to a bank of strips whose controls are not currently assigned to any control-surface functions. But, by recalling that particular bank to the surface, instant access can be provided to any control element.

Capricorn's centralized Assignable Facilities Unit is a remarkable piece of design. The AFU contains individual controls for the various aux sends (16 per channel strip); highpass and lowpass filters/notch; 4-band parametric EQ; expander/gate, limiter, compressor controls (including sidechain EQ); plus 48-track assignment and routing to 24 subgroups. For Capricorn's current configuration, outputs can be panned between conventional left and right stereo pairs; an alternative "film" position provides pan/balance between left, center and right output designations. A width control enhances the normally panned signal laid across the L/R outputs.

The AFU is designed to provide full access to all assignable functions on a designated signal path; it can also be used to copy settings from one strip to others (overall EQ or dynamics, for example, being applied to a string submix or a vocal balance). A central AFU Vacuum Fluorescent Display shows EQ, dynamics and filter settings in an easy-to-understand format.

For system setup, a master VDU display, trackball and keyboard provide access to various assignment and automation functions. For example, while defining the I/O and signal characteristics of a designated signal path, screen icons representing various processing elements can be moved to relative locations between selected inputs and outputs displayed on the screen.

Vacuum Fluorescent Displays provided at the top of each channel strip show six signal levels. In default mode, a master pair of vertical bars display peak-reading track send/return level, input level and dynamics metering. A

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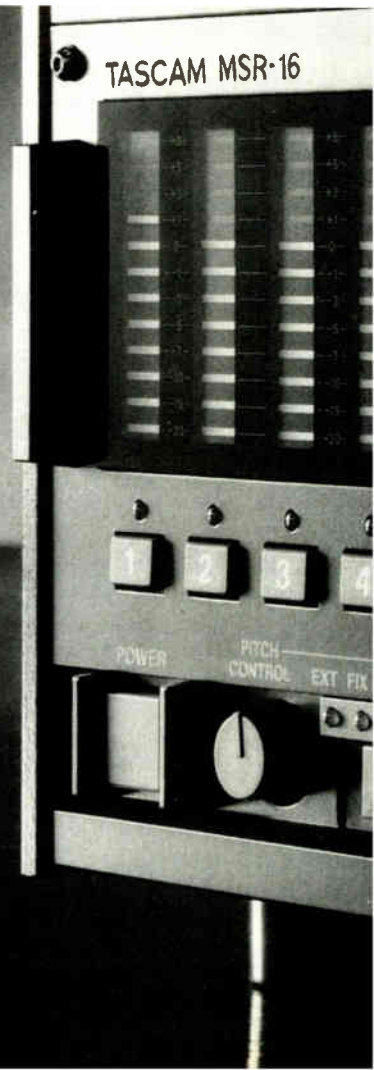

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set of four smaller meters can be selected to display input level (mono/stereo), compressor/limiter and expander/gate gain reduction; another mode selects EQ settings.

Machine control and time code synchronization of up to six independent multitrack and mastering decks is provided via an Adams-Smith Zeta-3 interface, in addition to planned, 9-pin, serial ESbus I/Os.

As with any digital console design, Capricorn has been configured to provide real-time control of all signal processing elements, no matter what size of processing rack the Capricorn control surface is connected to. It's a daunting task, as Lidbetter explains: "To eliminate zipper noise and other distortions, we need to perform *all* dynamic and snapshot changes in level, EQ, dynamics and mix balance on all signal paths every clock sample. That's a staggering amount of DSP! To ensure that we could provide sufficient processing power and resolution, Neve developed its own custom-designed, high-speed, application-specific integrated circuits."

All input ports operate with up to 24-bit data, which is maintained by Capricorn's operating system. Analog input ports can operate up to 24-bit, depending upon the converters used. (Neve's current A/Ds are rated at better than 18-bit.) Output ports can be selected independently for word length (16, 18, 20 or 24-bit), with the correct level of noise-weighted, triangular PDF dither.

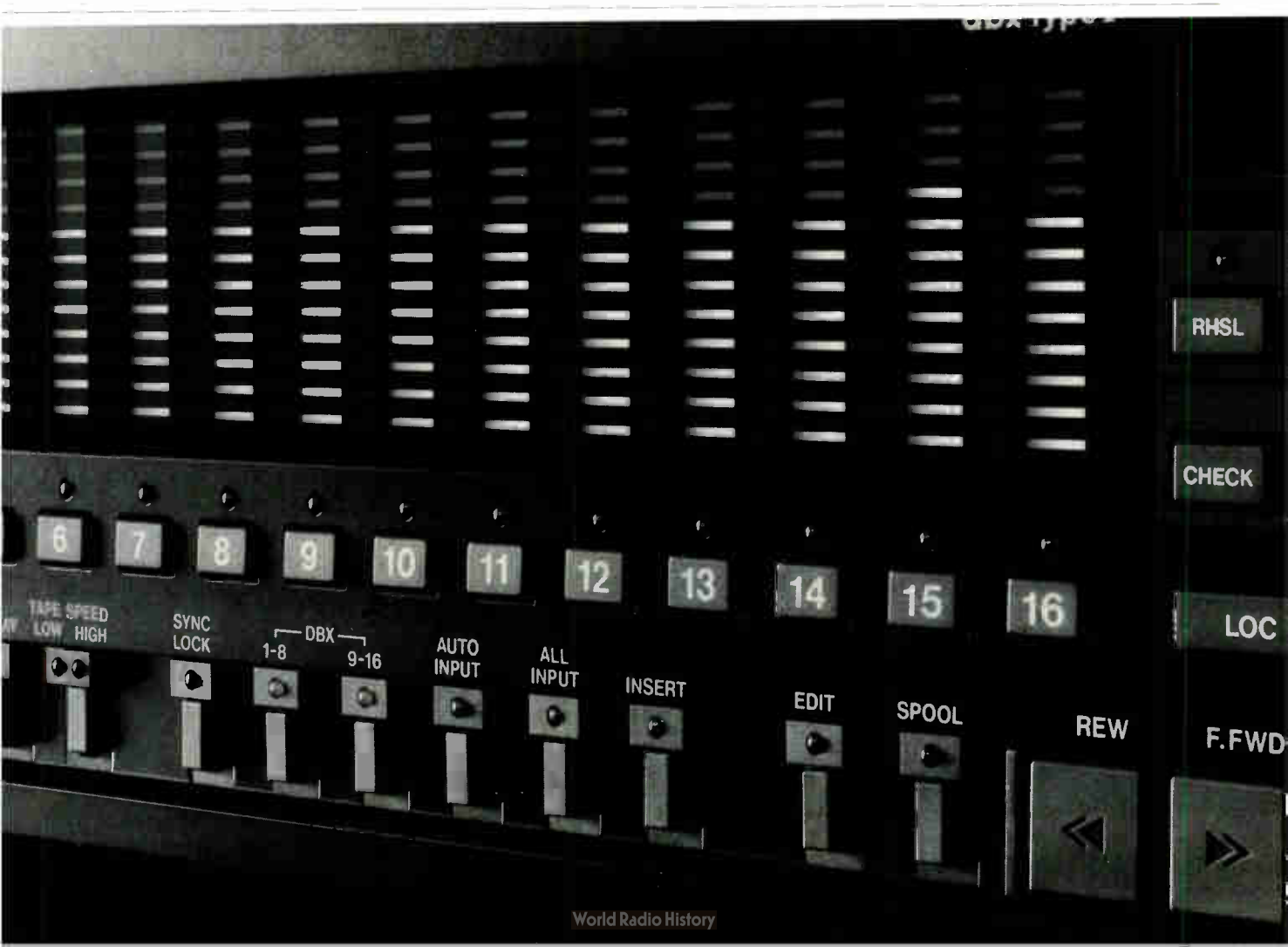
During an early April preview in England, I was able to use the board hooked up to one of the first MADI-equipped Studer D820 DASH-format 48-tracks. I agree with Neve's thinking that for music recording, an engineer needs to be able to access a number of simultaneous functions, without having to call it to the control surface. And it would be very easy to run a complex session from a Capricorn equipped with just two banks of 24-channel faders. I like the way signal paths can be freely assigned to channel or group faders located close to the central monitoring positions, where every control and display can be easily reached.

Having said that, however, it is amazing how quickly you begin to "redesign" the entire control surface and call to the designated controls just the functions that will be needed at that point in a session. For example, as a typical music session moves from tracking through overdubs to the mixdown stage, the topology can be gradually modified to add more auxiliary sends, and split signal paths—input and monitor—gradually give way to mono/stereo subgroups routing and panning to the master two-mix (or three-mix for film-style projects).

Capricorn will quickly set new standards of user familiarity. Once the full potential of an all-digital, totally assignable signal path is appreciated by a wider circle of recording and production engineers, it will set new standards of excellence throughout the music industry.

SSL Scenaria Post-Production Mixing System

Designed to provide full coordination of virtually all editing, mixing and processing functions during film/video post, the new all-digital SSL Scenaria incorporates a 38-channel audio mixing console, a 24-track audio recorder and random-access video storage in a single unit. As might be expected, Scenaria is fully compatible with SSL's



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ScreenSound and SoundNet systems. Larger facilities can operate ScreenSound units in, for example, dedicated sound editorial or ADR rooms, with a Scenaria located in the master remix suite and access to the various sound files and editing information obtained via a LAN connection. The flexibility of such networks allows complete freedom in the distribution and scheduling of projects.

The Scenaria control surface comprises a central VDU showing track layouts and other system graphics; a bank of eight servo-controlled, motorized channel/group faders; a transport control, scrub-edit and bank-switching panel; an assignable EQ, dynamics and aux send panel; plus the familiar SSL graphics tablet and pointer. In addition to the 24 virtual tracks provided by Scenaria's built-in hard drives (plus opticals for accessing libraries of music cues, sound effects, etc.), additional analog/digital inputs are available for connection to external sources, including time code DATs, digital VTR outputs and so on. The system's eight channel faders can be freely assigned to individual track or source inputs, or assigned as nested subgroups. All inputs pan between master left and right outputs.

A total of 16 analog inputs are available (expandable to 32) plus eight AES/EBU 2-channel digital ports (expandable to 16). Selected analog or digital inputs are routed to the selected system input channel via a microprocessor-controlled routing system. An identical complement of analog and digital output ports is also available.

The central assignable panel provides two independent 4-band parametric EQ sections and a single dynamics section that can be assigned to any input or subgroup. The dynamics section includes an expander/gate, compressor and limiter, with a frequency-conscious sidechain. Up to 500 ms of delay can also be inserted into the feed-forward or delayed path for enhanced flexibility.

Eight auxiliary sends are available from each input/subgroup. Direct machine control is also provided via standard 9-pin connectors for VTRs and laserdisc players, in addition to external synchronizers. All front-panel settings can be scanned and memorized dynamically, or as a series of snapshots.

One of Scenaria's stand-out features is the VisionTrak system, which allows one hour of bandwidth-compressed video to be stored to a dedicated hard drive. The system moves instantly to a selected time code location, without the delays associated with VCRs or laserdisc players. In addition, "edits" can be made to the VisionTrak files, either to remove material from a master reel, or to add black in sections where new material will be added. All audio edit points and processing data are automatically updated to accommodate any relative changes made to the master time code track.

EDLs generated by conventional video editors can also be imported into Scenaria and assigned to tracks for auto-conform sequences. All edit functions are controlled via the ScreenSound window built into the system—although track building and clip editing would probably be handled by a dedicated ScreenSound in a multiroom facility. Should changes be necessary during a mix session, instant access to a full-function, 16-channel editor obviously adds greater functionality to the system.

According to chief designer Phil Hill, "All material for a particular project, including notes, edit points, mix, EQ and dynamics information, is stored in 'project files.' Along with the labels for each of the various tracks and groups, the file contains information about the particular stored mix—for example, an M&E or foreign language dub, or a premixed stem that can be called back into a set of subgroup channels. A great deal of the routine paperwork associated with a complex audio-for-picture mixing session can be stored along with the source clips."

Routine archiving and backup of sound files is to 8mm Exabyte drives at 2.5 × real time (possibly enhanced to 5.5 ×); an erasable optical drive can also be used to offload edited files that might be needed later as part of an online sound library, or to make the files available to other ScreenSound users via SoundNet. A project can also be selectively backed up to an optical drive.

The true definition of a "digital audio workstation" goes far beyond a hard disk-based recording, editing and mixing system. I reserve the DAW appellation for systems that intelligently integrate all the functions an engineer might perform on an audio soundtrack: multichannel recording and playback; sample-accurate editing; dynamic mix automation; parametric EQ and dynamics control on all inputs and subgroups; assignable control surface for routine processing functions; dedicated channel faders in sufficient quantity to provide hands-on mixing of channels and subgroups; dedicated transport control and subframe-accurate time code sync; plus comprehensive digital synchronization to master clocks, video and time code.

For potential users to take advantage of the operational flexibility and creative potential of digital recording, editing and signal manipulation, we need a reasonably standard definition of the types of interface/display features and record/edit/mix/processing functions that a DAW might offer in video/film post applications. To my mind, at least, the new SSL Scenaria comes about as close to satisfying those criteria as any system I have yet experienced. ■

—FROM PAGE 34, AMS & YAMAHA

feature a choice of AES/EBU, Yamaha, Sony or PD formats; outboard A/D and D/A converters provide direct interface to analog recorders and signal processors. MIDI and external video interfaces are also featured. All front-panel controls and switches can be scanned and memorized to provide fully automated mixing and processing. Mixes can also be offloaded to floppy disk. Two onboard SPX1000 effects processors provide flexible reverb, delay, ambience generation and a variety of other special effects algorithms.

Optional Project Manager software for the Apple Macintosh enables external control and setup of console parameters, with external storage of automation files and console configurations to the Mac's hard drive.

Yamaha's DMR8 Digital Mixer/Recorder combines most of the DMC1000's functionality within a slightly smaller frame size, which also houses an 8-track, 20-bit stationary-head transport, complete with time code synchronization. Up to 24 digital channels can be accommodated in mixdown mode.

Deutsche Grammophon has purchased a total of 50 DMC1000 consoles for use in conjunction with Sony PCM-3324 DASH-format multitracks in Europe. In addition, the BBC, Sony Classical Productions, Multivison (Needham, Mass.), New York Digital and Karisma Studios (Montreal) have installed DMC1000s.

—Mel Lambert

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WORLDS IN TRANSITION

HOW STUDIOS MADE THE DIGITAL DECISIONS

BY DAN DALEY

It all seems so simple in retrospect. The Monday Morning Quarterback is never wrong, and how else could it have turned out except that digital audio equipment would become *de rigueur* in studios? Not that many years ago, the outlook was quite different. There was anticipation and some anxiety about costs, integration, obsolescence and interfaces.

Oddly enough, the situation is not that different today, because we're not looking back at the end of a road, but merely a way point on it. The evolution of digital is very much still in progress. Aside from the fact that this 15th anniversary issue of *Mix* is dedicated largely to developments within the world of digital recording and production, it's not a bad time to reflect upon the means by which many of us took our first major steps into the digital realm. The selection process that went on during that time holds lessons for the next round of decisions, both for facilities already on the road and those rooting around their pockets looking for the toll.

The studio operations examined here each began as analog facilities and made the switch to digital sometime during the past decade. Everyone has comments, ranging from complaints to helpful suggestions. By and large, however, the level of satisfaction is significant, especially when you consider how much more traumatic the growth of various analog formats was in the '60s and early '70s. And the continued disparity of tape widths

Soundtrack Studios, New York

World Radio History

between analog formats reminds us that the incompatibility issue between workstations has a precedent. Historical context offers no ready solutions, but knowing that incompatibility is a problem common to several generations helps ease the frustration.

SYNC SOUND: DIGITAL IN THE BIG APPLE

Manhattan's Sync Sound opened its doors in 1986 as an analog audio post-production studio and was faced with the digital dilemma almost immediately. One of their first sessions was a

PHOTO: ROBERT WALSH

Sync Sound Studio "D" Random Access Digital Editing Room

Peggy Lee (speaking of history!) concert, which rolled through the doors on a Sony PCM-3324. "In those days, there was nowhere to rent one of them, so we had to borrow one from Sony," recalls studio co-owner Ken Hahn. "That's when we realized that we had to go digital to remain competitive."

Since then, Sync Sound's digital arsenal has expanded to four AMS AudioFiles (two with the Plus upgrade); an NED PostPro SD system; a Sony PCM-3348 and a pair of 3324s; a Sony PCM-1630; numerous F1s (a legacy from digital's earliest days and still used occasionally for masters from the UK, where it remains popular in some circles); Sony PCM-7000 Series and Fostex D-20 time code-capable DATs; D-2 digital video equipment and Sony's 2830 analog/digital mongrel; as well as digital processing by Lexicon, Eventide, Yamaha and Roland.

The studio's first AudioFile was installed in 1986 and remains the mainstay of the studio because, Hahn says, it best addresses the studio's main client base—post-production. "It was the fastest way to edit sound effects and dialog and was akin to working on mag," he confides. "Much of our clientele was—and is—film people now working on videotape, and they wanted to feel comfortable. The AMS system had the best time code capabilities at the time."

As at many other studios, Sync Sound's owners kicked tires and decided that certain engines worked better for certain applications, despite the fact that many manufacturers were looking to cover as many bases as possible in a single box. That led to a PostPro SD for sound design work and an Eventide H3000 Ultra Harmonizer for its presets. "Some systems are simply better at certain things than at others," Hahn says. "But even that varies according to the studio and who's doing the deciding. [Digital audio workstations] too often try to be all things to all people, and you have to decide what you need."

The choice of Sony DASH-format digital multitracks dates back to the Peggy Lee sessions. Sony was early out of the box with a rugged, transportable tape machine, and the 3324 remains a favorite for many of Sync Sound's customers.

While some digital decisions were based on marketing, the decision to go digital was not driven by contemporary client desires but rather, Hahn says, by anticipating future client needs. "The biggest battle in audio post is noise," he asserts. "To combat noise in the analog domain, you have to decide on various noise-reduction schemes. But that still leaves issues like wow and flutter, print-through, harmonic distortion and generational loss. That's a big factor in post as you go from tape to tape, which all represent other types of noise to me. Digital technology, whether tape- or hard disk-based, eliminates such problems. And [with disk systems] you get random access. To me, there was no real hard decision to make."

Yamaha/Ocean Way Studios in Hollywood

To maintain that pristine quality through the interconnectivity chain, Sync Sound installed a digital patch bay of its own design, linking all of the workstations to the Sony tape decks.

Editel Chicago

While only raw data, without the all-important EDL information for post sessions, can be transferred, to Hahn that's enough for now. He says that those waiting for the all-digital studio, including console, will have a long wait ahead of them.

"There's a lot more to do, and we haven't found the ultimate format yet," he says. "Not everyone's satisfied with 16-bit; 24-bit would be a better goal. But I still think we got in at the right time. I don't think we'd have done it differently at all. We bought more as the demand grew, and we haven't thrown anything out yet, not even the F1s. That says *something* right there."

SCENE III: COUNTRY DIGITAL IN NASHVILLE

At Scene III, Nashville, the multiroom post facility has been handling "tons" of country music videos, according to studio vice president Nick Palladino. Using a single AMS AudioFile Plus, Sony PCM-2500 and portable DATs, a Lexicon 224L and a rented Sony PCM-3348, Palladino says that random access was the key to the facility's conversion to digital in 1983.

"It's faster and cleaner than analog for video, and random access makes

Phil Gazell, engineer and Nick Palladino, studio vice-president at Scene III in Nashville

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the clients happy when you're doing ten to 15 commercials a day," he says. "Everything was good, but you have to pick what sounds best to you and what you feel is best for your particular needs. You can have the same machine in the same setting doing the same job for the same client, but two different studios would have two different opinions about it."

Anticipating more digital video work played a part in the studio's decisions. A recent HBO country music special never left the digital domain because the AudioFile was locked to a D-2 deck straight through layback. That kind of interconnectivity is sufficient for the studio for now, and probably some time to come, according to Palladino. The only change he would make if he had to go through the process again would be to have done it even sooner. "It's been worth every cent so far," he says.

EDITEL CHICAGO: FILM MIXING SUCCESS

In business for 21 years, Editel's Windy City location went digital in 1987 with an 8-channel AudioFile, according to senior audio engineer John Binder. That conversion was recently capped with the addition of the first AMS Logic 2 all-digital console. It was film mixing, rather than video post-production, that drove Editel's transition.

"It's very difficult to slip tracks on 24-track," Binder says. The studio first considered a multiple PCM-F1 arrangement in conjunction with a video-editing system. Fortunately, he recalls, single-box workstations became readily available before a final decision was made.

Groundwork for acquisition of the Logic 2 console was laid in 1988, when the studio decided that it needed a more highly automated system than its MCI JH-600 Series. After nearly purchasing a new, highly automated analog console, a casual conversation Binder had with a Calrec engineer—just before that company was purchased by AMS—induced him to wait a bit longer. Binder recalls, "He told me that if I could hang on, I could get a totally digital console that would give me the time code and dynamic EQ requirements I wanted."

The only real transitional difficulties to a totally digital signal path have been dealing with a very non-digital problem—the RF that leaks into the A/D conversion stage in the studio's area, and word clock rates vis-á-vis digital

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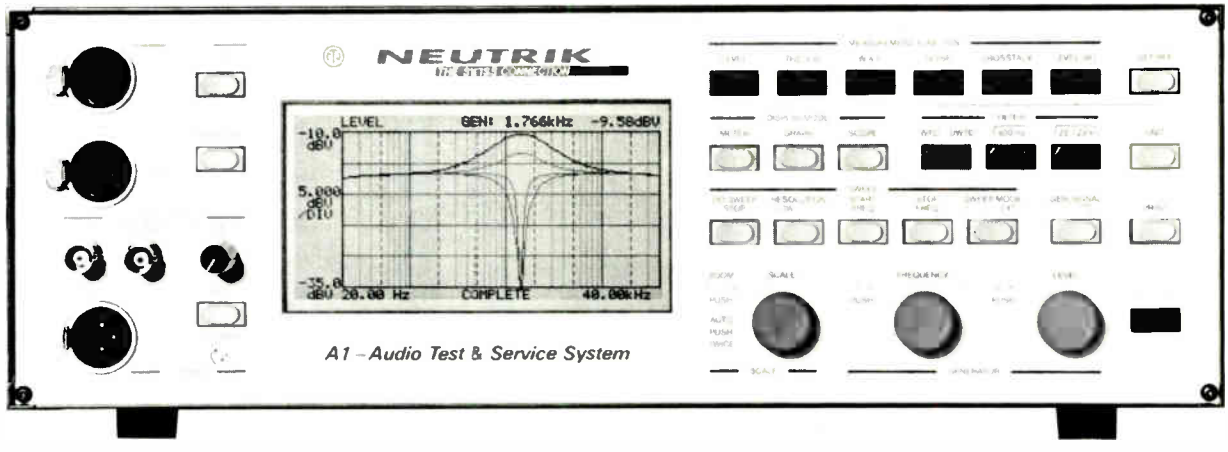

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storage media. The first problem was corrected easily enough via conventional, though substantial, grounding methods. The latter problem is dealt with on a regular basis by being aware of it.

"In layback you have to be careful about word clock so that you don't encounter rate problems," Binder explains. "They sound like clicks and pops, which you will get if you're asynchronous with digital systems like D-2."

SOUNDTRACK: MULTIPLATFORM DIGITAL SOLUTIONS

At Soundtrack, New York, owner Rob Cavicchio hosts three SSL ScreenSound systems, two NED PostPros and a Sonic Solutions Sonic System, as well as Sony, Studer and Otari digital multitracks and various digital signal processors. Starting in Boston in 1979, the studio opened its larger New York sibling in 1985 and went digital four years later.

Cavicchio's reasons were based almost solely on marketing—wanting to create and maintain a state-of-the-art image. "In New York, we were the new kids on the block," he says. "We needed [the digital equipment] as much to break into new markets, like post-to-picture, as for their sonic capabilities. Economically, it was feasible because it also lets us charge a higher rate."

Soundtrack may have started in digital relatively late, but the facility picked up quickly, becoming the first double-, then triple-SSL ScreenSound installation. Rather than follow client demand, Cavicchio attempted to create client demand.

"We had to educate the client base to the technology—to create our own demand and then supply it," he explains. "We actually lost part of our client base in the process, but we also learned the rules of the road as we went along. We not only paid for the equipment but also for our own education. The bottom line is that when the smoke cleared we had new clients, and they were beginning to demand it from other studios, as well."

Soundtrack began with a New England Digital PostPro, based on Cavicchio's perception of the company as groundbreakers in the field, and by NED's Dartmouth pedigree. But he added the SSL system as he came to realize the client preference for an understandable interface—in this case, the simple monitor screen and light-pen approach.

"SSL solved a major problem with that approach," he says. "Clients understand the [VDU] screen better. They're both amazing machines, but NED leaned on engineering, while SSL added marketing." Essentially, Cavicchio chose digital audio suppliers that were stable, rather than basing decisions on price, a philosophy that covered the range of equipment from Lexicon processors to workstations.

Music recording forms a considerable amount of Soundtrack's business. For that application, Cavicchio had to go with digital tape's storage capacity. "I can't get an hour of 48 tracks on a workstation," he says. Decisions there were also based on marketing, although the research wasn't nearly as painstaking.

"Music people are pretty clear about what they want," he says. "Look at what they're renting and you'll know what to buy. Most of our [digital] decisions were based on what clients want to see. That's why we've been slow to move on digital consoles.

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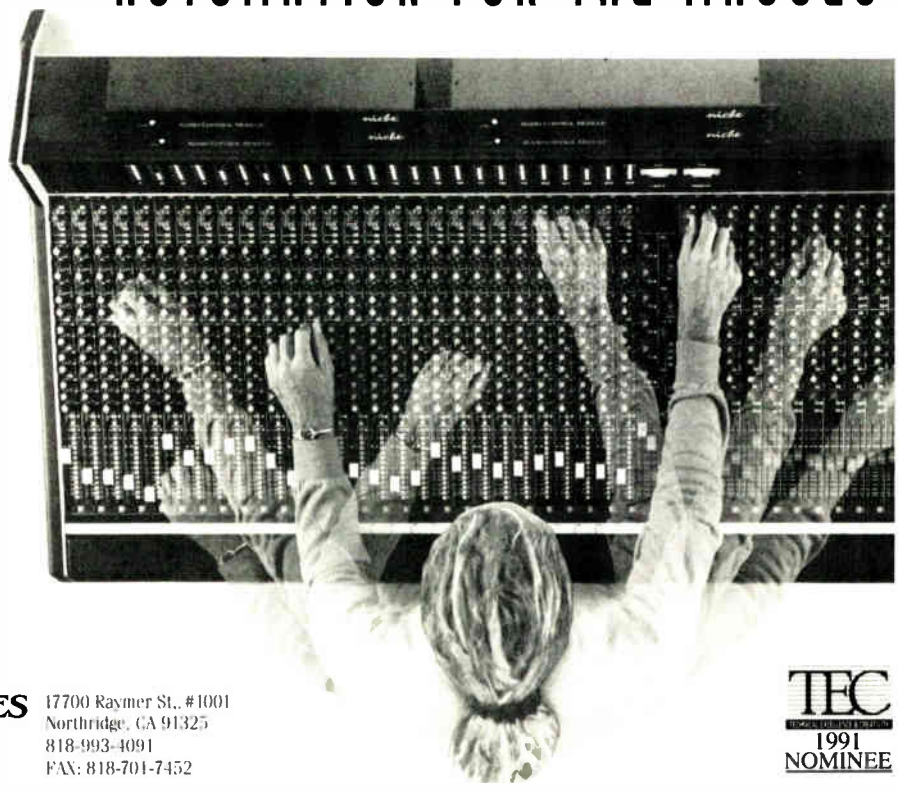

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They're not developed enough yet.

"The last real significant move in consoles was the reset feature, and that's what clients want now," he adds. In that regard, Cavicchio is happy with his 12-input Yamaha DMC1000 all-digital mixer. That and the price: "It's not cheap, but I'd take a shot at $30,000 where I wouldn't at $100,000," he says. "It gives me a good interconnection between various digital components in the studio. I can load audio from the CD player through it to the workstation, and then reload it to digital tape and stay within the digital domain.

"We're producers, not technoids, and our equipment choices were generated by marketing," he says in summation. "Function dictates equipment and attitudes."

CAPITOL RECORDING: DIGITAL MULTITRACK FOR MUSIC RECORDING

Music recording generally dictates the use of digital tape, the only digital long-form multitrack format currently in wide use. At Capitol Recording, Los Angeles, studio director Michael Frondelli has access to a Mitsubishi X-800 Series 32-track with Apogee anti-alias filters, and often rents 48-track decks for film-scoring dates. The Mitsubishi was purchased in 1989, he says, in response to artists and producers looking to increase noise reduction and playback capabilities. The choice by artists and producers to go either digital or analog with Dolby SR is a budgetary one, according to Frondelli, and the studio will need to retain analog capability to accommodate all budget levels.

Capitol also added three Sonic Solutions Sonic Systems about the same time, mainly for their NoNoise function in remastering catalog music for Capitol Records and other labels. Another digital acquisition was the MUSE digital mastering console, which Frondelli says was chosen as much for its phase-linear equalization as for its digital quality.

"That's what is most remarkable about digital now," he says. "When the technology first came out, it had a certain electronic sound to it. The advances in filters and converters make it much more effective for music and other applications." However, he adds, there's still a perception within the music community that analog is better for at least some types of music. "Rock seems to prefer analog, while jazz and classical and other types of music with wide dynamic ranges prefer digital."

The studio also uses Sony BVU-800 U-matics with PCM-1630 processors, as well as a Sony DAE-3000 digital editor. Archiving is still questionable in digital, Frondelli points out. While recovering damaged analog tapes using a heat-baking process is well-established and effective, digital still resists certain types of recovery. "Dropouts are almost always unrecoverable," he says. "Analog backup is still preferred."

DIGITAL RAPPING...

In the course of these conversations, little was said about other quiet-but-essential digital components of modern studios, such as reverbs and other processors. The reason is that they've integrated themselves so well and completely into the way things are now done that they've become almost transparent; their employment tends to be more subjective than objective.

I can remember when the Yamaha REV7 was the hottest toy on the market. It's now four generations old. But enough people out there still have a

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soft spot for it. (My personal favorite is the old Ibanez SDR-1000+, a true classic.) The point is that if this article were being written seven years ago, it might well have centered more on processing, leaving the workstations and tape decks as part of a future yet to come, as toys to be experimented with by only the wealthiest or riskiest players.

Now that Roland, Korg and Yamaha have all demonstrated inexpensive workstations, those items will take their place in our collective consciousness as the next round comes to the fore. The evolution is far from over. ■

Dan Daley is the Mix *East Coast editor.*

OCEAN WAY

DEMO VENUE FOR YAMAHA DIGITAL

Nested within the confines of Hollywood's famed Ocean Way studios is Yamaha's Professional Digital Products demo facility. Like Yamaha's demo facility in New York, the West Coast installation offers key end-users in the recording, video post-production and broadcasting industries the opportunity to gain hands-on experience with the manufacturer's digital product line.

The control room currently incorporates three different recording/editing systems: a DMR8 digital mixer/20-bit recorder, a DRU8 digital 8-track recorder and DMC1000 digital mixing console, and a YPDR601 compact disc recording system. Also available are A/D converters, interface units, digital patch bays and accessories, and outboard signal processors. Either of two stations offer a clear sight into the studio, while providing on-axis monitoring in an acoustically isolated environment. The adjacent space is designed for recording acoustic instruments.

The control room can also accommodate other manufacturers' multitracks and workstations. Ocean Way's Allen Sides says, "When the opportunity came along for Yamaha to come in, it seemed like it would be a mutually beneficial relationship. They use our studios for experimental purposes, and we use a lot of their products."

—Paul Potyen

Bruce Swedien
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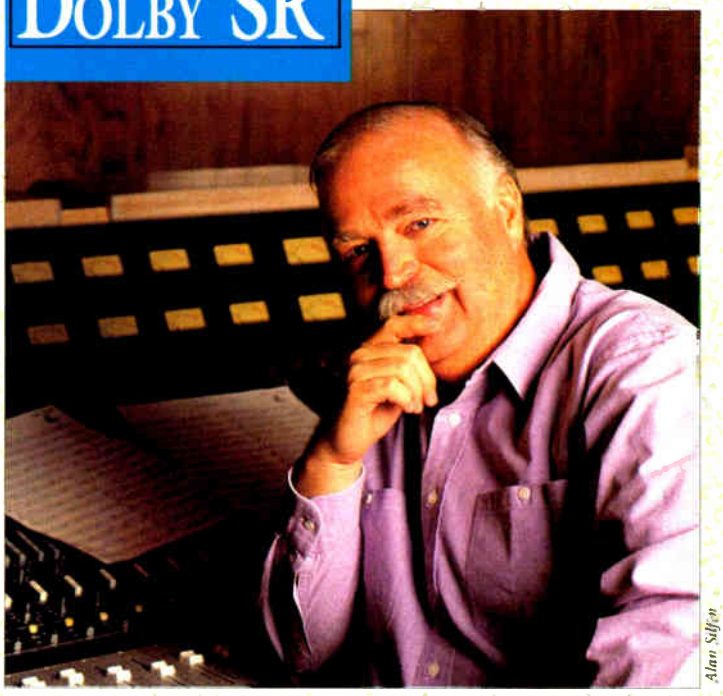
Alan Silfen

"A little voice inside tells me not to give up my analog machines. There is a refinement and character with analog not available with other mediums."

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Recent credits Co-produced 5 and engineered 11 songs on Michael Jackson's "Dangerous." Currently working with Michael Jackson, Sergio Mendes and Rene Moore.

Career credits At age 19 recorded Tommy Dorsey, and hasn't stopped yet: Quincy Jones, The Chicago Symphony, Duke Ellington, Count Basie, Stan Kenton, Oscar Peterson, Sarah Vaughn, Natalie Cole, Barbra Streisand, Dizzy Gillespie, Diana Ross, Nat 'King' Cole. Awards: 3 Grammy's (8 nominations); TEC Hall of Fame.

Career direction "I want to do more co-producing and song writing along with engineering."

On his technique "Lately I have returned to recording directly to analog recorders, later transferring the final elements to digital for editing and storage."

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Since being taken over by Sony Pictures Entertainment, Columbia Westside's sound department has been completely overhauled, redesigned and gradually re-equipped with a variety of digital production and post-production systems, notably WaveFrame 1000 and 400 editing workstations.

BY IAIN BLAIR

"When I first [joined Columbia Westside], we were still involved in the analog PAP or Post Audio Prelay-type of systems," recalls Barry Snyder, digital prelay supervisor. "These PAP systems were basically synchronizers that were made to replace film editing. Source

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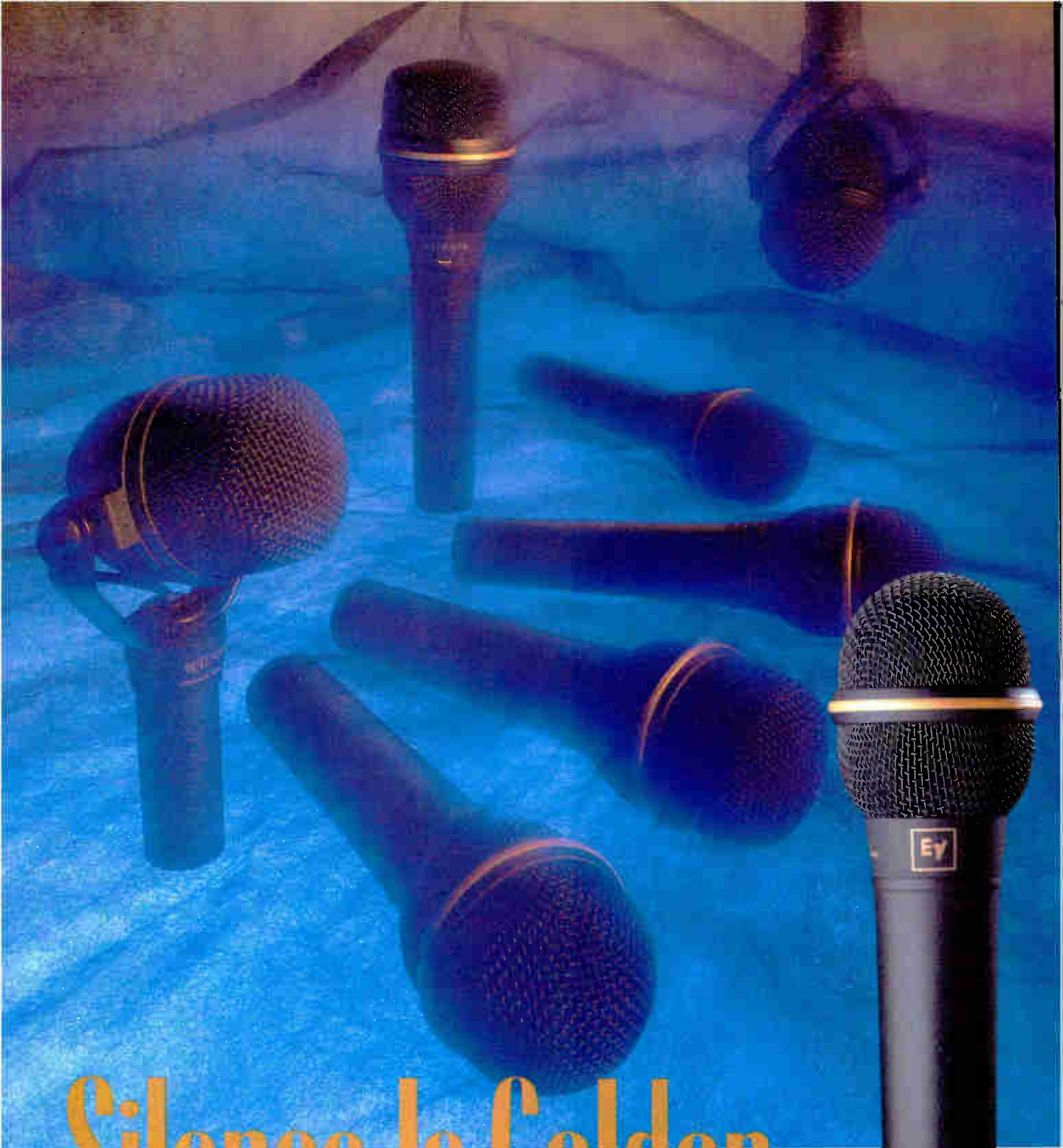

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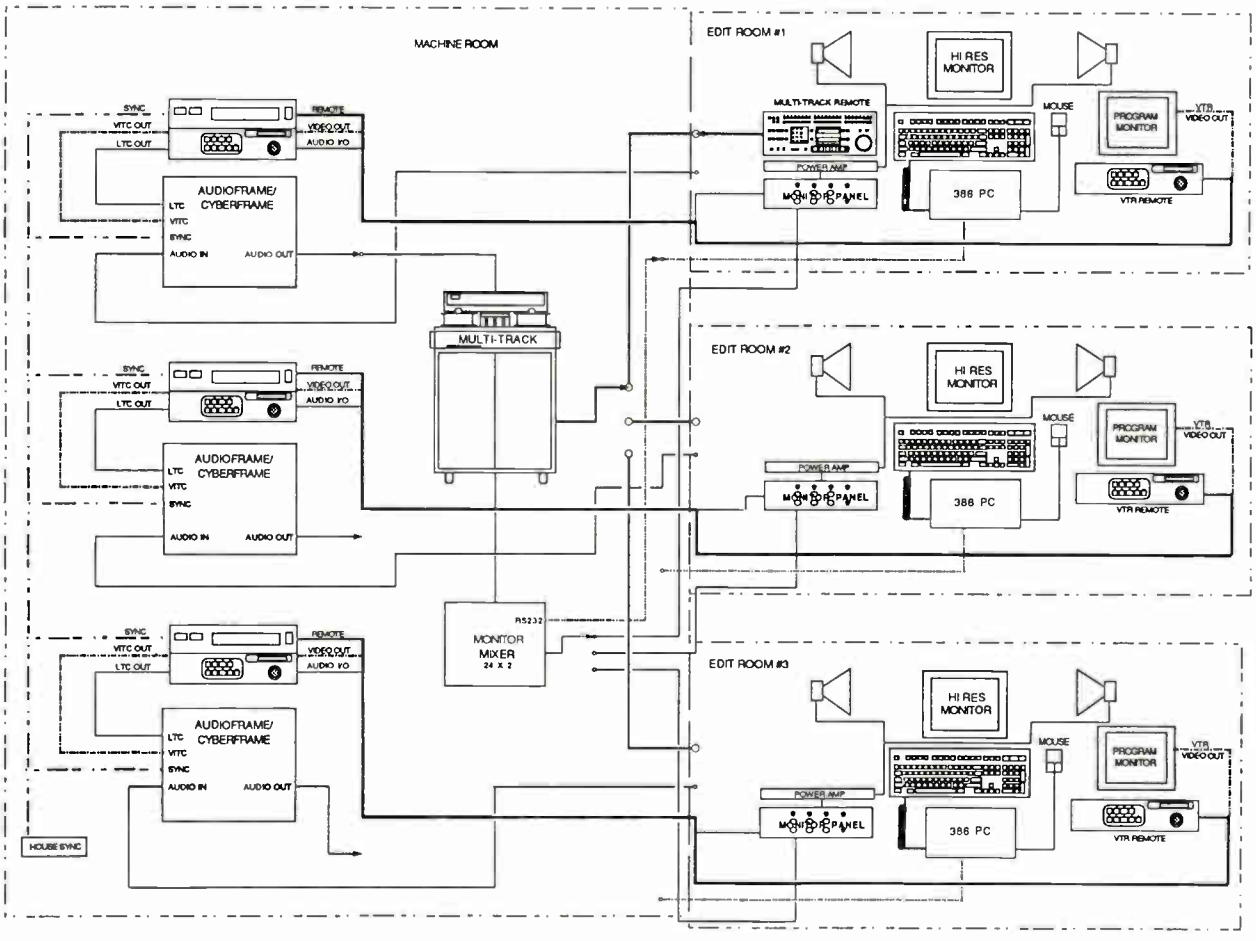

Above: The interconnectivity of the Sony Pictures Studios' digital editorial workstations.

material, effects and dialog from 1/4-inch would be prelaid to a time code-striped 24-track. Then we'd lock that up [to the video work print] and mix in-sync with picture."

According to Snyder, this audio prelay process was being used by the majority of post facilities when he joined Columbia Westside four years ago, "and it was considered to be the new technology, the state-of-the-art." Although this approach worked well for television, "when the picture came in locked with basically no changes," it didn't make much sense for feature films. "With film, you get a lot of last-minute picture changes," Snyder says, "and there were a lot of shortcomings with 24-track—although it wasn't really the hardware that was the problem. It was the way the system interfaced."

MOVING TOWARD DIGITAL

Although the department had ten PAP rooms, they began to experiment with digital systems. "This was over three years ago now, and we started talking to all the major digital editorial manufacturers," Snyder reports. "We looked at the New England Digital Synclavier and PostPro, the AMS AudioFile, and various WaveFrame systems.

"Back then, WaveFrame only produced the AudioFrame [now named the 1000], and we got hold of one," he continues. "We began to use it for a season, and meanwhile I'd gone to Vermont, Boulder [Colo.], San Francisco—looking at every system out there, from big to small."

Michael Kohut, senior VP in charge of Columbia's former post-production facilities, along with Snyder and the department's chief audio engineer, Jeff Taylor, began to favor the WaveFrame. "We used it mainly on TV productions, although we'd done some low-budget features," Snyder says. "We found that the WaveFrame's capability of going directly to disk—while still almost an infant technology at that point—had some big pluses going for it. We all found it to be very versatile, with an incredible sound quality and with great flexibility that we'd been lacking on 24-track PAP systems."

After using their initial WaveFrame system for a year, in mid-1989 Kohut decided to purchase another half-dozen 1000s. At the same time, another new system, the CyberFrame [now named the 400], was being developed under the direction of Cybermation's Chuck Grindstaff, now president of WaveFrame.

COMPLEMENTARY DIALOG AND EFFECTS EDITING SYSTEMS

The team decided that each system had its own strengths and merits, according to Snyder. "We felt that WaveFrame's editorial software was stronger for dialog editing, plus ADR and Foley editing, which are linear-type functions," he reports. "It looks more like a KEM or a sync block on a video screen, while the standard software package is more of a list management-type or EDL function, which is really good for sync effects."

However, Snyder is quick to say, "There's no rule saying you can't edit dialog on a 1000 and edit sound effects on a 400, and do it efficiently. The 400

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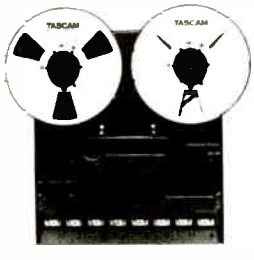

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is a straight 'cutting' system, while the 1000 is more of a 'processing' system. The 1000 provides powerful sound design functions, so it tends to lean toward sound effects and related editing tasks."

In the fall of 1991, Sony Studios added 12 more systems. "We now have 21 digital systems," notes Snyder, "and we've pared back our analog systems to six. At the same time, we expanded outside working in television into feature films."

To complete this realignment, the facility acquired the services of respected veteran sound supervisor Tom McCarthy Jr. "He handles all the big films, while I handle TV, low-budget movies and mini-series," Snyder explains. "More and more, we're doing sections of big-budget movies, such as *My Girl*, *All I Want for Christmas*, Stephen King's *Sleepwalkers*, and producer Ivan Reitman's *Beethoven*. Tom is bringing in these big clients, and we're handling dialog, or dialog and Foley, or effects and Foley—all different parts on our digital systems.

"And we're doing all of our television work on digital now. The PAP systems we still have left will all be replaced with digital systems next season. The problem with these systems is not what they'll do once the stuff's in there," Snyder adds. "It's getting it in and out. If we had it shot on MO or hard drive and then just took a disk out and popped it into another system to edit it and then dub it, that would be the most logical way. Right now we're discussing other ways these systems can benefit us."

DIGITAL SELECTION CRITERIA

The decision to go with WaveFrame systems had to do with versatility and expandability, especially the future move toward magneto-optical. "Sony is a large manufacturer [of optical drives and related technology], and MO represents a large part of where we want to take this facility in the future," Snyder says. "So that was another plus."

In terms of cost-effectiveness in operation, Snyder adds that "right now the limitations are input and output. Once the material has been loaded [onto the hard drives], it's incredibly cost-effective, versatile and fast. In fact, it gives you the versatility and mixability of 24-track tape and the precision of film all rolled into one. You can perform post-production tasks that you couldn't possibly handle on film or tape, and do

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them both fast and well, and without any generation loss.

"There are still issues with 24-track on the dub stage, such as not being able to slip tracks or roll back and forward like you can with film. But those are shortcomings of multitrack technology, not of a digital system. And we can lay back to film or transfer material to whatever format we choose. We've also experimented with some magneto-optical technology on the dub stage with mild success."

TOWARD THE FUTURE: DIGITAL INTEGRATION

Beyond the editing suites, Snyder cites the company's use of field DAT recorders for recording production dialog and the installation of new digital-ready consoles. "We are also involved in High Definition TV, which ties in strongly with digital developments," he says. "Now that we have the editorial department in place, we're essentially creating the software for their new, improved hardware. We're obviously heading toward digital dubbing and release formats."

According to Snyder, an all-digital

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facility is not that far in the future. "The main issue now is converting the big producers and directors to this new technology," he comments. "When that demand is there, it'll be immediate, because we're all in place now. We've positioned ourselves to be able to deliver an all-digital product today by adding digital multitracks on the stages. And we can lay back to D-2 and be on a digital format. There's nothing stopping us right now apart from that demand."

With this in mind, the development team is also discussing the future possibilities of linking various sound and music editorial rooms, ADR, and Foley via fiber-optic links. "That would be part of our entire plan, although we haven't yet started using fiber optics," Snyder reports. "But obviously that would be the preferred method of transporting data across the lot, and it's only a matter of time before that happens."

In addition to working on feature films, the sound department has been extremely busy with television work. Shows include *Young Riders*, *Reasonable Doubts*, *Parker Lewis Can't Lose*, *Full House*, *Sibs*, *Home Fires* and *Julie*. "We also handle a lot of advertising work," Snyder says, "and we have already completed some 60 campaigns, including the Nike Air Jordans spot. These systems are great for commercial work, because you're in and out in a couple of days."

LEARNING FROM THE EXPERIENCE

Would the team have designed the facility differently if they'd known some three years ago what they know today? "I think every upgrade has a little of what we've learned in it," Snyder says. "Our newest section is a little further along in terms of practicality and convenience, and we're definitely learning as we go along. On the other hand, we haven't made anything we're using obsolete—with the one exception of the old analog rooms."

In this regard, Snyder has high praise for facility boss Michael Kohut. "He's very smart when it comes to expansion, and he never gets ahead of himself. We added digital, but we kept the analog systems until the digital units really overran them. We've done it one step at a time, and could have probably made changes faster. But this way we haven't wasted a thing." ■

Iain Blair is a freelance writer and frequent contributor to Mix.

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DIGITAL TECHNOLOGY FOR FILM AND VIDEO PRODUCTION

A CASE EXAMPLE AT TWICKENHAM SOUNDSTATION, ENGLAND

Unlike certain studios within the Hollywood-based movie community, the British film industry is slow to accept change. Most of the equipment used to record sound for films was designed at least 20 years ago, and there has been little incentive to seek out alternatives. The current 35mm mono/stereo optical soundtrack imposes such limits on the final product (Dolby SR notwithstanding) that many film producers consider it a waste of time to improve the noise and frequency response characteristics available from the standard analog recorder.

The digital revolution that is currently taking place in sound for feature films and TV drama will have an impact as significant as the development of Dolby Stereo. Until recently, this revolution has been disjointed; it will only have full effect now that we can produce a soundtrack that was recorded digitally on location, edited digitally and exhibited in a digital format.

The development of cinema digital replay systems by Kodak/OCR, Dolby and Sony have made this a reality. In fact, recent practical demonstrations have shown that playback is so good that audio post-production will have to be carried out within the digital domain to avoid unwanted background noise and degradation of an otherwise pristine soundtrack.

The accuracy of digital playback exposes many flaws that may have previously gone unnoticed or been ignored and calls for much higher standards during post-production. Digital recording and editing techniques produce a sound quality that is technically as good as the original production sound and contribute significant economic advantages. Such techniques enable a film to carry a soundtrack that is, in all respects, as near to first-generation quality as possible without affecting the traditional practices either on the stage or location during the shooting, or during the final mix.

Many people within our industry are unaware of the abuse that a typical soundtrack now suffers during its passage from the original Nagra tapes to the final mix.

The mag dub of original location sound

BY CHRIS MUNRO

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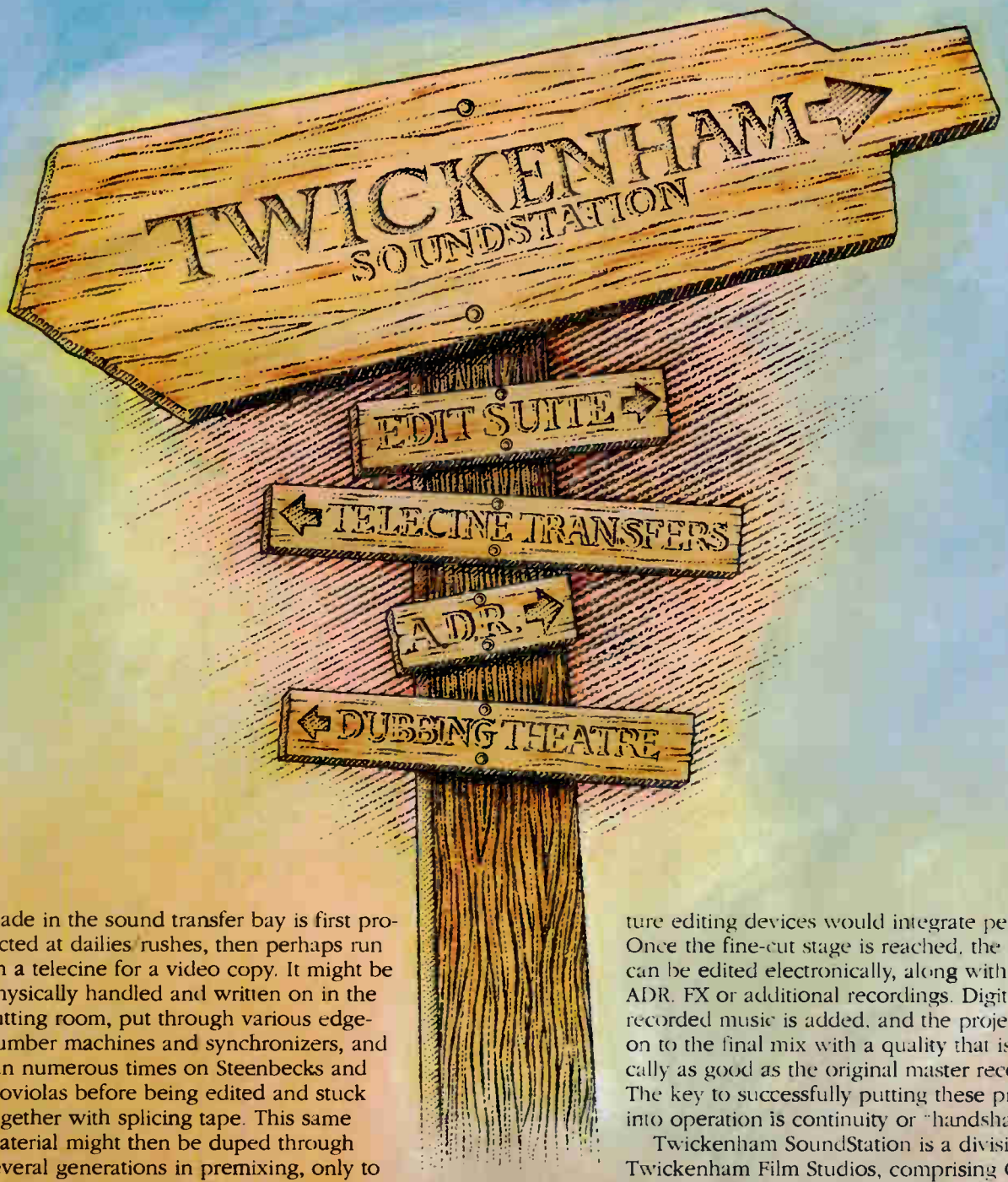

made in the sound transfer bay is first projected at dailies rushes, then perhaps run on a telecine for a video copy. It might be physically handled and written on in the cutting room, put through various edge-number machines and synchronizers, and run numerous times on Steenbecks and Moviolas before being edited and stuck together with splicing tape. This same material might then be duped through several generations in premixing, only to be presented in the dubbing theater as a "master" to be re-recorded for a final soundtrack. At best, the final product produced will be fourth or fifth generation, with every transfer suffering a loss of quality.

It doesn't have to be so. Original dialog and effects can be recorded digitally to DAT or similar formats, and then transferred to mag film with time code. The picture editor can then synchronize and assemble the film in the traditional manner, although the use of one of the new generation of non-linear, random-access picture editing devices would integrate perfectly. Once the fine-cut stage is reached, the sound can be edited electronically, along with any ADR, FX or additional recordings. Digitally recorded music is added, and the project moves on to the final mix with a quality that is technically as good as the original master recordings. The key to successfully putting these processes into operation is continuity or "handshaking."

Twickenham SoundStation is a division of Twickenham Film Studios, comprising Gerry Humphreys, head of sound at Twickenham Film Studios, Dean Humphreys, a re-recording mixer, and myself, a freelance production sound mixer. From our experience, it is vital that a production sound mixer records the audio in the right format with time code; that sound transfer knows how to deal with that time code data; and that the digital editing system is capable of auto-conforming the various sound elements from the final cut assembled by the picture editor—in a format that is suitable for the final mix.

The process starts on location, —CONTINUED ON PAGE 60

ILLUSTRATION PETER SIU

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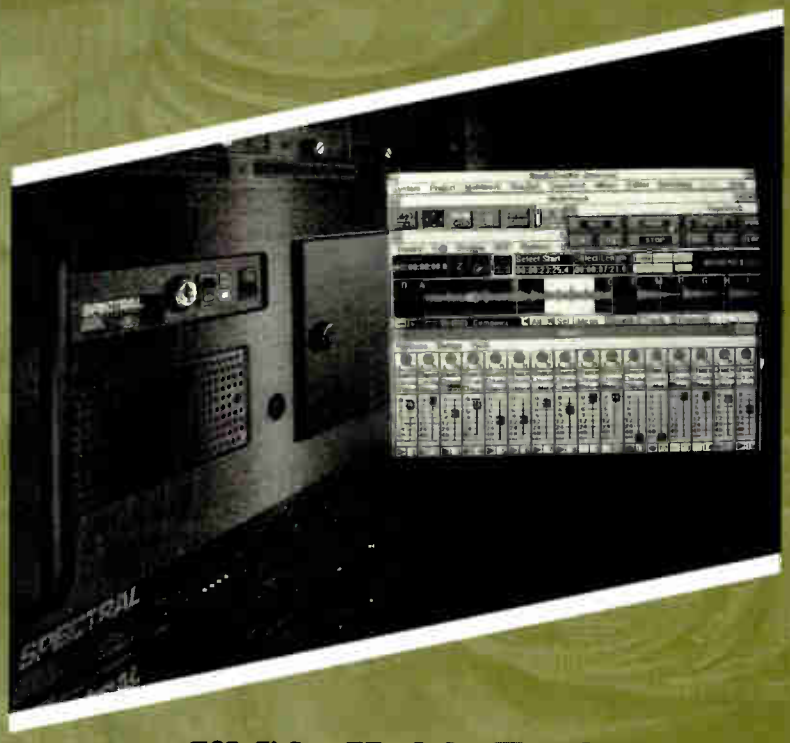

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THE FIRST STEP: DIGITAL RECORDING ON LOCATION

Production sound mixer Chris Munro currently uses Sony TCD-10 Pro and Fostex PD-2 portable DAT recorders. Transfer to 16mm or 35mm mag is made using a Fostex D-20 time code DAT to any convenient dubber.

"I was immediately impressed by the playback possibilities of DAT recorders," Munro recalls. "But I discounted their suitability for film recording because of their generally flimsy construction, which made them appear to be far more suited for the domestic audio market. The early machines I tested had unbalanced inputs, making them impractical when used with professional-grade microphones. And they ate batteries like there was no tomorrow!"

Digital recording became a necessary step for Munro in January 1990 when he undertook sound recording for *The Strauss Dynasty*, a mini-series made for a European consortium of major TV stations. Director Marvin Chompsky wanted top-quality Strauss music to be prerecorded for the project, and decided to record in a digital format. "The production contained not only music but also a lot of dialog and sound effects that had to be intercut," Munro says. "If I recorded the effects in analog, it would have meant degrading the music tracks to match other elements."

Although he had acquired a Sony TCD-10 Pro by then, Munro decided for security reasons to run the conventional Nagra in parallel. "Now I was hooked," he admits. "The Nagra IV-S, which I had always revered as an outstanding example of Swiss design and precision engineering, sounded like a 78rpm record in comparison [to the DAT recordings]. Not only because of the tape noise—which I could choose to ignore if I monitored direct instead of off-tape—but also for analog's lack of dynamic range. In fact, even radio mics sounded a little better on DAT!"

Munro went on to record in dual formats for several other major films, including *Robin Hood, Prince of Thieves*, which made use of some of the digital tracks during editing.

"I adapted the Sony DAT recorder to auto-start from the Nagra," Munro explains. "I also powered the DAT from a separate battery supply so that I did not have to worry about its seemingly enormous greed for the internal battery volts. The TCD-10's biggest failing was its inability to monitor off-tape, making it necessary to back up on the Nagra. So when Fostex offered to loan me one of the new portable PD-2 DAT recorders, that was a quantum leap. Not only did the PD-2 look and feel like a professional recorder, but it was sturdy and had off-tape confidence monitoring. Time code meant that the PD-2 would interface perfectly with the digital editing process I had become involved in and the Fostex D-20s I already owned." —*Mel Lambert*

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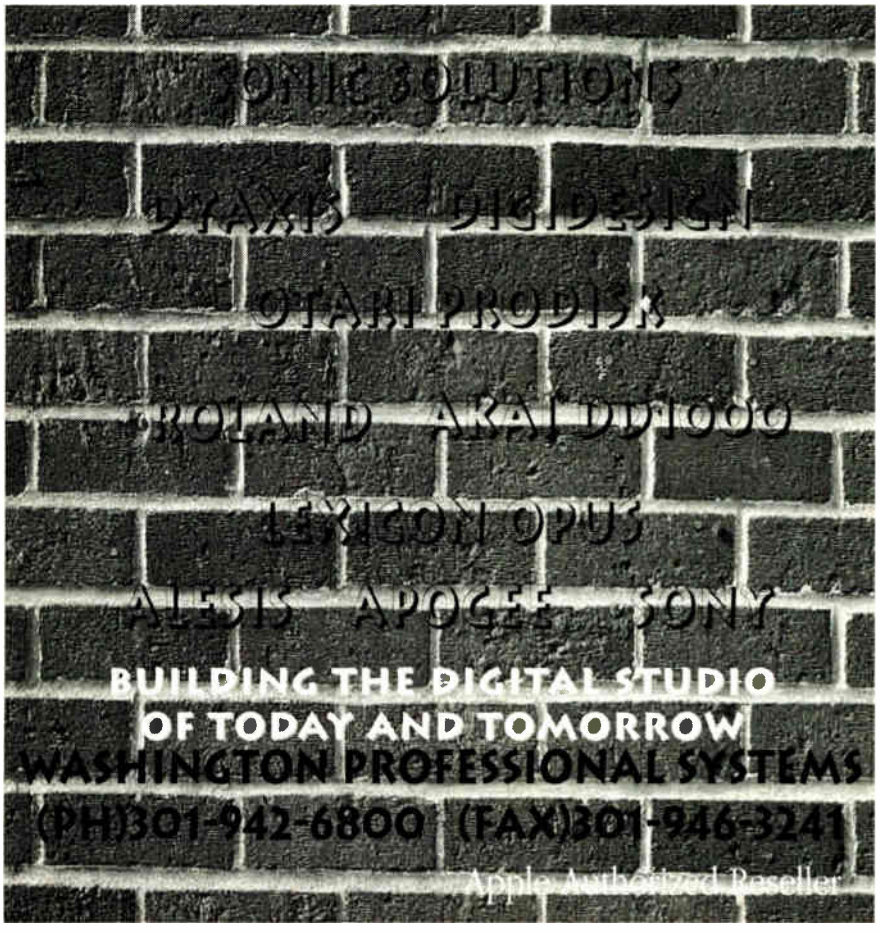

—FROM PAGE 57, TWICKENHAM

where the original recordings are made with time code that is carried through sound transfer and remains with the film, like invisible edge numbers, throughout the picture-editing process. (See sidebar on "Location Recording," p. 59.) But much of the work takes place within the chosen digital editing system.

At our facility, digital sound editing is carried out on a DAR SoundStation. In addition to the superior sound quality achieved from an all-digital process, editing in this manner automates many of the labor-intensive tasks performed in conventional sound editing. The sound editor then can find time to provide a more creative soundtrack.

We investigated all of the available hard disk-based digital editing systems, but were immediately aware that the DAR SoundStation was the most suitable for film-sound editing. One drawback, however, was a lack at that stage of auto-conform, a function that was essential to automate the replacement of the working soundtrack with the original DAT recordings. So we worked closely with DAR to adapt some techniques of auto-conforming used in video post-production to produce Edit Decision Lists that could be read directly by SoundStation.

Why re-invent the wheel? The project took some time and effort, but the system worked well. We can record time code onto the original 16/35mm mag transfers. When the film is assembled to fine-cut stage, we're able to deal with discontinuous time code and auto-conform the original sound recordings into SoundStation. A vital piece of hardware for this operation is the Fostex D-20 time code DAT, which can be used to record the original time code and act as a "play-off" machine controlled by SoundStation when inputting source material.

We use the SoundStation's WordFit to lip-sync any necessary ADR. By shooting wild tracks on location, with the same ambience as the original, we can automatically match them up in the studio. This capability can rescue complete scenes from post-synching and, consequently, save a significant portion of a film's post-production budget.

World Radio History

WordFit is an added bonus while shooting musicals if the actors must mime to prerecorded tracks. A system employed on *Wild West* (a film for which Twickenham SoundStation provided digital audio post-production services) involved pre-recording vocals and music in the controlled environment of a recording studio. While filming the relevant scenes, a silent playback system was used for the vocals with the actors singing along. By recording the vocals during shooting, we were able to WordFit the original studio tracks, achieving perfect lip sync with a studio-quality track. With several musicals currently in pre-production, including *Phantom of the Opera* and *Les Miserables*, such a system could be used with great effect, both economically and artistically.

The final mix can be tackled in several ways. When track-laying and editing is complete, audio can be recorded onto Dolby SR-encoded 35mm mag stock, then mixed in the conventional manner or by taking SoundStation into the dubbing theater, direct from disk. SoundStation can easily be packed into a flight case and configured as a transportable system, allowing editing and mixing to be carried out at any suitable facility. On smaller projects, mixing can be done on SoundStation using the system's DSP facility.

By eliminating or automating many of the labor-intensive operations, hard disk-based digital sound editing becomes a very attractive proposition at the end of a production, when time often can be of essence to meet a delivery date. We have all heard arguments contending that with an experienced editor, post-production can be carried out just as quickly and at the same cost using analog techniques. The difference, however, is that a digital sound editor will spend more time and creativity improving the soundtrack, while the "dinosaur" will be cutting corners and compromising solely to preserve an outmoded work practice. The contention that sound quality is achievable using traditional methods is just not good enough.

Chris Munro is a freelance production sound mixer and a director of Twickenham SoundStation Ltd.

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by Paul Potyen

MOVING TOWARD DIGITAL TECHNOLOGIES

A GUIDE FOR THE ENTRY-LEVEL RECORDIST

Anyone willing to take a chance on digital audio technology five years ago had to have two things: a lot of money and chutzpah. The handful of available options were expensive, to say the least. And they were just that: a handful.

Today things are very different for the potential buyer. Whether you operate your own tape-based private studio, handle commercial work at a multitrack analog facility or plan to build a studio from scratch, chances are that if you haven't climbed aboard the digital audio bandwagon, you've at least thought about it.

But making an informed decision on how to enter the digital realm is difficult at best. The advance of technology in the last five years has been relentless, with the result that options (and price points) are myriad. In preparing yourself for such a move, you first need to ask the right questions. What can you do with digital that you can't already do with your analog tools? How steep is the digital learning curve? How much should you spend? When is the right time to make the transition? What manufacturers will provide reliable technical support? Do your clients require this new technology? How do you relate what you read and hear to the real (reel?) world? (Despite the fact that *Mix* and other magazines expend a lot of ink talking about digital audio, the majority of professional studios continue to rely on analog technology.)

In the face of these and many other daunting questions, where do you start?

"...even if clients can't list all the technical advantages of digital, they are increasingly aware that it's a good thing, and with that awareness comes a willingness to pay for it."

Pros and Cons of Random Access

Probably the best place to begin is to compare conventional tape-based recording and editing with random-access digital. Anyone who has made the transition from editing analog tape with a razor blade to editing digital audio with a computer knows the latter is easier (though easier doesn't always mean faster). While new techniques such as "virtual scrubbing" on a computer screen might at first seem awkward to some, the comparative efficiency of the digital environment quickly becomes apparent: edits are non-destructive; a wide variety of crossfades are available; instant navigation is possible over audio regions

World Radio History

that are widely separated in time; any number of alternate edits are easily stored and retrieved; and audio quality is never degraded from the source recording.

Apart from the advantages digital editing provides within a given piece of music, sound effect or voice-over, this same process makes sequencing sets of music almost effortless. As long as you remain in the tapeless environment, you can quickly create and preview as many edit options as you wish without consuming valuable computer memory (insufficient memory being an Achilles Heel of this technology).

Digital signal processing offers additional advantages over the analog equivalent. With sufficient computing power, mixing, equalization, compression/expansion and other operations can all be performed entirely in the digital domain, without the kind of signal degradation that exists in an analog console/tape-based system. These are just some of the compelling arguments for investing in digital. And even if clients can't list all the technical advantages of digital, they *are* increasingly aware that it's a good thing, and with that awareness comes a willingness to pay for it. That is in itself another incentive for studio owners to make the move to digital.

But are there disadvantages? At risk of being burned at the stake, I'd like to suggest a few...well, things to consider.

First, you need to take into account that any new technology requires new concepts and ways of working. Random-access digital is no exception. Experienced engineers and producers can count on having to take some time to "unlearn" older methods and learn some new ones. Budget some time to do this in a low-risk environment before bringing in serious clients.

You also need to become familiar with the idiosyncrasies of the software you are using. How long does it really take to find a specific cue in a huge hunk of audio, to cut and paste that cue, to change its volume or EQ? Those familiar with creating and editing sound on samplers have an advantage in this regard, because the concepts are similar. The main difference is that the amount of memory available for storing and manipulating digital data is much larger in a digital audio workstation. How much larger depends on

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your intended use.

Finally, making safeties of your work is even more important in the digital domain. The role of the computer as the "brain" of your workstation makes the system vulnerable to failure. Crashes—even on the most reliable of systems—have been known to wipe out hours of work. This fact, together with the high cost and limited amount of memory, make backing up a critical part of the production process, and time and money must be allotted for that purpose. Some systems have the ability to perform automatic backup of work in the background. Others provide removable optical media (see this month's "Insider Audio"), while still others provide digital tape backup solutions (see "Chip Shots").

Examine Your Goals

Any decision to use digital audio technology depends on what you want to accomplish. What is the current focus of your studio? Do you handle multitrack jingle production? Album work? Audio post? Voice-overs? Mastering? Each of these areas implies different sizes of systems. A simple 2-track system might well serve your needs for voice-over or album sequencing, whereas a typical tracking room would require a much more sophisticated multitrack system.

The second issue is whether you are interested in providing better tools for your existing clients, or expanding. That is, do you want to attract more of the same kinds of clients, or do you want to diversify?

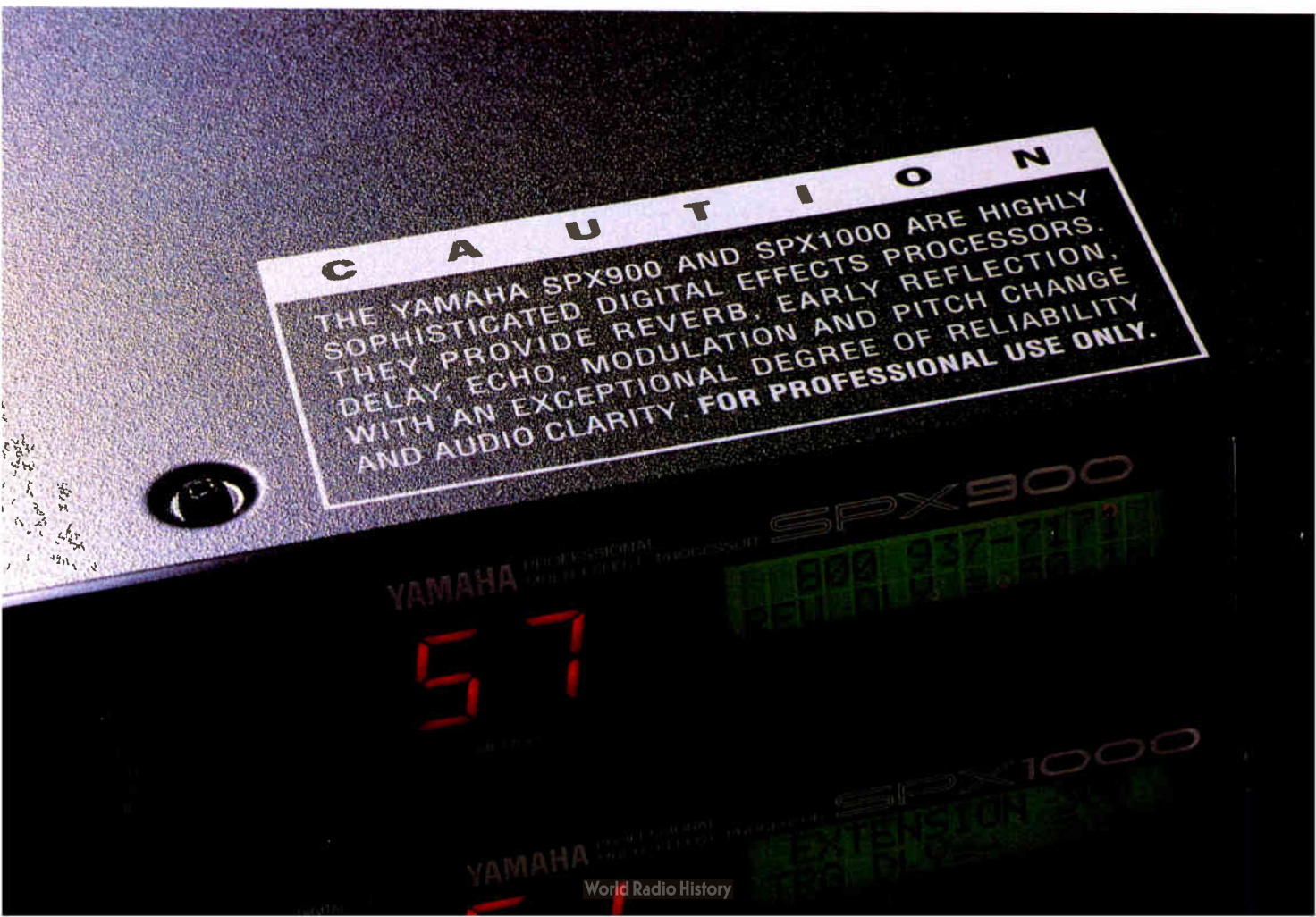
Economics: How Fat Is Your Wallet?

Implicit in much of what I've said is the issue of money. It's a complex issue, because the amount of money you spend to get into digital depends on how you want to use the tools, what equipment you now have that can be used for that purpose, what rates your clients are willing to pay and how big your existing and/or potential client base is. Project studio owners should look at their typical rent for equipment and studios and estimate what can be saved by buying. Ask yourself whether these new tools will provide additional income from such areas as voice-over recording/editing or album sequencing.

If you already own a personal computer and are willing to dedicate it to digital audio production, your options are many. At the lowest end of the pro audio spectrum, you can use your old MS-DOS computer and your DAT recorder to build a no-frills 2-track digital recording/editing system. The 56k from Turtle Beach Systems (York, Pa.), the ADAS-PC from Plasmec Systems (Surrey, UK), MicroSound from Micro Technology Unlimited (Raleigh, N.C.) and the Audio Engine from Spectral Synthesis (Woodinville, Wash.) offer hardware and software solutions for 80386-based PCs.

On the Amiga front, Sunrize Industries (Campbell, Calif.) is developing a 16-bit stereo card that will work with its Studio 16 software. It's expected to be available by August.

However, the leading edge of PC-based digital audio technology has been, and continues to be, the domain of the Apple Macintosh. Digidesign (Menlo Park, Calif.) offers a variety of systems, from utilitarian 2-track to powerful 16-track, for Mac II Series platforms. Digidesign systems offer the added benefit of compatibility with



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leading MIDI sequencer programs. StudioVision from Opcode (Menlo Park, Calif.), Digital Performer from Mark of the Unicorn (Cambridge, Mass.) and Cubase-Audio from Steinberg/Jones (Northridge, Calif.) all support Digidesign's NuBus audio cards, allowing multitrack recording and playback of digital audio and MIDI in the same environment. In addition, Digidesign's Pro Tools system allows MIDI tracks to be imported into its multitrack digital audio environment.

Mark of the Unicorn has developed its own 2-channel DSP card for the Mac, which is an alternative to the Digidesign Sound Accelerator card when used with its Digital Performer sequencing software and the A/D/A converters of your DAT machine. Among other alternatives to the popular Digidesign cards is Yamaha's recently announced CBX-D5 4-track system, a SCSI device that can be used with less expensive Macs as well as Atari ST computers. Initially, the CBX-D5 will be supported by Digital Performer software on the Mac and Cubase-Audio on the Atari. The product is expected to be available later this year.

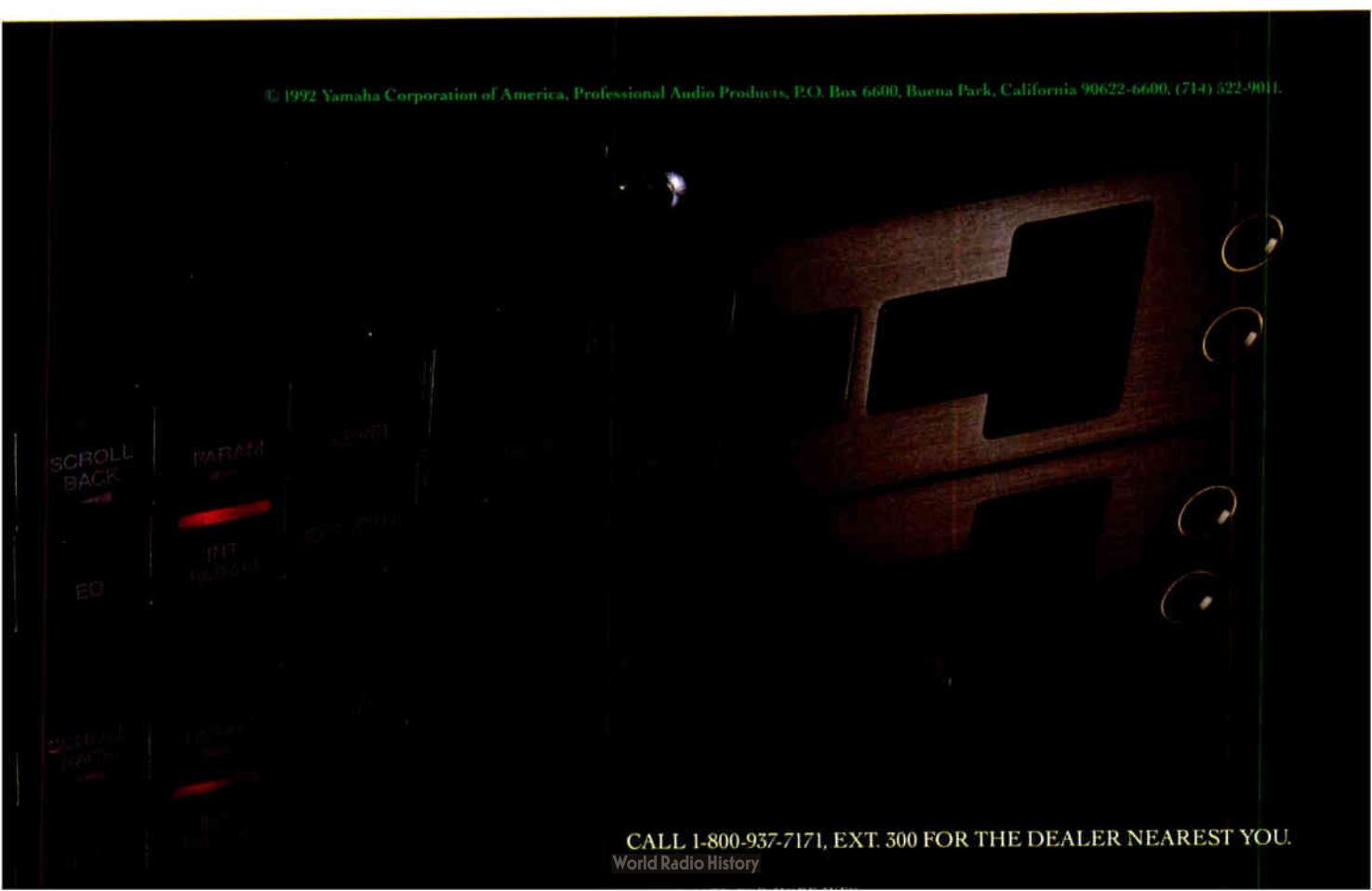
Somewhat more upscale modular systems for the Mac are currently offered by Sonic Solutions (San Francisco), Doremi Labs (Covina, Calif.) and Studer-Editech (Menlo Park, Calif.). Sonic Solutions, known for its stereo NoNoise Sonic Restoration package, offers the SonicSystem, with up to 24 channels of simultaneous recording and editing, advanced DSP options and SMPTE time code sync. Doremi Labs' Digital Audio Workstation Nucleus (DAWN) provides up to 16 simultaneous digital and/or analog ins/outs. Synchronization is achieved via MIDI Time Code. The Dyaxis system from Studer-Editech provides 2- or 4-output virtual multitrack recording and editing, DSP and SMPTE synchronization. The recently announced Dyaxis II system provides additional track capacity, plus powerful EQ and dynamics control.

The beauty of these systems is that you can begin to use the technology with a modest investment and, if you go about it intelligently, you can add to and modify the system in stages. Bear in mind that you may need to shop for at least one digital storage device for your system. Its capacity and performance requirements will vary according to your needs, as will the price.

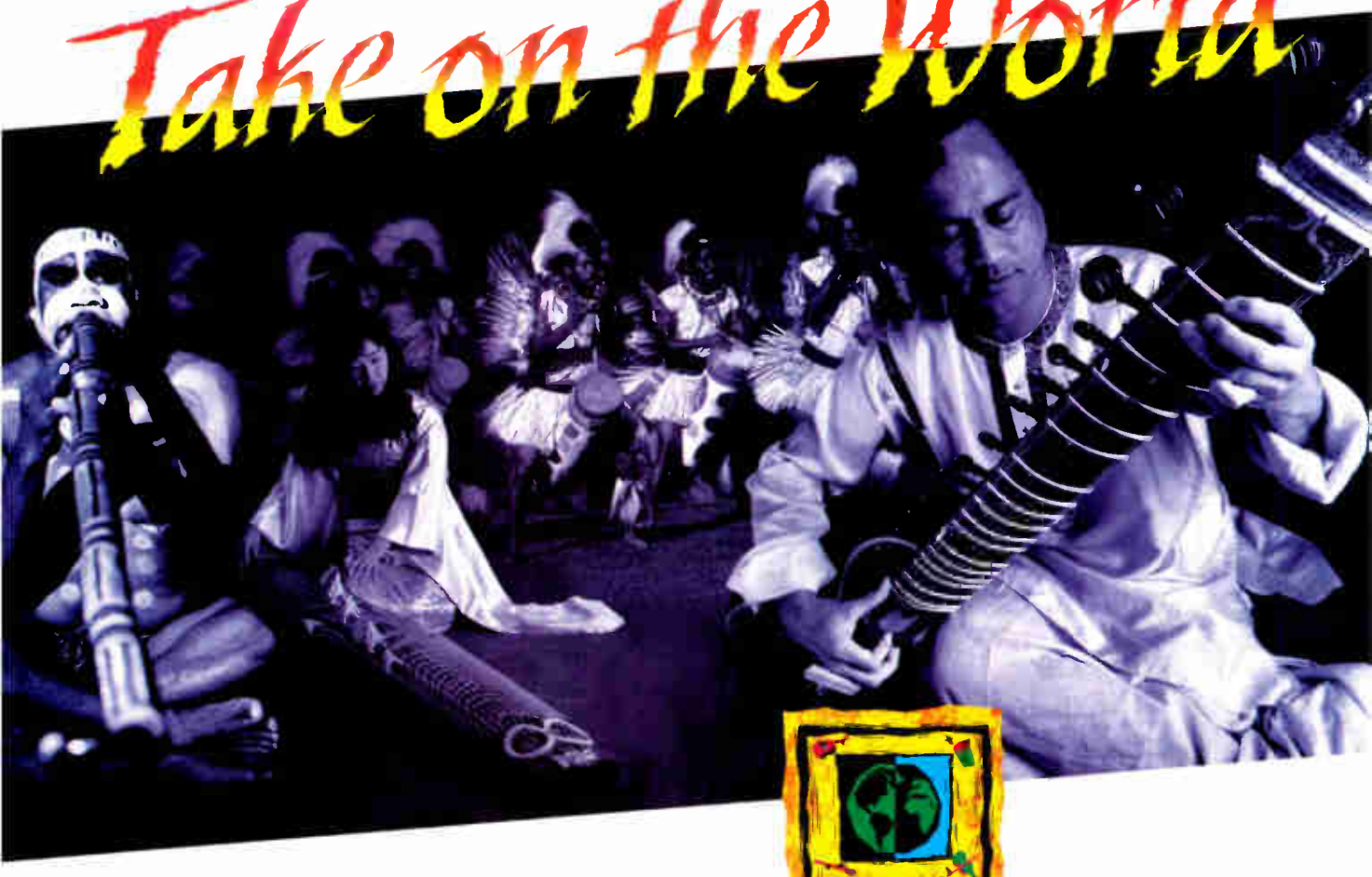
Among the biggest drawbacks of systems designed for use with personal computers is that they are likely to perform less efficiently than dedicated, turnkey digital audio workstations. And if you have an aversion to plugging cards into your computer, routing SCSI cables or reconfiguring your computer's operating system, you might want to pay the higher price for a dedicated system. Here the options abound: from MI entries such as the Roland DM-80, Yamaha DMR8 and Korg SoundLink, to the powerful NED PostPro, Lexicon Opus and AMS AudioFile systems.

Another important consideration in choosing a digital audio workstation is compatibility. While 2-inch analog tape has become an industry standard, no similar consensus has yet emerged in the arena of digital audio. If it's important for you (or your clients) to be able to take your audio files to another studio for additional production, you may want to consider what systems already exist in other facilities.

Finally, the ultimate success of any system—no matter how well-tailored it is to your current needs—depends



Take on the World



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greatly on the reliability of the manufacturer. Before you spend your hard-earned cash, talk to other engineers and producers who are currently using any system you are considering. Find out what they like and dislike about their system and how well the manufacturer supports it.

As with any high-tech application, no matter how much you research the pros and cons of competing digital systems, you will get more for your money six months from now. So, to an extent, it's a philosophical issue: digital audio is not going away, so do you want to jump aboard now or later? Only you can answer that one. ■

Mix associate editor Paul Potyen uses random-access digital technology in his project studio in the San Francisco Bay Area.

Chip Shots

Grey Matter Response ProArchive Tape Backup Units

The ProArchive 8mm (Exabyte) and 4mm (DAT) tape backup units from Grey Matter Response (Palo Alto, CA) are designed for use with Digidesign digital audio products. The 3U rack-mount Exabyte version offers 5 Gigabytes of storage and a data transfer rate of 500 kilobytes/sec. The 2U ProArchive 4mm, with its high-speed data-DAT drive, can store up to 2 Gigabytes of uncompressed data with a data transfer rate of 233 kilobytes/sec. ProArchive software supports background backup and restoration when used with a Pro Tools System Accelerator. Suggested retail for the 8mm Exabyte is $5,100, and $1,995 for the 4mm DAT.

Circle #201 on Reader Service Card

Digidesign Sound Tools II

Sound Tools II is the second generation of Digidesign's (Menlo Park, CA) popular disk-based recording system for the Macintosh. The new system includes Sound Designer II stereo editing software, the new Sound Accelerator II DSP card and the Audio Interface. The new card is 65% more powerful than its predecessor, and the Audio Interface is the same that is used in Digidesign's Pro Tools multitrack recording system.

The system allows users of Digidesign's DECK software or third-party digital audio sequencers to record and play back four independent channels of digital audio. An upgrade path is available for Sound Tools II users who are interested in eventually purchasing Pro Tools. Sound Tools II is now shipping at a suggested retail price of $3,495.

Also announced is Pro Tools Version 1.1, a major upgrade that includes optional expansion to 8, 12 and 16 channels; support for the Pro Tools System Accelerator; and other features. The upgrade is free to registered Pro Tools users. The System Accelerator is priced at $3,500.

Circle #202 on Reader Service Card

Opcode Systems Studio 4

Opcode Systems (Menlo Park, CA) announced Studio 4, a 128-channel, 8-in, 8-out MIDI and SMPTE interface for the Macintosh. In addition, up to four Studio 4s can be used together for up to 512 MIDI channels. The unit's synchronization features include SMPTE read and write ability in all formats, as well as flywheeling and jam synching. The Studio 4 is priced at $495.

Circle #203 on Reader Service Card

Imran Anwar MIDI-Vanilli

The MV2 (also dubbed MIDI-Vanilli) is a MIDI-based DSP voice editing system for the Macintosh from Imran Anwar Inc. (New York City). The software can alter previously recorded digital audio so that it follows the pitch of any MIDI controller connected to either its own 8-bit internal DSP card with a built-in MIDI interface or other popular MIDI/digital audio systems. The MV2 was expected to be available in the third quarter of 1992.

Circle #204 on Reader Service Card

Passport Designs Alchemy Upgrade

Passport Designs (Half Moon Bay, CA) released Version 2.5 of Alchemy, its digital audio and sample editing software for the Macintosh. The new version is System 7-friendly, supports new sampling devices and sound formats, provides faster processing speed and offers many additional MIDI and sampling features. Suggested retail is $695, with upgrades for registered users priced at $99.

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InVision SampleCell CD-ROM

Lightware Volume 1, from InVision Interactive (Scotts Valley, CA) is a CD-ROM library for Digidesign's SampleCell. Included on the disc are a collection of drum kits, percussion, basses, keyboards and orchestral sounds. In addition, InVision is now distributing *A Poke in the Ear With a Sharp Stick*, a SampleCell CD-ROM with avant-garde sounds. Lightware Volume 1 has a list price of $295, and *Poke* sells for $149.

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Tripp Lite UPS for Desktop PCs

The new Tripp Lite (Chicago) BC 250 standby UPS is designed to safely run most desktop computers through brownouts, blackouts and other power problems. Features include long-life batteries and two spike-protected AC outlets. The compact unit retails for $169.

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World Radio History

In the audio aristocracy of digital workstations, desktop systems strike a blow for sonic equality.

DIGITAL PARITY

BY · MICHAEL MOLENDA

Musicians can fool themselves into thinking that creativity is a democracy and that true talent always finds success, because sometimes it actually happens. Recording engineers, however, are bound to a stark landscape of haves and have-nots. The analog society is a divided one, where deep pockets are rewarded with amazing tools (SSL consoles, Studer 24-track recorders, AMS reverbs, etc.), and under-capitalized dreamers struggle to produce transcendent work with semipro gear.

However, the digital revolution promises to be the harbinger of change. PC- and Mac-based digital workstations now offer nearly as much sound editing power as high-end units costing ten times more. Obviously, economic breakthroughs are impotent if quality is compromised for price, but that's the miracle of digital: The medium's pristine sonics are blind to the bottom line. In fact, digital may reinvent audio democracy, because small project studios can pop a few thousand dollars for a modular digital recorder and compete sonically with large facilities.

Rather than exploring the entire range of lower-cost workstation systems, we contacted two users of Digidesign's Pro Tools as an illustrative example. The subjects in this article have widely differing needs, yet each has embraced modular digital systems as one aspect of his daily working routine. Some contrasts: Independent producer Russell Bond has a single system that he incorporates into his production tasks, while Mark Mangini uses Pro Tools as an adjunct to the two large SSL Screen-Sound systems in his 22-room facility.

THE EQUALITY ISSUE

"Expensive turnkey digital audio workstations can do more work faster than my Pro Tools system, but the end-result doesn't sound any better," says Russell Bond, a recording engineer/producer. "In the analog realm, engineers often equate money with quality. Expensive units are perceived as having more features and better sound. In the digital domain, this isn't necessarily true. I've found that the audio quality of Pro Tools stands up to Dyaxis and NED systems."

Bond, who operates his CornerMarket Productions from an of-

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fice in the Music Annex recording studio complex in Menlo Park, Calif., upgraded his Macintosh and installed the 4-channel version of Pro Tools for approximately $5,000. Building a system from the ground up (computer, large hard disk, software, etc.), can cost between $10,000 and $20,000.

"Obviously, there are some compromises in performance, processing speed, and user ergonomics with Pro Tools as compared to turnkey systems," admits Bond. "However, the least expensive of those workstations costs more than $30,000. Since I can do just about anything with the system I have, I don't feel the extra cost is worth it."

PC-based digital recorders are even creeping into the exclusive club of film sound editing facilities, where megabuck digital systems are as common as Range Rovers, car faxes and personal trainers.

"We're using Pro Tools [4-channel version] quite effectively in our editing suite," states Mark Mangini, a noted feature film sound editor and co-owner of Weddington Productions in North Hollywood. "Although the system was designed to be a bit of everything for everyone, it's biased toward music editing rather than film sound editing. Expensive digital workstations often are tailored for specific applications. However, for a tenth of the price of the big units, I've got a digital editing system that really works."

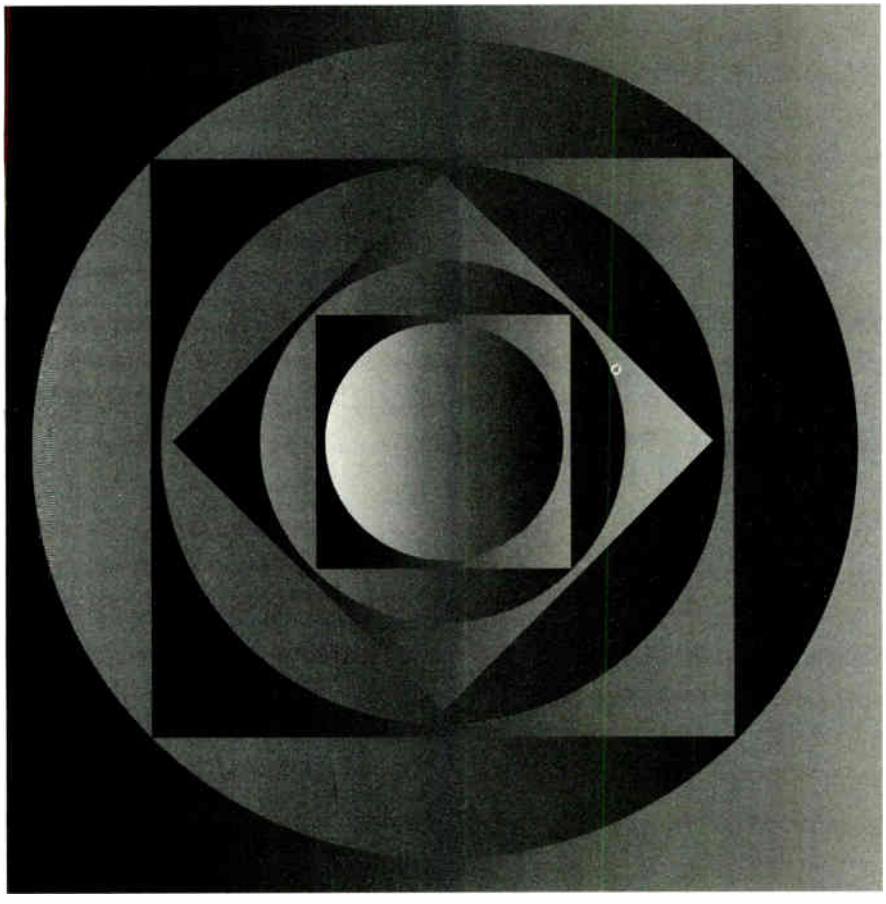

ILLUSTRATION: TIM GLEASON

THE LEARNING CURVE

Unfortunately, "easy-to-buy" doesn't necessarily translate into "easy-to-use." As tumbling price barriers seduce more and more sound engineers into purchasing digital recorders, a conceptual revolution is imminent. Currently, the ultimate power in the computer-based digital recording medium belongs to software programmers. Because these systems are software-driven, the programmer determines the system methodology. And there lies the conceptual crisis: It's often difficult for notoriously independent engineers to conform to someone else's work ethic.

"The problem is that every recording engineer works differently," Bond says. "It would be great if a hard disk recorder's software could be custom-tailored for each user."

The most important virtue in the digital domain is patience. Affordable hard disk recorders are in their infancy and therefore attempting to assimilate massive functionality into a developing medium. (Just try asking your two-year-old to explicate William Blake's *The Marriage of Heaven and Hell* and type the result on a word processor.)

"Whether it's a drum machine, sequencer or digital recorder, everybody wants everything to work immediately," muses Bond. "I believe 80% of the problems with hard disk recording are caused by the user. People get impatient and work ahead of the program. Remember, we're asking these little computers to do things they weren't designed for. Considering the few thousand dollars I paid for my Macintosh and Pro Tools, it's a miracle the system works at all."

CRASH AND BURN

When a hard disk recording system doesn't work, it's curtains. Hard disk crashes are as merciless as the Black Plague. It's terrifying for analog-oriented engineers to consider that previously recorded work can be decimated by a computer hiccup. Bond once logged 100 crashes in 20 recording days. Luckily, with the exception of one audio loss, the malfunctions were limited to destruction of playlist *regions*—instructions that tell the software where to start and stop playing data from the hard disk.

It doesn't help that backing up data is problematic because of the processing time involved. Paranoid engineers cannot save files after every take because oft-idled clients (who pay by the hour for services)

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"The reliability issue is still a factor. If your hard disk crashes during a session, you're out to lunch," Mangini states. "This is fragile software and hardware, and the systems are finicky. Product support is essential. If a Moviola breaks [during a sound editing session], there are several facilities where I can rent another unit. However, high-end digital workstations usually have one supplier, and you're dependent on that single avenue of support."

Fortunately, there are a few safeguards available to circumvent tragedy. Bond recommends upgrading to the 8-channel version of Pro Tools because, although it offers more power, it's actually easier on the computer. The 4-channel version must use the Macintosh CPU for its processing, and the Mac is not used to working so hard. A fatigued computer is a crash waiting to happen. However, the 8-channel system includes a NuBus card that takes over all the signal processing. Also, backups can be planned during session breaks and switch-overs (going from underscoring to sound effects editing, tracking drums to setting up guitars, etc.).

THE DIGITAL QUESTION MARK

Query: If random-access recording is so scary, why is everyone glad that a fast track to an ulcer is finally affordable? Obviously, the rewards of digital sound are self-explanatory and often worth the practical hell of dealing with the medium. Also, the modular design of computer-based systems offers almost unlimited tracking. If a project starts on analog 24-track, it must remain on that format. Sure, two tape machines can be synched to increase tracks, but this is more trouble and expense than simply carrying a hard disk to a facility that runs 8- or 16-channel versions of your software.

In addition, an entire system can be assembled in a single rolling cabinet (or rack) and dropped in the trunk of a subcompact sedan. Unless you own one of those massive location recording trucks, the emergence of PC-based digital systems marks the first time professional-level "studios" can be so easily transported. The entire concept of a recording studio changes, because these systems are capable of tracking master-

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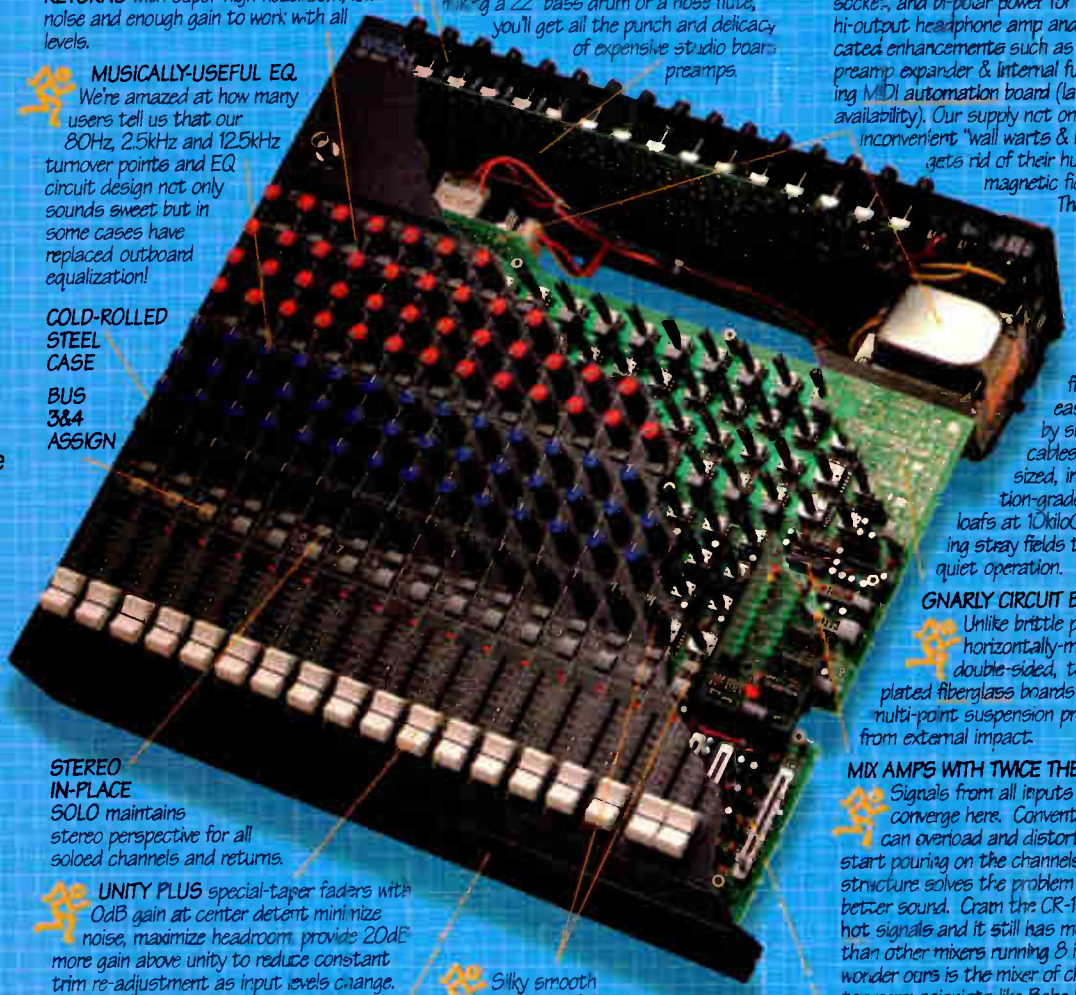

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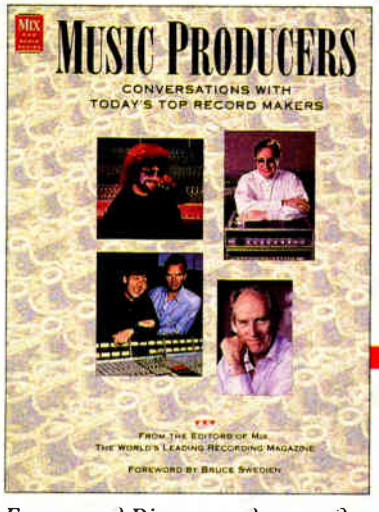

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Computer-based digital editing systems also are making life easier in film dubbing studios.

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Portability also has become a factor in film work, as most dubbing stages do not offer random access playback capabilities. Analog has format standards, but nothing yet has been formalized for digital mediums. If a sound editor wants to utilize digital source material at the dubbing stage, he or she must provide the system.

"We simply bring our Pro Tools system in its roll-around cart and plug directly into the recording console," says Mangini.

Although reliability and backup issues need addressing (Bond predicts most existing software problems will be history within six months), many engineers can do everything they need on modular systems without pining for the increased features of a huge digital system. It's definitely sweet, sweet revenge for analog veterans whose quest for sonic excellence often has been sabotaged by the callous whimsy of a pauper's budget. ■

Michael Molenda is the associate editor of Electronic Musician *magazine and co-owner of Sound & Vision Studios in San Francisco.*

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"The Lawnmower Man" image courtesy of Allied Vision Lane Pringle Productions and New Line Cinema Corporation. "CyberBoogie" created by Angel Studios.

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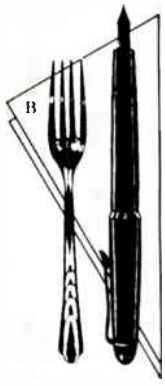
World Radio History

by Mr. Bonzai

BRUCE BOTNICK

THE DOORS TO DIGITAL



Bruce Botnick is well-known as the big game hunter who captured the wild and beastly dynamics of Jim Morrison, but what other acoustic animals has he faced head on? He nabbed the *Pet Sounds* for the Beach Boys. He caught The Turtles while they were "Happy Together." National Lampoon "Lemmings" John Belushi and Chevy Chase were fair game for Botnick. And let's not forget The Chipmunks. Read on to discover how Alvin's high-pitched voice was created.

In recent years, Botnick has been recognized for his exemplary work as the scoring engineer/mixer and/or producer for a ton of heavyweight soundtracks. Producing the music for *Star Trek: The Motion Picture* was one of his first triumphs and is in the history books for bringing digital audio to the movies. Botnick likes working with big orchestral tracks and has contributed his talents to a few of the century's favorites, including *E.T.*, *Indiana Jones and The Temple of Doom*, *Rambo*, *Total Recall*, *Beauty and The Beast*, *Basic Instinct* and, appropriately, *The Doors*.

I first met Botnick a decade ago when he was playing around with some of the earliest digital equipment. He seemed very confident and natural as he tweaked those mysterious knobs. Later on I learned that he's always been bold and tenacious when it comes to new technology, like the time he rented the first 3M 8-track from Wally Heider and then kept it for a year-and-a-half.

As we join Botnick at his Digital Magnetics studios, he is viewing the film *Exodus* and trying to figure out what can be done with six tracks of ancient mag soundtrack and a phase problem from another dimension. He discusses a few of the scenes with Ted Hall, his chief mixer, and together they lay out the procedure for getting the best of a grand old soundtrack into our home video theaters. Just another "nightmare," as he calls it, in the Botnick day.

PHOTO: MR BONZAI

Bonzai: While I was watching you prepare *Exodus*, you referred to your company as The Fixit Company.

Botnick: Well, we have been restoring a lot of movies for MCA/Universal Home Video, MGM and Paramount. In the early days of wide-screen cinema

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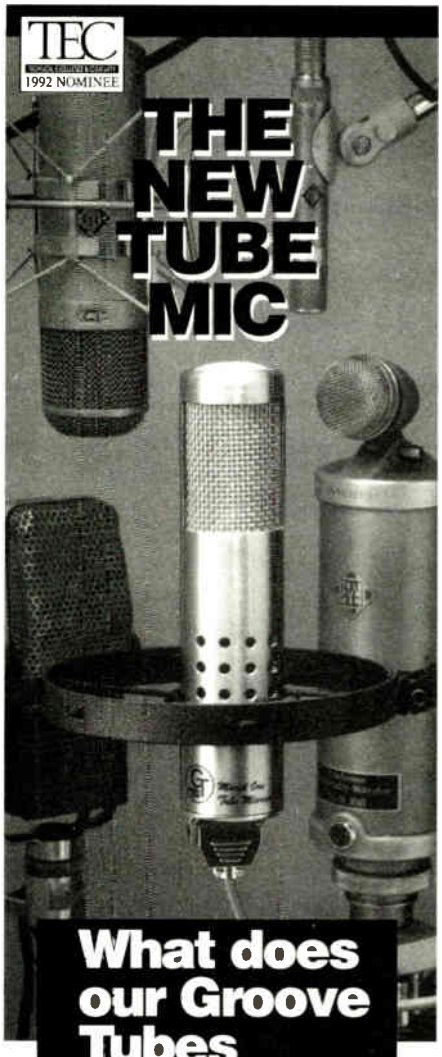

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and stereophonic sound, the first 6-track, 35mm magnetic film recorders were introduced. They were hand-built, and the film stock was new as well. So when the mag stock comes in today, it smells like vinegar, and you have to wear a gas mask while you're working. We take the six tracks and make something that works with the Dolby matrix.

We find that a lot of our time is spent in restoring films rather than instigating new shows. One day, I made signs for "The Fixit Company" and put them on the front of the building. The staff came in and had a laugh—that's where it came from.

Bonzai: Are you the best at this type of restoration work?

Botnick: I think we are the best at the way that we do it. Our operation is all digital audio, but it also involves the care that we take with an old tape to investigate how each track on that 6-track master relates to the track next to it. We make sure that they're all in-phase, timed and azimuthed. Because those old machines were all custom-made, the technology wasn't as good as it is now.

What you just heard with *Exodus* was possibly the result of the old pan-pot system that they used—actually a collection of six pots, which were gear-driven with a master knob. You turned the master and some would turn up and some would turn down for the motion from side to side. It's very possible that some of the tracks are out-of-phase. Music might be in-phase on track 3, right center, but the dialog is out-of-phase. In a 6-track theater environment where you had six speakers—five in the front and one in the rear—the problems wouldn't be as obvious as when you go into a Dolby matrix, which doesn't like out-of-phase conditions. You start to hear phasing as if it's a Jimi Hendrix record.

Bonzai: Can you remember your very first meeting with a tape recorder?

Botnick: A friend of my father, a composer name Raul Krashaur who used to do all the Hopalong Cassidy TV shows, had a Webcor tape machine. Because my father was a studio musician, I had been to the studios and was fascinated with all the equipment. I went to Raul's house, and he had this Webcor and he let me borrow it. I was about 12 years old.

Bonzai: What did you record?

Botnick: Probably myself, and I experimented with playing things backward and that sort of thing.

Bonzai: Did you anticipate that your entire life would revolve around audio?

Botnick: No, I didn't know what I was going to be. I just let it grab me and it took me. Later on, I used to go along when my father was playing viola in the studios. I was studying saxophone at the time, but I found it more exciting in the control room than in the studio. I also liked the fact that the mixer would push the button and say, "Take one." I don't know what a psychiatrist would say about that. [Laughs]

While I was still in high school, I got an old Berlant Concertone, 15 ips, reel-to-reel 2-track machine, and two Telefunken U47s to record the orchestra and chorus at Hollywood High School. I had my own record label, and I used to press them up and sell them to the student body.

Bonzai: Was it profitable?

Botnick: No, I didn't make a dime, but I had a good time. I didn't lose any money, and I learned a lot about recording, editing, mastering-to-disk and record pressing. I went to Radio Recorders where they cut the lacquers, and then off to Research Craft—they were the first to do the safety edge so that when the stylus came down it wouldn't fly off the end of the record, but the edge would catch it and throw it back in. They also came up with the compounds for the first anti-static records. Anyway, I learned about pressing, and record labels, and jackets and all of it.

Bonzai: When did you have your first professional gig?

Botnick: After high school, I got a job at Liberty Records recording studio in 1961. I worked for two-and-a-half years, for free, as an assistant. I cleaned floors. I operated the tape machines. I was an apprentice, and I learned about microphones and how to cut disks. I worked my way up to solo engineering, and did my first records with groups like Jan & Dean and The Ventures.

Bonzai: Weren't you pretty young to be taking charge?

Botnick: I had an affinity for recording, and I was a good watcher. Throughout my life I've had this ability to sit behind somebody, and all of a sudden I get the feeling that I could do it as well, if not better. I would see things and ask why they weren't doing

World Radio History

it another way. So I moved from second engineer to mixer, and I had some little bands that I wanted to work with. I became friends with musicians who came in, like Leon Russell and David Gates. Slowly but surely, they started asking me to do their engineering.

Bonzai: What was your first session as a solo engineer?

Botnick: I think it was for The Ventures. Actually, it was for Bob Bogel, who was their bass player. He had a little label, which was distributed by Dolton Records, a subsidiary of Liberty Records. He did one of those records that were very popular at the time: You'd use hit songs and take lines and edit them into a comic, narrative story line. That was the first thing that I ever did for money. It was basically recording dialog and doing editing.

Bonzai: You also worked on The Chipmunks' records. What was the secret of the sound of The Chipmunks?

Botnick: Well, Ted Keep was the mixer, and he came up with the sound. In those days we didn't have the ability to VSO, so he did it with batteries and a Variac connected to the capstan motor. We just literally slowed the recorder down.

Bonzai: What about "Good Vibrations"?

Botnick: The vocals were done over at Western 3. Brian [Wilson] had recorded the track at Western 3, and then moved over to Gold Star. He'd go to one studio and record everything, then he didn't like the chorus so he'd go to Gold Star. He'd edit it in and throw the old stuff away. You'd have verses from Western combined with the choruses from Gold Star. I was familiar with the process, because I had done most of the tracks on *Pet Sounds*. Anyway, we did the choruses again, edited them in, and threw away the Gold Star tracks. A week later he came back and we recorded new verses. This was 4-track half-inch.

Bonzai: Was it a problem editing tapes from the two studios?

Botnick: No, we had tones. We adjusted azimuth.

Bonzai: Did you record the famous theremin?

Botnick: Yes, that was done live with a microphone and an amp.

Bonzai: Who played the theremin?

Botnick: I have no idea. They got some guy who played it for all those eerie '50s movies.

Bonzai: 1967, Stevie Wonder and

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Botnick: Stevie was in this movie with Annette Funicello and Frankie Avalon. He was Little Stevie Wonder at the time. He came into the studio and played on top of tracks—he played drums, organ and sang. I'll never forget the scene in the movie where he's playing and there is a crazy fight, and he gets covered with yellow paint.

Bonzai: Let's hear about your first session with The Doors.

Botnick: Well, I was doing work for Elektra Records. I had done their first rock 'n' roll record with the band Love. This record and the next album, *Tim Buckley*, were produced by Jac Holzman. Through Jac, I met Paul Rothchild, then head of A&R and their main in-house producer. Since The Doors were an L.A. band, and Paul was out of New York, Jac Holzman asked that I be involved. They just booked the studio for a week and that was their first album. We recorded the album in seven days.

Bonzai: What was your first impression of Jim Morrison?

Botnick: He was a pretty normal guy—an upstanding Irishman.

Bonzai: What was your involvement in The Stones' *Let It Bleed*?

Botnick: Glyn Johns engineered, but I assisted and brought in some musicians: [fiddler] Byron Berline for "Honky Tonk Woman" and [singer] Merry Clayton for "Gimme Shelter." It was wonderful. I enjoyed working with them. I remember I was astonished looking at the 2-track tapes: They had played them so much that you could literally *see* the two tracks worn into the tape.

Bonzai: Were you one of the first guys to make the jump from engineer to producer?

Botnick: I guess so, but I think Bones Howe did it before me, when he was working with the Fifth Dimension.

Bonzai: How did you swing it as producer of The Doors?

Botnick: Basically, we just went into the studio to do *L.A. Woman*. After all the years of making records with Paul Rothchild, The Doors had gotten to the point where they didn't want to be produced any more. Paul was getting tired as well, without that enthusiasm of the first or second record. It evolved to the point where the band wanted to do it on their own. So I suggested that we just do it together. They asked where we should record, and I thought we should do it in their rehearsal hall. It was a comfortable place to work. I brought in the equipment, and we recorded the album in seven days, same as the first album.

Bonzai: How many tracks were you using?

Botnick: This was eight tracks, as many as we ever used. I had the very first 3M 8-track, their first multitrack. Wally Heider owned it and rented it to me. I didn't give it back for a year-and-a-half.

Bonzai: I guess this opened up a lot of new opportunities?

Botnick: Yeah, and we heard a lot more tape hiss than we had been used to. I had to relearn recording all over again to make it quiet.

Bonzai: What was the secret?

Botnick: It was in the mixing. With no automation, you had to have everything memorized perfectly, turn things on and off, and just run the faders. Open with one thing, and add and add and add—by the time they were blasting, the signal was so much louder than the noise that you didn't hear the hiss. Of course, as they came down, you had to pare it away. We didn't have any noise reduction until the *Waiting for the Sun* album. *L.A. Woman* was recorded without noise reduction on BASF tape at +10 dB, so we could get around the noise problem.

Bonzai: Was *Star Trek* your first film work?

Botnick: No, but I believe it was the very first digital audio for film. I was working for Columbia Records at the time as a producer, and they knew I was wild and crazy and would take on anything that was technologically advanced. So they asked me to produce the *Star Trek* soundtrack.

I was looking through this magazine and saw an ad for digital audio. I didn't even know what it was. So I said, "Hey, we're doing a movie about the future—we gotta have this." So they went out and bought serial number six of the Sony PCM-1600 processor and two BVU-200s with a controller. I recorded the orchestra for all the underscore with that system.

Bonzai: You must have had an analog machine going as a safety.

Botnick: Oh, we recorded analog multitrack, absolutely. But we recorded a live 3-track mix to mag film, a live 2-track mix to digital, and a live analog multitrack [mix] with Dolby A.

—CONTINUED ON PAGE 191

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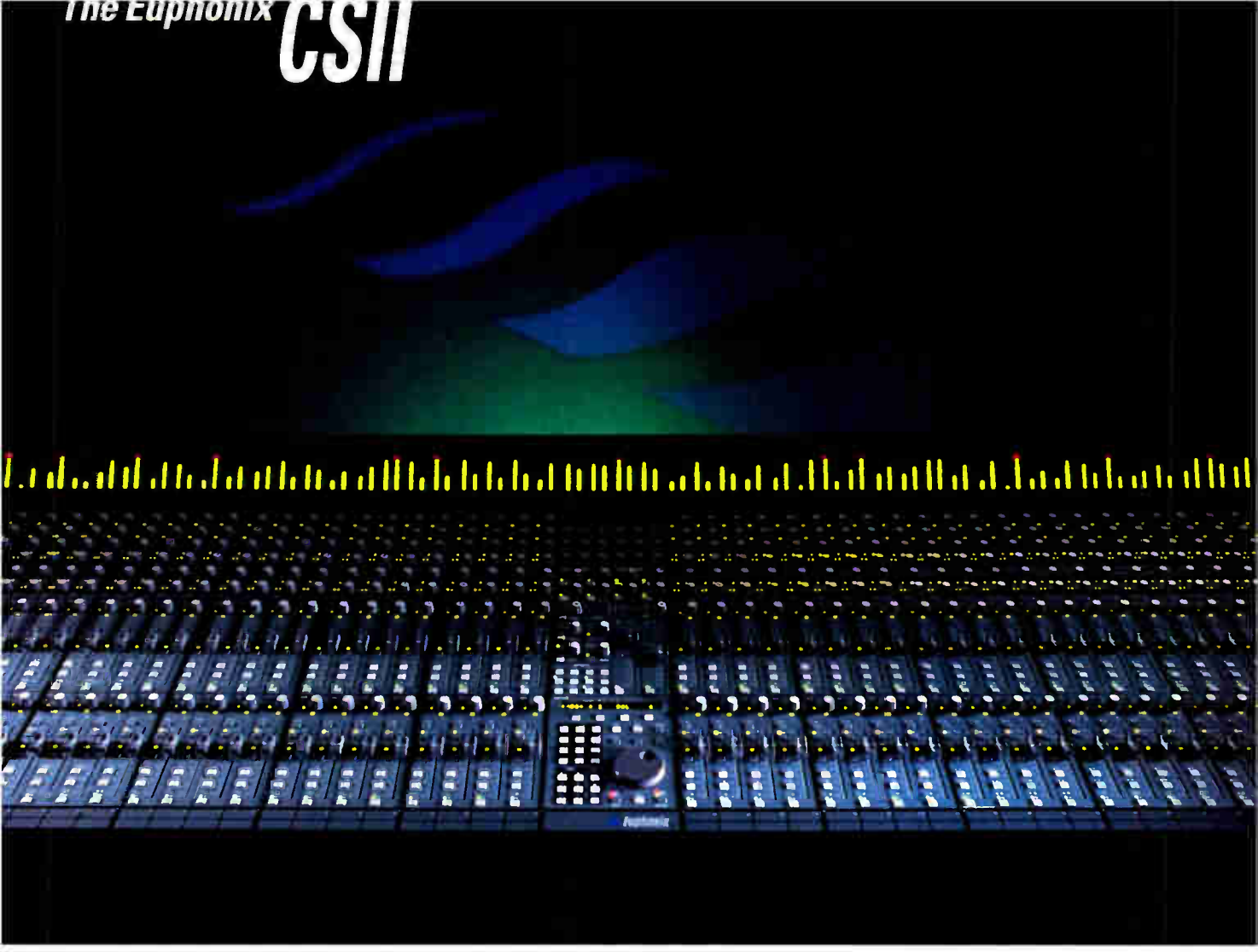

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Bob Clearmountain & Robbie Robertson

A Conversation About Destroying the Myths of Digital Recording

Ah, there's nothing like the enthusiasm of the newly converted. In this case, the converted is none other than Robbie Robertson, and the cause is digital recording. Robertson made the great binary leap on his most recent album, the exquisitely crafted and soulful *Storyville*. Aside from the fact that it represents Robertson's best writing since The Band's *Northern Lights-Southern Cross* 17 years ago, *Storyville* is one of the best-sounding records I've heard in the last few years, possessed of an incredible warmth and clarity. The disc was produced by Robertson, Gary Gersh and Stephen Hague, engineered by Steve Nye, and mixed by Bob Clearmountain, who re-

World Radio History

ally deserves special mention for the outstanding job he did keeping Wardell Quezergue's amazing horn arrangements from dominating the mix—their use as subtle punctuation is a master stroke.

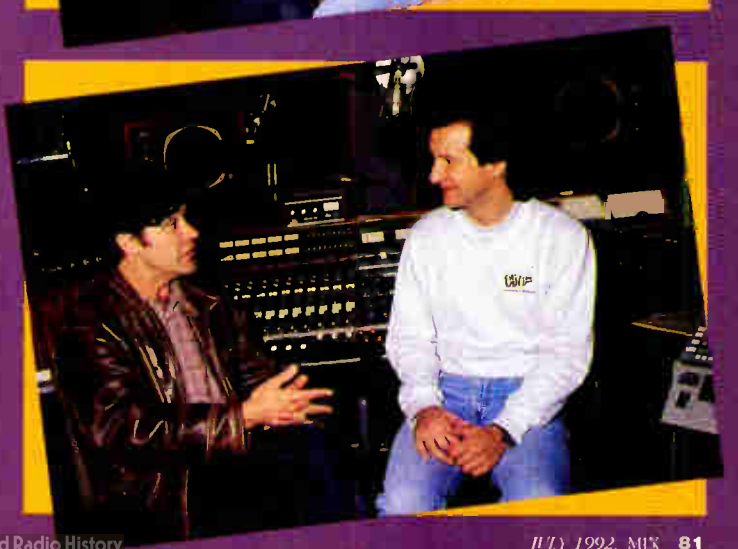
Clearmountain has been an outspoken advocate of digital for some years now (regular *Mix* readers will recall his series of articles on digital editing), and Robertson's *Storyville* LP gave the mixmaster a chance to ply his trade once again on his beloved Sony 48-track digital recorders. (Clearmountain also likes and is conversant with the Mitsubishi digital format, though he prefers the Sony.) In late April, Clearmountain and Robertson sat down together with a tape recorder to rap about digital. An edited version of their freewheeling chat follows.

—Blair Jackson

Robertson: For years now I've had recording engineers, producers, musicians, people off the street say, "Stay away from this digital stuff. It's not musical. It does weird things to your ears. It's like standing in front of a radar oven too long." [Laughs] I've heard all these myths.

Clearmountain: I think that's all just prejudice. It's something that people have built up in their minds. They've become polarized against digital, and they won't accept it. When they listen to digital and they don't hear an obvious difference, they think, "Well, everyone's really against this and it's like a computer digesting my music and spitting it out again, and that can't be good."

Robertson: Well, this is an interesting angle—that with all the other prejuduces in the world, there's actually



PHOTOS ELIZABETH ANNAS

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prejudice against machines.

When I started recording *Storyville*, one of the reasons I was going to work with producer Stephen Hague was because he was really digital-familiar. I had this idea that I wanted to do some recording in Los Angeles and then go to New Orleans, do stuff there, go back and forth, and I wanted it all to be able to be put together without the nightmare of locking machines up and time codes and all these things that have turned into the extremely time-consuming nightmares of all our lives at one time or another. So one of the things I'd heard was that you could bypass all that with digital machines.

Clearmountain: Right, it's no longer a problem at all.

Robertson: So I thought, "This is for me, *if* it sounds okay." While I'm contemplating this move, everybody is telling me, "Don't do it." These are other big recording artists, other engineers, other producers. The biggest complaint I heard was, "It's not a musical-sounding machine." As we know from the past, certain old analog machines really do sound good. They have a nice punchiness to them. They hype the bottom end a little bit. They have some compression in them. Then when you hear it back, it's making you sound good.

Clearmountain: So what you're saying is the analog machine is changing the sound. People got used to recording things, and the machine, being a bit forgiving, spits it back a little warmer and a little nicer-sounding, except for the tape hiss it adds. But that's part of what's happening. A lot of the little irregularities of the original recording are getting covered up by a lot of the tape hiss. So you don't notice imperfections that you will on digital, because the digital doesn't have all that noise, plus the analog is changing the bottom end

In the Beginning...

In the beginning there was Sony, then Mitsubishi, and finally there were Otari, Studer and Tascam. That would seem to summarize the development of digital multitrack recording. However, the initial entry in the field has survived, almost in secret, to today.

At the Fall 1977 AES show, 3M demonstrated a working prototype 2-channel digital recorder. At the Fall 1978 AES show, 3M demonstrated a working system consisting of a 32-track and a 4-track mixdown machine. In Los Angeles on February 6, 1979, the first two operational digital audio recording systems were installed at Herb Alpert's studio D in A&M and Chris Stone's famous studio C in Record Plant. Later that same month a third system was installed at Warner Bros.' Amigo Studios in North Hollywood. All this less than four months after the maiden lab operation of the first prototype 32-track. All three of these machines are still operational and supportable to this day.

During the remainder of 1979, the 3M lab pursued the development of the editor, and the factory geared up for production of the 32-track and 4-track machines. By September 1979, editing had begun in the field: Linda Ronstadt's *Mad Love* album at Record One, Bonnie Pointer's *Bonnie Pointer* album, and Rick Dufay's work at Record Plant with Lee DeCarlo and Jack Douglas. Herb Alpert's *Rise* album went gold, the first digitally multitracked album to do

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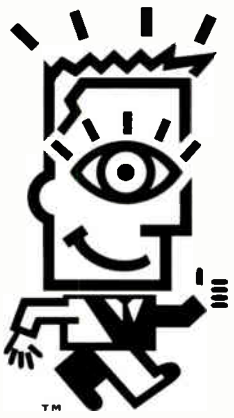

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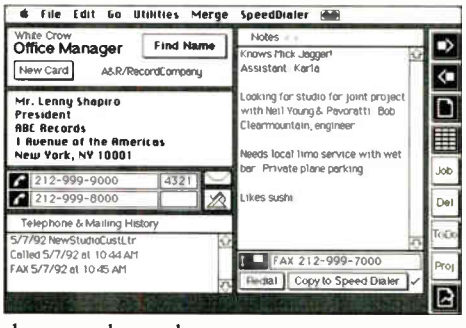

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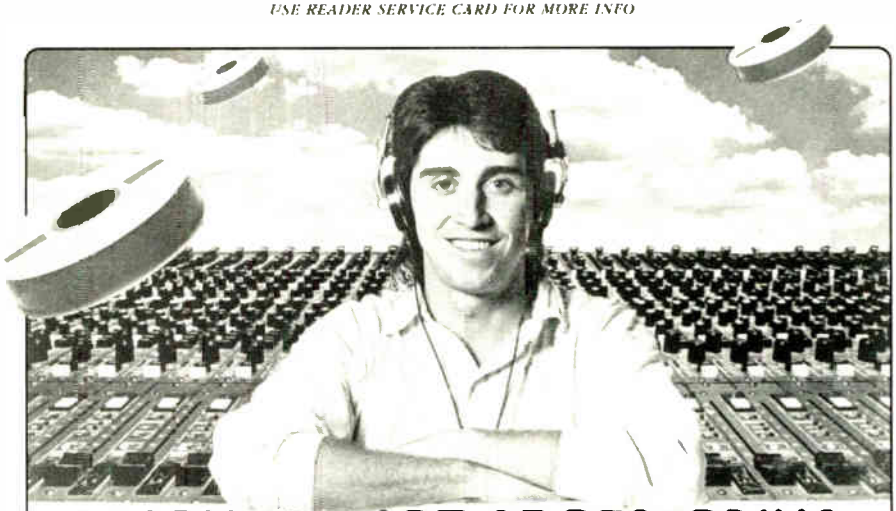
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a little bit.

I had the opposite problem with analog: I'd play a take back and it sounded different than when it was being recorded. I was always really frustrated by that, so I couldn't wait for digital to be perfected, because I wanted it to sound the same when it came back off tape.

Robertson: Well, we had many, many years to get used to the analog tape characteristic.

On this album [*Storyville*], I wanted to work with an engineer whose work I've enjoyed for years—a guy from England named Steve Nye. He comes from the Abbey Road school of music, and he worked on a lot of records that had a very warm quality to them—Clannad, Bryan Ferry, David Sylvian, Penguin Cafe Orchestra. There's a very particular, warm, comfortable, sexy sound to those records. So I got in touch with him, but when he came over to Los Angeles and we told him that we were thinking of doing this record digitally, he said, "I don't know if I can work on this record. I'm going to admit that I'm a die-hard analog fan. I like the sound of it, and from my limited experience with digital, I just can't get what I want."

So I said, "There's only one way to get to the bottom of this. Let's set up a great analog tape machine and a great digital tape machine side by side, and let's have it out. Let's have this war and may the best machine win! Whatever really sounds the best, that's the way we'll go." So I got the musicians in and we tried all this stuff—playing together, playing separately, putting lots of stuff down on tape. We got it all lined up, to play back for the big A-B test, and we went back and forth and back and forth—this went on for hours. We listened with SR Dolby and without it.

We were going around and around on all the instruments—from the bass to the cymbals to things in the string range, high guitar ranges, distortion, no distortion, everything you can possibly do. Steve Nye is going through all these things one by one, and we're sitting there like the jury. Finally, he said, "I hate to admit this, but I like the sound of the digital better." He said, "What I'm finding is that in the analog things get stuffed together a little in their sounds. The bass drums, things in the low register, get a little mumbly in analog. In digital I'm hearing this air and this definition between things." It's like things really sit by themselves. So we came to the conclusion that the analog machine

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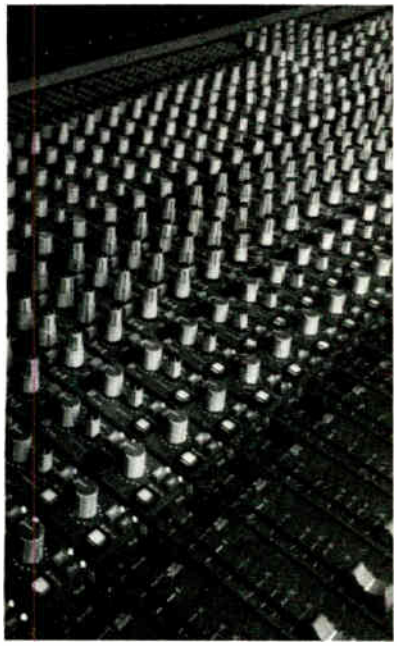

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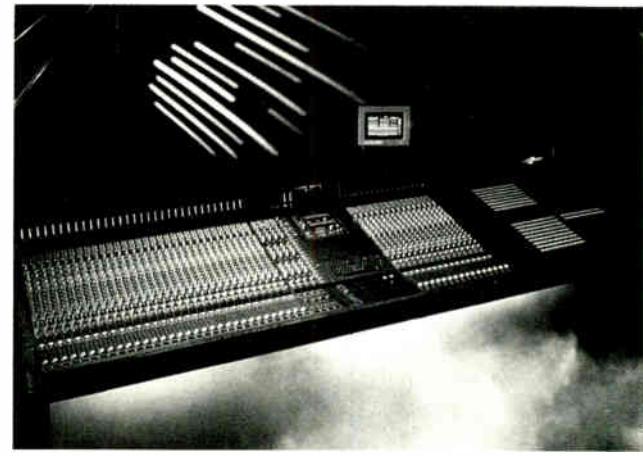

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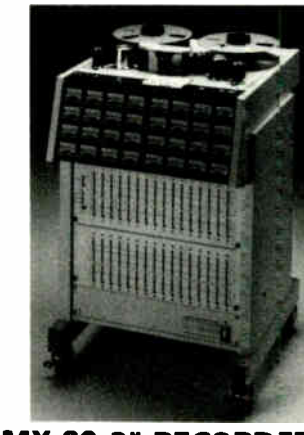

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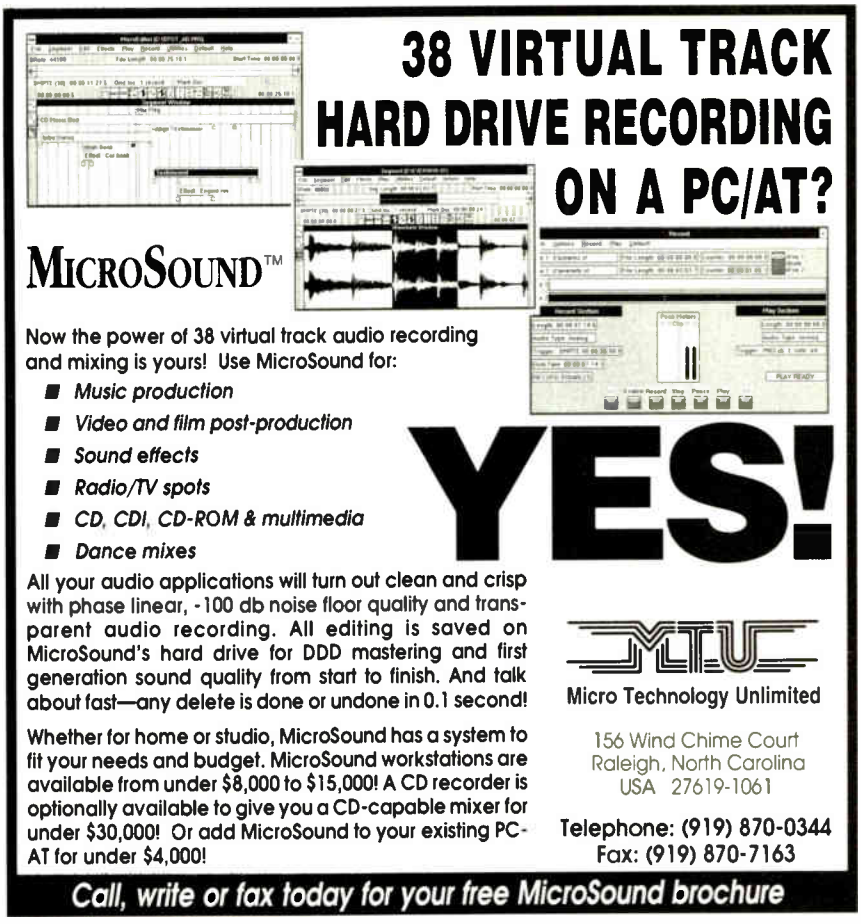

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was like a piece of equipment for *an effect*. If you want this effect that it gives you, you can go through this machine. But Steve found that on the digital he could match this effect with just a little bottom EQ and a little compression. It was virtually the same thing, but he had better control over it.

Bob, one of the things I wanted to ask you is, aside from the fact that there is no hiss and that you can go generation after generation and it doesn't add or take away anything, what can you do digitally in the editing process?

Clearmountain: This is what intrigued me about it from the start. Besides all this other stuff that you've been saying, you don't have to worry about alignments and optimizing the machine to make it sound the best, which always drove me crazy with analog. Digital recorders are incredibly creative tools, way beyond anything that any analog machine can do. On two-inch analog tape, you'll usually have to try your edit on a monitor mix on a piece of ¼-inch tape first to see if it works, and then you'll try it on the multitrack and it will inevitably be different depending on what instruments you have featured on the monitor mix. And once you've done it—once you committed a razor blade to a piece of tape—then putting it back the way it was can be a nightmare. With digital you don't have to worry about that because when you're editing, you're actually only making a copy of the tape without any generation loss, so you're not destroying anything. You keep the original take in its original form no matter how many times you edit. You can try it a million different ways. These machines have a rehearse feature that programs the edit and lets you try as many types of edits as you want before you even commit to the one edit you end up with. You can even alter crossfade time on the better machines.

I remember on your first solo album we would do edits, and you'd say, "Okay, we want to cut this bit out." There would be a guitar lick or something that would hang over the edit, so what we'd have to do is fly that off onto another tape or into a digital sampler, do the edit and then punch the sample back into the tape over the edit, which would take forever, and it was always a roll of the dice as far as getting it in time. Well, with digital, you can just leave that one track out of record when you do the edit, until it finishes its phrase, and then punch that track in. So

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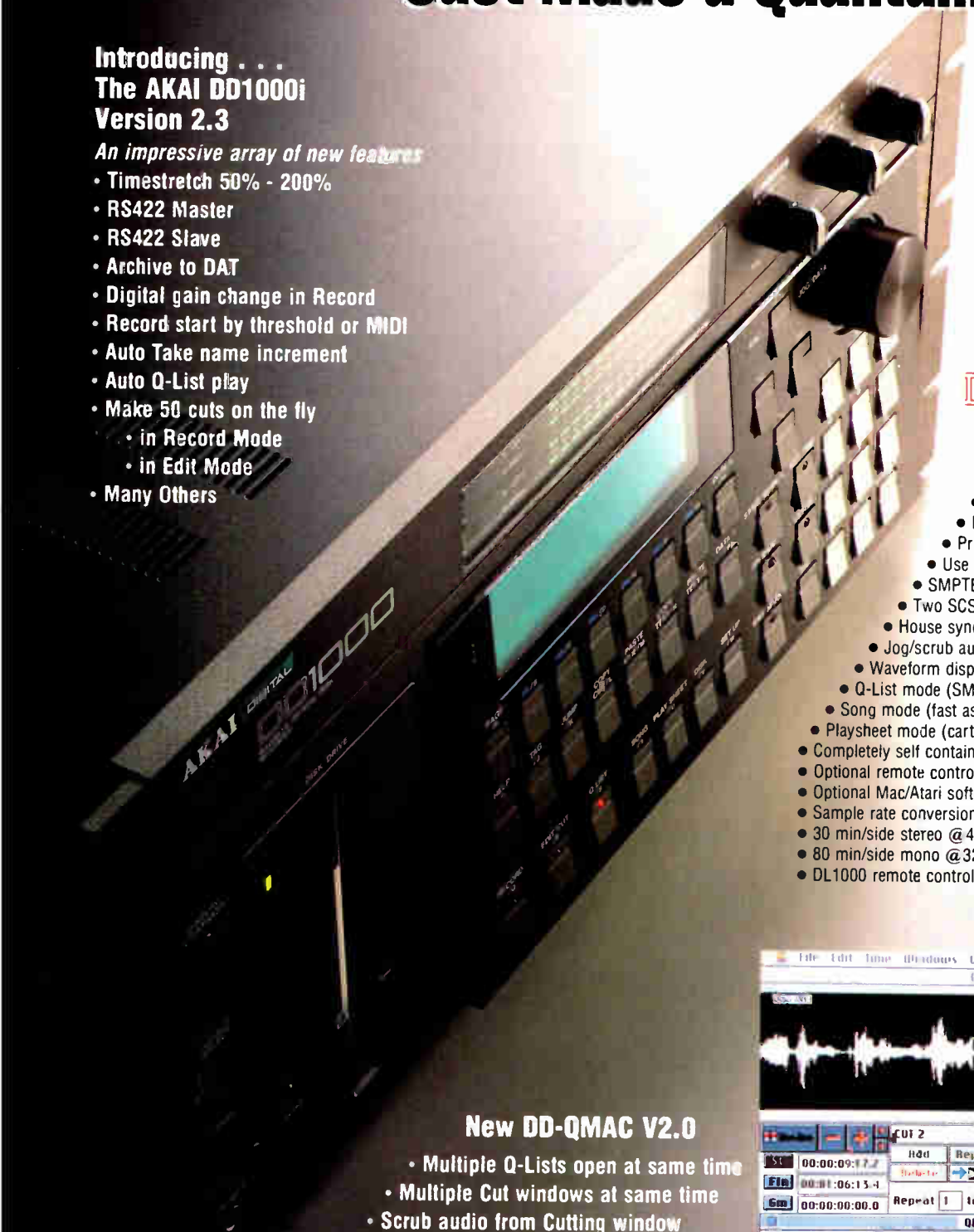

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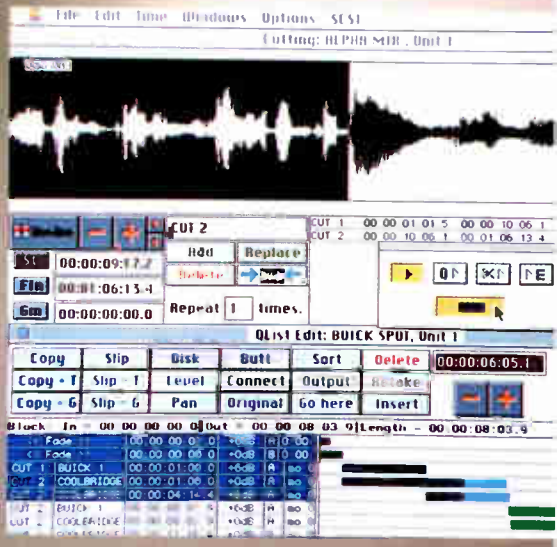

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you can actually edit the tracks at different places. You can edit the drums in one spot, edit the keyboards in another. Especially with music like yours, which is not that cut-and-dried—it's not like dance music where everything happens on a down beat or on a backbeat. In your music, things are always floating over the beats.

Robertson: The time-saving element is amazing.

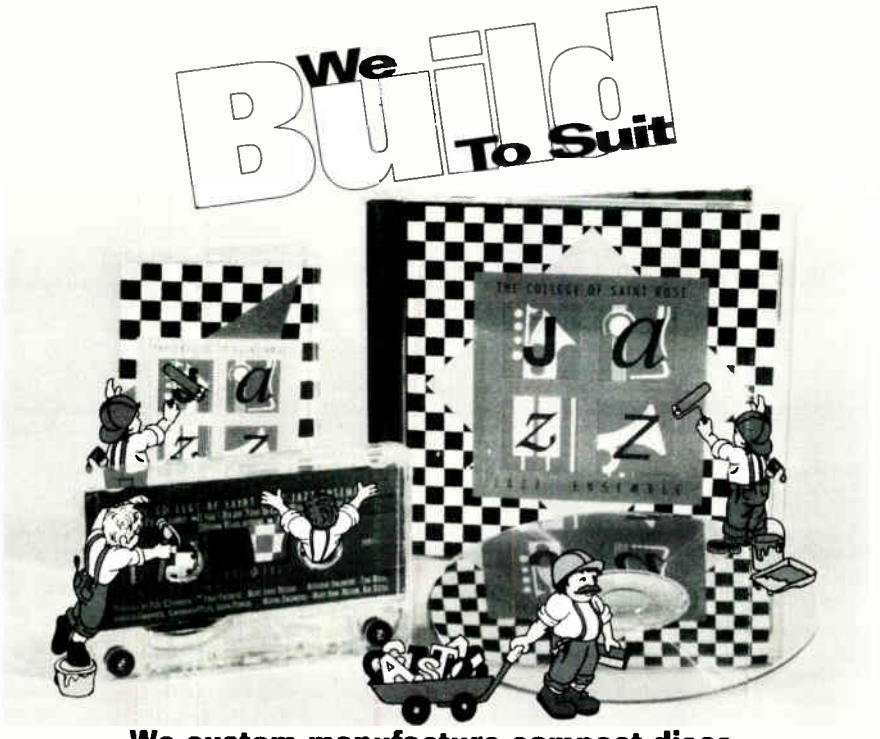
Clearmountain: And now some of the machines have samplers built right into them, so you can move sections of individual tracks around in time extremely quickly without even patching! The Sony 48-track has that, and I think the Studer has it, as well. It's all D-to-D; you're not even converting the signal, so you don't lose signal quality or gain tape hiss. Then it remembers where on the tape you recorded it from, and it'll store where you want to fly it into, so if you don't fly it in right the first time—you're really close but the timing is just a bit off—you can nudge it around to the millisecond until it sounds just right and *then* record it.

It's amazing to me what people are missing out on because of their prejudice against digital. If they had any idea what they were missing, they might listen a little harder.

Robertson: When we made those A-B tests, after a while I said, "Look, I don't even want to know which one is which. Don't tell me." And when we started playing them, it was so obvious to me which was the digital and which was the analog. It was a clarity. It wasn't "brighter," really, just clearer. More present. It seemed like you didn't have to cut through any woods to get to any of the sounds. They were *right there.*

Talking about these partial myths about what analog and digital do to music, the whole belief is that with digital recording you're going to get this cold, manufactured kind of sound. On *Storyville*, what I really wanted was the opposite. I wanted a lot of depth and a lot of warmth, and I think we got that.

We are kind of coming out of the dark ages on this technical thing. It's funny, in some recording studios you go in and the favored equipment in microphones are things that have been around for years and years. So we have a built-in thing in our minds—older is better. And in some cases it's just not true, as we're finding out with computers. And these digital machines are obviously the same kind of thing.



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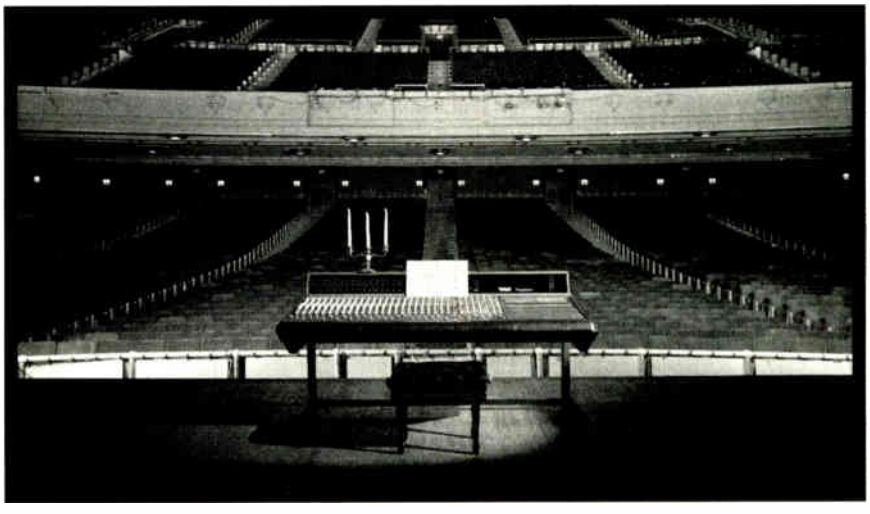

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Clearmountain: People tend to generalize that older is better and anything that is too new and too high-tech is not warm and not artistic. But you have to look at each piece of technology on its own and examine each thing and really listen, pay attention and keep all your biased ideas out so you can be objective.

Robertson: Having worked with these digital machines for a while, do you ever think, "Well, this is great, but I wonder why they did this and why they didn't do that?" What's the next step that needs to be taken care of?

Clearmountain: I believe the next step is creating another machine that will facilitate editing 48 tracks. The problem is, to edit a 48-track tape you need another 48-track machine, and they cost somewhere around $200,000 and up, so that's half-a-million dollars of tape machine to do an edit! Now obviously, there aren't too many people who can afford that these days, so I'd think maybe a switchable 48-track playback head for a 24-track machine would be the next step. There are a lot of 24-track machines around, so if you could upgrade them so they would just play back a 48-track tape, you could edit from that machine onto a 48-track in two passes. Or possibly a 48-track that was really stripped down—that didn't have any features on it—that just played back and didn't even have converters. You wouldn't even have to play it back through a console; it would just have to plug into another 48 digitally.

Robertson: So, there's no turning back, eh? [Laughs]

Clearmountain: Not for me. But to give the other side of things for a minute, a few record companies have been putting a paragraph on the back of their CDs about how if the recording was done analog there may be limitations in the source tape, and because digital is so clean and has better resolution, it could point out these flaws. It's like a disclaimer, which is really a shame. Now you and I are obviously big digital fans, but there are people who for various reasons, sometimes budgetary—otherwise the records wouldn't get made if they had to do them digitally, because it *is* more expensive—they've chosen to record analog. To put this paragraph on the back of the CD is almost penalizing them; it's like saying, "Well, this doesn't sound as good as if it had been done digitally," which whether it's true or

—CONTINUED ON PAGE 187

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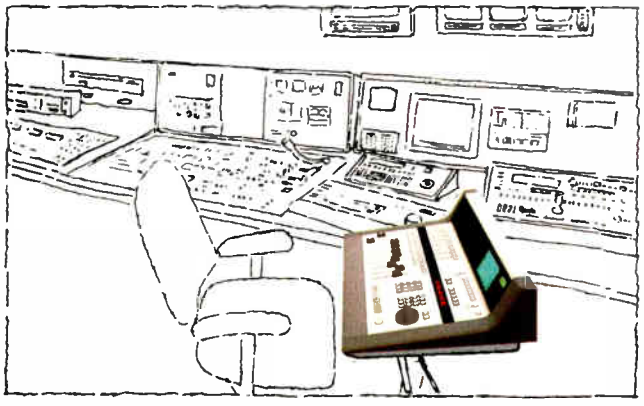

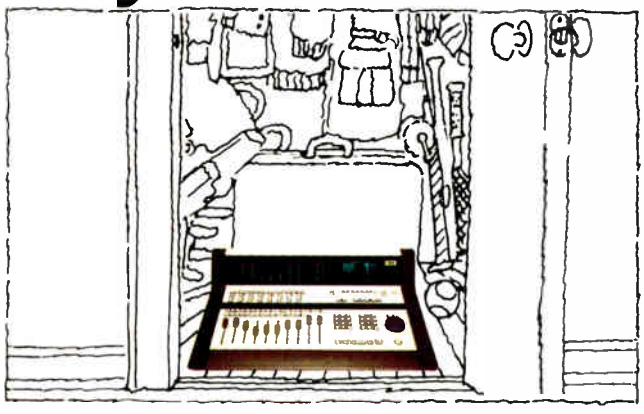

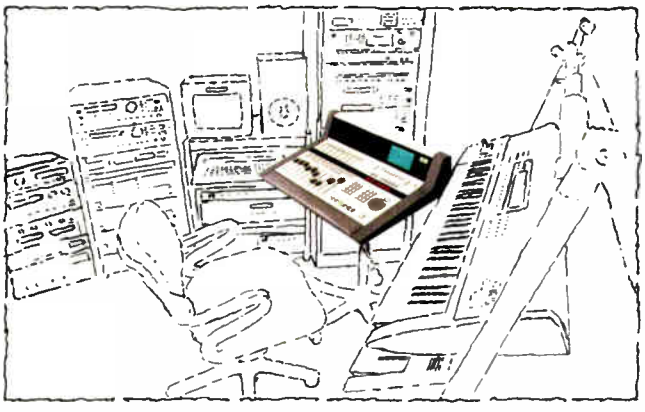

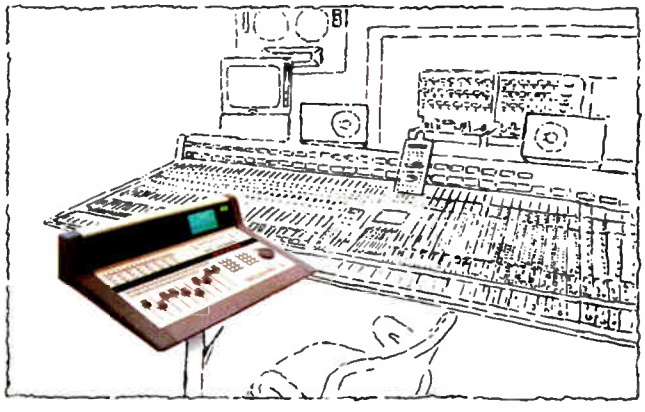

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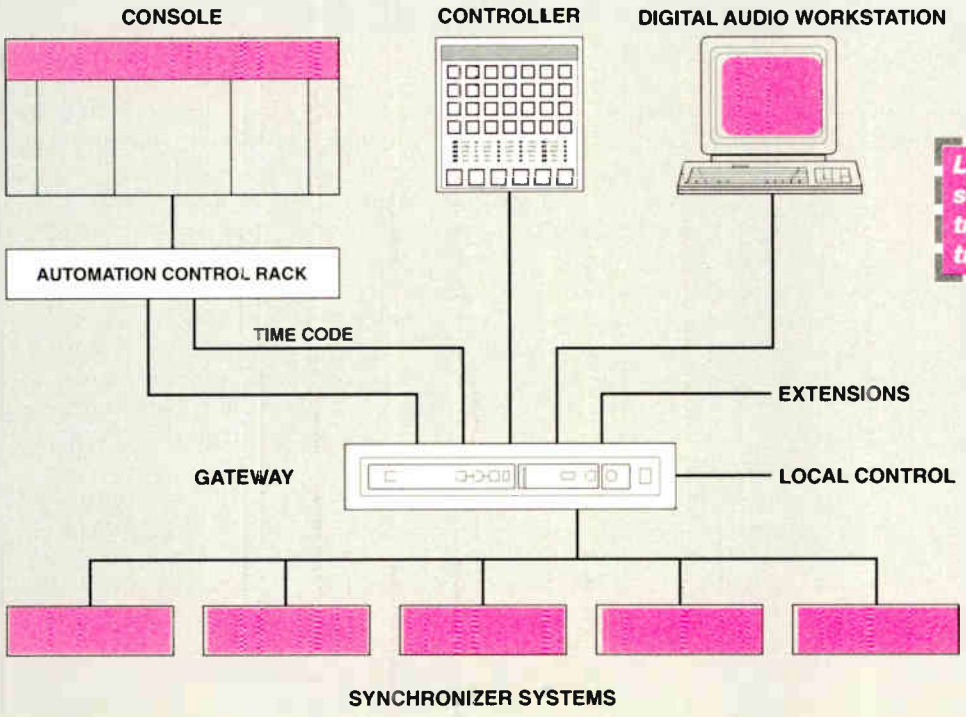
Serial Transport Control From Digital Audio Workstations

The key to successful integration of audio and video transports from a centralized workstation surface lies in the use of serial control schemes running industry-standard bidirectional protocols.

by Tim Cuthbertson

The growing trend toward full integration of audio and video systems places increasing demands on controlling methods in recording studios and post-production facilities. Once upon a time, a simple chase-synchronizer was all that was required to satisfy the record producer's need for more tracks or to ensure that a soundtrack remained in lock with the picture.

The "simple" time code synchronizer has now grown up to become a component part of a much larger machine control system that manages



Left: Block diagram of a typical serial-interface scheme for controlling external audio and video transports plus synchronizers.

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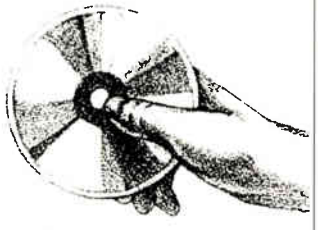

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multiple and varied sound and picture sources. Commonly, audio or video machines are located centrally within one facility; in some instances, however, they may be situated in separate studios, or even in a different building. Once viewed purely as a tape-machine accessory, the time code synchronizer has become a network integration device to communicate information between discrete and complex subsystems.

With increasingly complex productions and the need to coordinate more functions via a single control system, the development of an effective, universal communications protocol is critical. Historically, such methods evolved from manufacturers' needs to integrate and control their own equipment. The early parallel control systems were barely more than direct replications of a machine's front-panel controls. Demands for greater functionality led to serial communications schemes, which provided more sophisticated control.

SERIAL CONTROL PROTOCOLS

Two of the common serial protocols in use today were developed by Ampex and Sony specifically to control VTRs from a video editor. Both protocols have been extensively improved to facilitate the changes demanded by modern production methods and equipment. (For example, a DAT machine can be controlled from existing editing equipment simply by plugging in the 9-pin serial interface connector.)

Unfortunately, Ampex and Sony protocols are incompatible in design and too different in operation for a single unified protocol to evolve, even though they are based on the same 9-pin D-type connector and use balanced RS-422 communications running at 38.4 kbaud.

Two other serial protocols of interest are the ESbus protocol and MIDI. Jointly developed by the EBU and SMPTE, ESbus uses a 9-pin RS-422 format, while MIDI is based on an optically coupled, 5-pin DIN connector. Both were developed through the combined efforts and input of several manufacturers and their industry standards committees.

The ESbus protocol is now being used by a growing number of synchronizer, console, ATR and VTR manufacturers. MIDI, of course, has gained universal acceptance as an efficient method of controlling musical and associated equipment. In January of this year, the MIDI Manufacturers Association published an extension to the original MIDI protocol specification to add MIDI Machine Control (MMC). This development permits manufacturers of MIDI-based sequencers and related software to include direct transport control via standard MIDI I/O for systems equipped with MIDI synchronization capability.

However, the problems of serially controlling a diverse range of equipment still remain. Fundamentally, many devices used in post-production have very little in common with each other apart from the fact that they are being used together in the production process. Digital audio workstations, samplers, CD jukeboxes or optical recorders should ideally be controlled in a totally different manner from dubbers, film chains, VTRs or analog tape recorders. The common link currently holding these systems together is some form of time code and a simple set of commands composed of the basic instructions: "stop," "play," "rec," "cue," etc. This level of control is sufficient for the transfer, assembly or mix process, but inadequate for today's computer-controlled production environment.

SOPHISTICATED CONTROL SYSTEMS

Implementing a sophisticated control system is not easy. No simple solution answers all the requirements. Operationally, the system needs to be transparent. Users should be able to move from task to task, changing controllers and equipment as circumstances demand, yet have all the necessary status information and control immediately at hand.

Dedicated control systems such as video editors provide control at a single point only, which simplifies the design of the equipment. A complete audio post-production system may require control from multiple operators at a variety of different points. It might, for example, include a console automation system, a synchronizer control system, a digital audio workstation and a central machine room. From each of these control stations, an operator needs to gain access to and control the machine assignment and status information.

A number of companies have developed products that meet some of the requirements, but effective integration of a digital audio workstation has not been achieved. Workstation manufacturers, quite naturally, have spent their R&D resources on recording sound or

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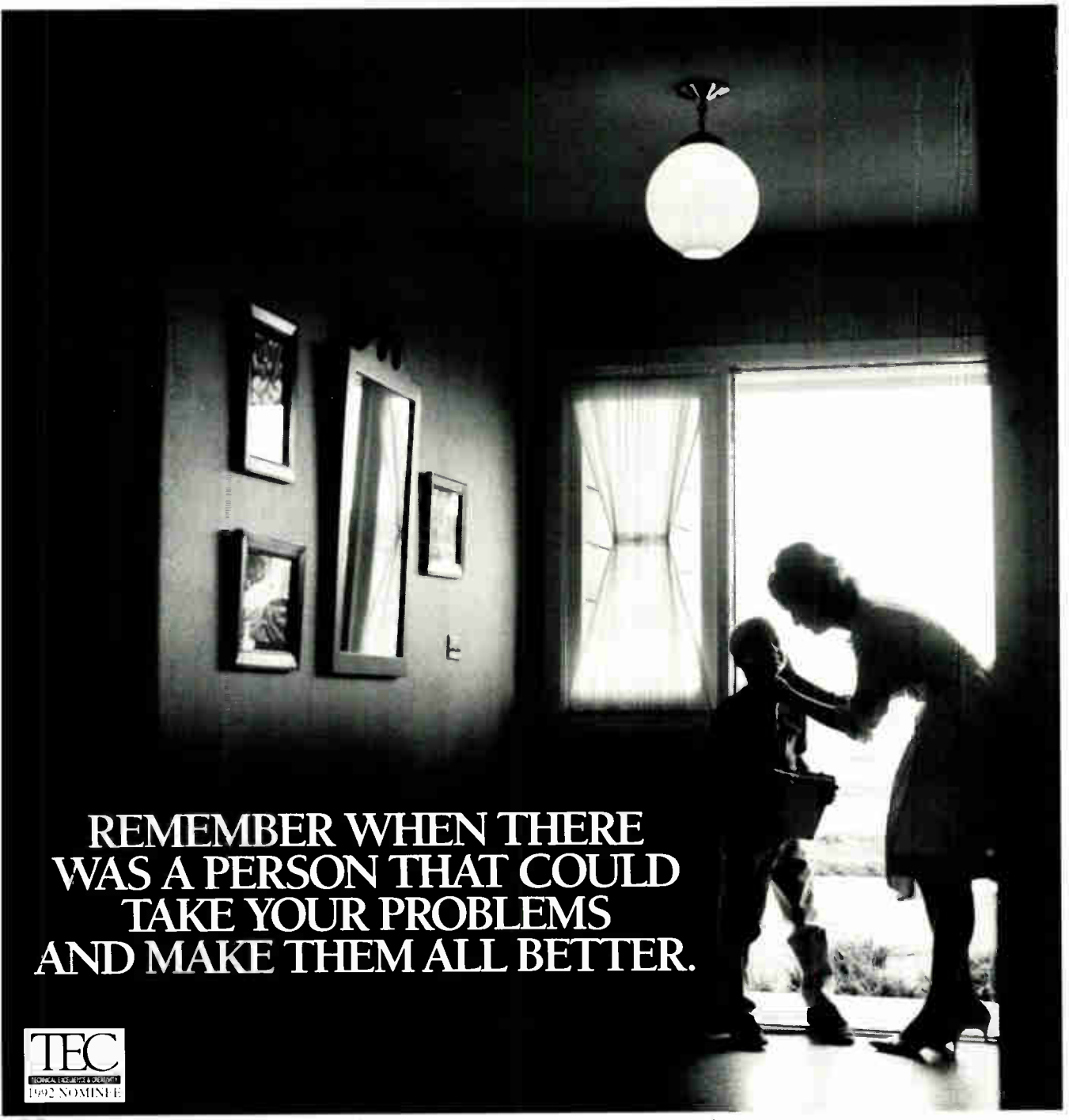

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picture to disk and on implementing the editing features required to manipulate the digitized audio or video files. Machine control, however, has taken a back seat and, with a few notable exceptions, has been limited to the control of a single transport.

Control of a single VTR may be all that is necessary for the auto-assembly, pre-production and editing processes. Unfortunately, this control limitation requires the workstation to operate either as a time code slave to a source transport or leaves the operator blind when audio source material is not being transferred from a videotape.

The workstation user ideally would like the workstation to be the control center for the system. As processing capability increases and it becomes possible to create "complete" studios in the workstation, the importance of an integrated machine-control system becomes paramount. Therefore, the workstation must be capable of operating in a bidirectional control system as either master or slave. To do this, it is necessary to establish workable communications procedures and a standardized protocol that can be easily transported from subsystem to subsystem.

POSSIBLE SERIAL-CONTROL DESIGNS

A number of serial-control solutions are possible. The most promising scheme is similar to the standard local-area computer network, where a central file server has a number of personal computers attached. In the machine-control system, the file server is a dedicated communications gateway for a number of local subsystems. Each transport or controller has local intelligence synonymous with the network PC. The local systems supply information to and obtain status from the central gateway. If a controller or transport changes status, then that information is available for the other devices on the system.

This system of distributed intelligence reduces the processing overhead on each of the local systems. As each controller operates on a single point-to-point link with the gateway, it only has to take care of itself. This consideration is extremely important, because it is doubtful that some local systems probably would not have sufficient spare processing power to control the complete setup.

At present, user expectations are exceeding manufacturers' development capability. The dream of being able to plug a workstation into a general-purpose studio "umbilical cord" that runs around a facility is unlikely to be realized. The many trade-offs required to produce reliable control and operational software for myriad applications effectively prohibits the successful implementation of a machine control network. Imagine trying to issue a "record" command at the same time that a sound file is being downloaded over the network!

We need a dedicated serial machine control network specifically designed to handle the real-time needs of machine control. The user can then improve and simplify the production process with a standardized protocol and command set that permits total control of the elements within a system. There are no shortcut methods to achieving these goals, and anything but a comprehensive implementation will prove false economy in the long run. ■

Tim Cuthbertson is VP of marketing with TimeLine Vista, a manufacturer of time code synchronizers and system controllers.

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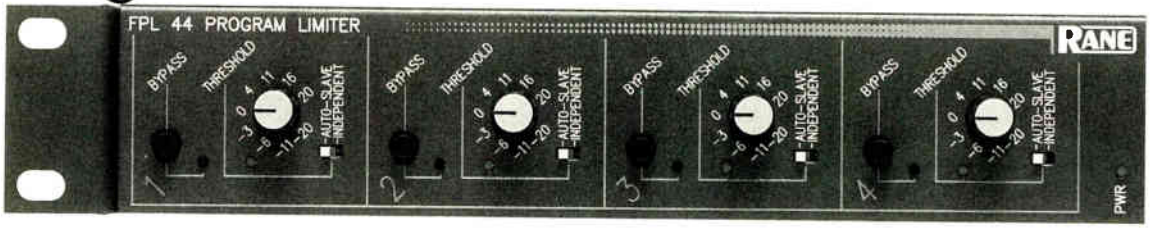

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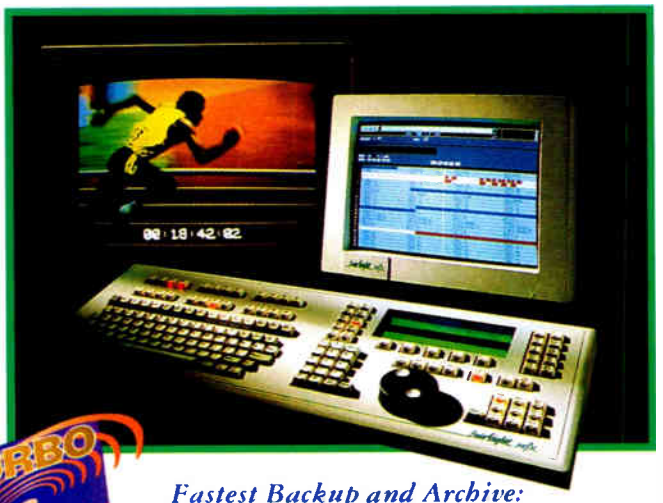

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Universal

Developments in Standardized File Exchange and Media Formats

Various formats are currently being proposed for archiving audio material from workstations and hard disk recorders. Our industry may also be moving toward the implementation of a universal file/media format—maybe even one from a neighboring industry—which will allow routine exchange of data between systems from different manufacturers.

by Mel Lambert

Current and prospective owners of disk-based recorder/editors and workstations face some tough questions in terms of digital audio formats and archive methods. What is the most efficient way to inload digital audio data for editing, mixing and processing during a session? And what methods exist to offload or archive the digitized materials from the storage media? Add to this the problem of transferring a project from one workstation to another, and it's obvious that system designers and users alike have some critical decisions to make.

First, let's examine what techniques exist to purge a disk-based editor or workstation of sound files and companion edit/mix/processing data, so that the system can be reconfigured for a new project. The majority of manufacturers appear to be standardizing on cost-effective Data-DAT and Exabyte drives. Data-DAT is related to the familiar 4mm audio DAT transports, with the addition of a standard I/O port with sufficient data bandwidth (such as a SCSI interface) and extra error-protection information. Exabyte drives use 8mm tape and can run at several times real time, allowing a series of digitized sound files and directory information to be offloaded from hard drives.

Further along the cost/complexity spiral are erasable optical drives, which, depending on the media choice, offer between 128 MB and 1.2 GB (or more) per removable platter. DAT and Exabyte tapes cost between $10 and $60, according to capacity and supplier; optical media, dependent upon the supplier and formatting, can cost as much as several hundred dollars per blank drive.

As Peter Gotcher, president of Digidesign, points out, the choice of archiving or backup media is based upon a facility's operational needs. "Sound Tools and Pro Tools users are normally as concerned with cost effectiveness, compared to the speed with which a project can be offloaded. We are now offering a new DAT-based system, developed by Grey Matter Response, that provides background archiving to DAT during an editing project. The controller continuously monitors the hard drives and progressively updates the DAT so that the user can virtually walk away from the system within a

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ILLUSTRATION: JEREMY THORNTON

couple of minutes of the session being completed.

"After all, during the editing process very little information—in relative terms—is being created by the user," he adds. "It is easy for the system to add the various time code in/out points, edit profiles, mix and DSP data to the DAT archive. The speed of reload to hard disk depends upon the complexity of the particular project and the amount of data to be accessed. We are finding that restoring takes close to real time for a 2-channel system.

"As an even more cost-effective alternative, we offer archiving and restoration from conventional DAT tapes," Gotcher continues. "We record maybe 50 KB of header and EDL information, plus the digitized audio and a sync pulse to provide local timing references. Let's not forget that in the days of analog recording, it was normal for an extra hour of studio time to be booked at the beginning of a session so that the engineer could align the multitrack and mastering decks. These days, workstations require a similar amount of time for routine inload and other housekeeping tasks. Few users find that unacceptable."

To provide offline archiving and system restoration, Otari Corporation is now offering 425MB removable hard drives for its ProDisk 424 workstations. "The SCSI-compatible drives can be held in a library," explains Bob Snider, director of the firm's Digital Systems Group, "or used in our newly developed Archive Station to offload sound files and system data to Exabyte and optical drives for long-term storage and archiving. The station can be connected to virtually any type of SCSI-based storage media, including 8200 Exabytes, which offer up to 3-times-real-time backup speeds, and 8500s that provide 5.5-times speeds. We will probably be adding 4mm Data-DAT with file data compression, which will provide archive/inload speeds of up to 8-times-real-time backup using the new Wang DAT transports."

At Studer-Editech, VP of engineering David Haynes explains that the Dyaxis workstations are being configured for networking and interfacing with optical drives. "All files from Dyaxis systems, including the new compact Dyaxis Lite and Dyaxis II multichannel systems, are interchangeable. Projects can be started, for example, in a sound effects editorial room on a smaller Dyaxis Lite, and then moved to a larger system for multitrack mixing and processing. And, for multisystem users, we now offer local area networking so that workstations can be connected and exchange data with one another."

Conventional magneto-optical and phase-change optical drives, depending upon file formats and data I/O, offer real-time, 2-channel performance. "To increase the amount of data that we can get on to and then access from a phase-change optical," Haynes continues, "we are making Dolby AC-2 data reduction available as an option on our MO drives." AC-2 provides up to 6:1 data reduction, allowing either extended storage

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capacity or enhanced data throughput from Dyaxis optical drives.

Several workstation manufacturers, including Roland, Akai and Digital Audio Research, offer optical drives as their primary storage media, allowing complex projects to be moved off the platform as simply as removing and reloading a 650MB or 1.2GB platter. According to DAR's director of marketing, Jeff Bloom, "Archiving to the SoundStation II or Sigma's MO drives occurs in background mode, either as a complete project or selectively as a series of Segments or Groups of Segments, which, in DAR parlance, make up a 'Reel,' complete with EQ, level and panning data.

"We also offer real-time DAT backup of 2-channel data," he adds. "Although DAT represents a cost-effective medium for many users, we feel that for long-term archiving and data exchange, MO is a far more reliable medium."

Solid State Logic provides Exabyte backup (currently at 2.5-times real time) for its ScreenSound system, plus optical drives for sound clip libraries that need to be loaded to internal hard drives for editing.

"Now that [SSL] has broadened its digital product range to include the new Scenaria post-production mixing system," explains marketing director Colin Pringle, "users can interconnect individual ScreenSounds and Scenarias via SoundNet. In this way, an unassigned ScreenSound, for example, could be used to inload material to a central bank of hard drives or optical libraries, control functions of which could then be accessed via SoundNet from the appropriate control surface.

"One possible feature that we might add in the near future is elective backup of sound files and project information to removable optical drives," Pringle continues. "The user will be offered a choice of backing up the entire hard drive system, or selectively according to job title."

Exchanging Data with Other Digital Systems

Although manufacturers have agreed on standard techniques for archiving or offloading sound files and EDL data—using Data-DAT, audio DAT, Exabyte and/or optical media—the same cannot be said

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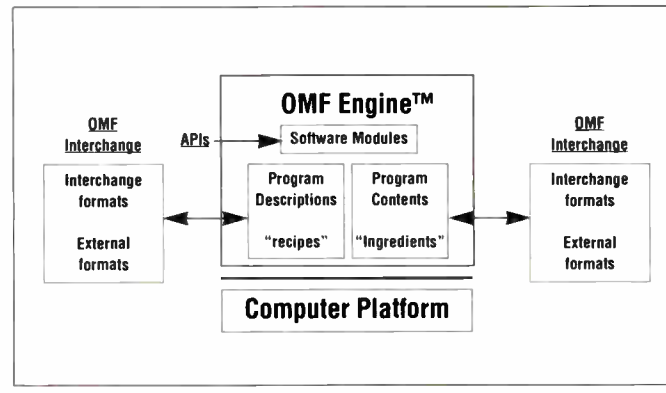
for file interchange formats. The problem is far from trivial. Several megabytes of data, often stored to hard disk using a proprietary disk format, need to be placed onto a removable media that can be read by another platform. In addition, the various data that constitute the sound file placements, track layouts, edit information, crossfade profiles, EQ and signal-processing information need to be placed on the archiving media and then accessed by the "foreign" system. Overcoming such incompatibilities represents real logistical problems for workstation developers.

Two possibilities immediately present themselves. In the first scenario, all manufacturers adopt the same file structure and data formats, so that removable media from one platform is readable by another. In the Apple and IBM-compatible worlds, it is relatively easy for either platform to read each other's 3.5-inch floppy disks. For example, files from compatible word processing programs can be read by both systems.

For the second scenario, workstation manufacturers develop a File Interchange Format, which would require a one-time processing of native sound files and companion data, prior to their being offloaded via an appropriate removable medium. Within the second system, an inverse function would convert between the File Interchange Format and that appropriate to the its proprietary data storage and software requirements.

To a certain extent, existing systems already offer some degree of file compatibility. Studer-Editech, Sonic Solutions, Otari (for the 2-channel DDR-10) and Digidesign use variants of AIFF (Audio Information File Format). "That provides a starting point for Apple-based platforms," offers Otari Corporation's VP of sales and marketing, John Carey. "But we still need to handle 4-channel sound files, for example. And what is the best way to tag edited data plus the necessary EDL information?"

"What we are searching for," offers DAR's Jeff Bloom, "is a translation algorithm that we can all agree upon. I envision the situation something like a wheel; all of us manufacturers are gathered around the rim, and what we need is to



Conceptual elements of Open Media Framework (OMF), a new file and information exchange system developed by Avid Technology.

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develop a common interchange format that represents the hub of the wheel. Then each of us can develop the corresponding "spokes" that allow our proprietary files and edit information to be converted into this exchange format. In the short term, it might very well take the concerted efforts of at least two leading companies active in the workstation industry to develop a means of exchanging files between popular systems."

Taking Bloom's point that file-exchange standards might evolve through practical experience—and users' needs—a recent announcement by Avid Technology might prove to be the catalyst our industry needs to at least move forward. Unveiled at the recent NAB Convention in Las Vegas, Avid's Open Media Framework is described as a multivendor, open-platform program designed to allow various media, including sound files, to be imported and exported between audio and video systems. Already several workstation manufacturers, including New England Digital and Digidesign, have announced plans to implement OMF within their respective systems. (Avid's Media Composer non-linear video editing system for the Macintosh ships with a version of Digidesign's Audio-Media and/or Sound Designer audio editing software.)

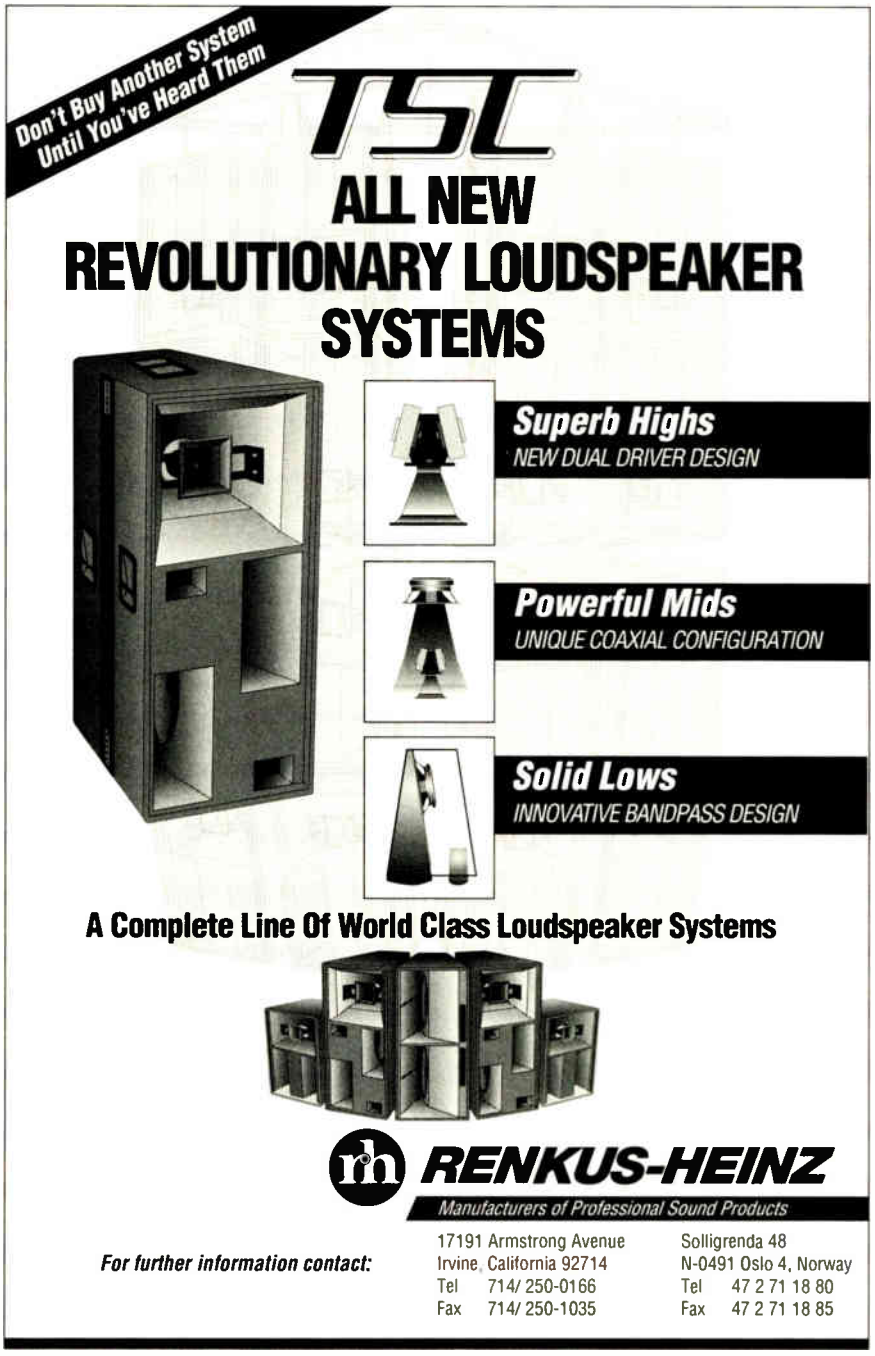
Although OMF was developed by Avid primarily to allow its Media Composer to exchange EDL-based information with other editing systems—and hence open its connectivity potential within video and audio facilities—even the briefest examination of the Framework's structure shows some intriguing potential. For audio workstation users and manufacturers alike, OMF may be just what the doctor ordered.

The goal of OMF, according to Avid president Curt Rawley, is to enable media integration, "[thereby] allowing many different applications to communicate with one another, share and combine media, and provide an integrated application environment to the end user." The Framework allows both the content and descriptions of edited program material to be shared, exchanged and augmented, as necessary. At the heart of the proposal are a series of APIs (application programming interfaces) that translate file structures from a proprietary format to one that can be read by other OMF-compatible systems.

In OMF vernacular, digital media files become "Ingredients" for a designated project, while the program descriptions—how the native sound files, etc., are arranged and being mixed, edited and otherwise processed—are referred to as "Recipes." Ingredients can comprise various media, ranging from animation frames to digitized audio. OMF Media can also be interchanged through specified OMF-compliant formats, in addition to optional software modules that exchange media with other digital audio storage formats.

OMF "Recipes" also support EDL-style information, allowing time code-based data relating to edit points, crossfade profiles, multitrack source/destination assignments and signal processing data to be standardized via the appropriate file structures.

"Our goal in supporting OMF," confides NED's VP of marketing, "is to provide users with device-inde-



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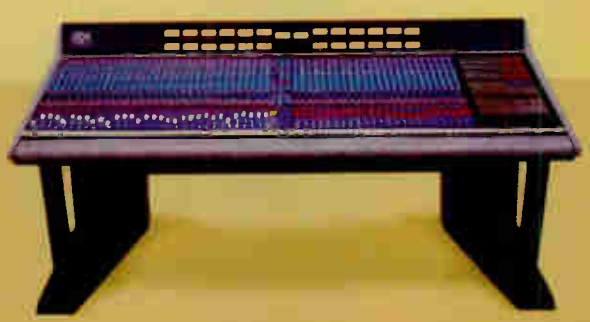

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pendent and platform-independent functionality. Many PostPro users have been asking us for ways of exchanging sound files with other platforms. To provide that capability, we are working closely with Avid Technology to develop standardized file and data formats that can be exchanged via a suitable removable media with other systems.

"In addition to file exchange, OMF will open up creative possibilities for fully integrated audio-for-video," he continues. "Using OMF's various functions, we can connect directly over a suitable local-area network and pass multitrack EDL to and from an Avid Media Composer system—without the need to convert to a 'neutral' format such as floppy disk." The expanded OMF interchange format captures up to 24 tracks of audio (rather that 2/4 provided on standard EDLs), plus panning and level information.

Avid Technology is actively canvassing opinion and reactions from the pro audio industry. The company plans to publish by midsummer a draft version of the OMF Interchange standards for exchanging digital data without requiring multiple intermediate translations and conversions. During the fall, Avid will also be introducing OMF Engine, a common software platform for media integration via open, published interfaces that translate between proprietary file and data formats.

Whether all of the current workstation manufacturers rush to embrace the proposed OMF proposals remains to be seen. From initial discussions with various firms—some of whom were more familiar with the relevant technologies than others—I would expect it to be in all of their best interests to closely examine the current draft documents and involve themselves in the upcoming discussions. For integrating digital audio and for multimedia production, OMF offers a great deal of creative potential. And if it offers sufficient data and information bandwidth for exchanging sound files from one platform to another, OMF will further fuel the expansion and wide scale acceptance of digital audio recording, editing, mixing and processing in a variety of applications.

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TYING IT ALL TOGETHER

SYNCHRONIZATION ISSUES FOR ALL-DIGITAL STUDIOS

BY

DAVID HAYNES

Today's audio engineer must provide clearer and more creative sounds, in a shorter amount of time than ever before. New digital audio equipment and video equipment have helped to meet these needs but include synchronization requirements of significant complexity.

What do we mean by "synchronization requirements?" In this case, two or more pieces of equipment *must* share a common timing signal. The signal could have components that refer to time (absolute or relative), frequency (like the sample frequency) or phase. Most analog equipment has no inherent sense of phase, frequency or time. Problems can exist (comb filter effects, phase cancellation, mis-synchronization, etc.), but the equipment is quite happy to continue working and output less-than-perfect signals. Digital and video equipment work differently, however. Each works with discrete samples of the original signal.

In digital equipment, an incoming analog audio is "sampled" at specific time intervals by a clock that sets the entire system timing. With digital audio, this frequency is usually 44.1 or 48 kHz. Video is somewhat different. Any video or film camera effectively samples the incoming picture several times per second. These frame rates are 24 fps

Digital Signal	Frequency Stability	Jitter Performance
AES 3/IEC 958 Type I	10-5	Very good
S/PDIF/CP-340/IEC 958 Type II	10-3 to 10-5	Varies
AES-11 DARS	10-5 or 10-6	Excellent
NTSC video	3 * 10-6	Excellent
PAL video	2 * 10-7	Excellent
Film sync	10-3	Poor
SMPTE time code	NA	Varies; usually poor
MIDI Time Code	NA	Varies; usually poor
Analog tape recorder	Varies	Varies; usually poor

Figure 1

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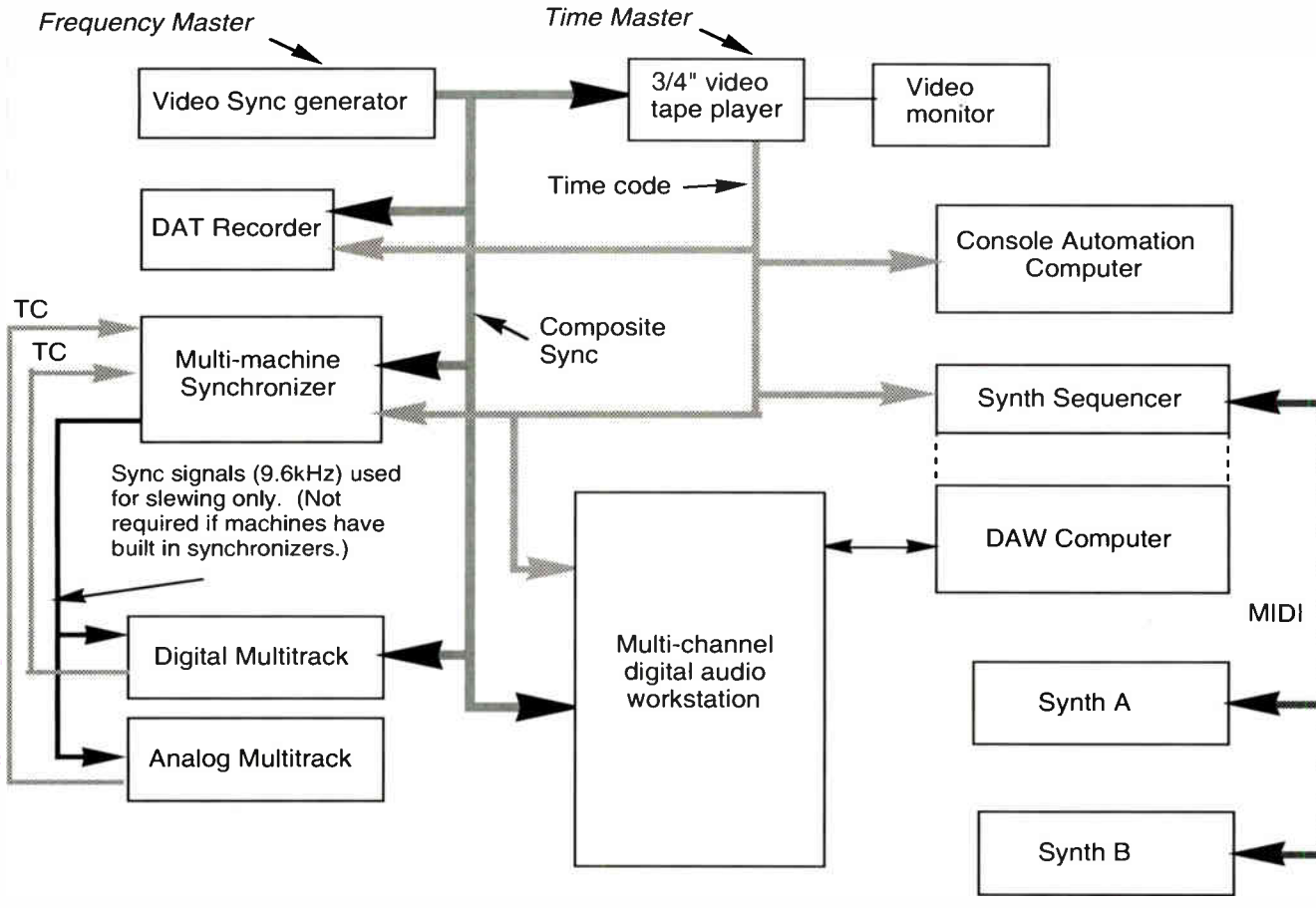
for film (25 fps in Europe), and 29.97 or 30 fps for video. How or why any of the above numbers were chosen is a matter of standards and history. The fact that they are inconvenient numbers—and cause trouble—is something that we can't change; learning how to live with them and synchronize them correctly can be very valuable.

THE PROBLEMS: GETTING IN SYNC

Digital audio offers the possibility of exact frequency, phase and time lock between equipment in any environment. With proper execution by both the manufacturers and users, audio sources can be connected and synchronized with *absolute* accuracy in any creative way desired. Newer workstation systems are designed to provide such flexibility, and that is what leads to a simple modular architecture. It's an exciting concept.

Two problems must be solved before trouble-free synchronization can exist. First, systems must be phase-*and*frequency-synchronous. This condition allows equipment to coexist nicely, because the receivers know right when a sample is coming, transmitters know when to send a sample, and at the D-to-A converters all signals being played back will be in perfect sync. When all devices are frequency-synchronous and run from a common clock, connecting the equipment and mixing different signals is remarkably easy.

The second problem involves getting sources to be time-synchronous, preferably to subsample accuracy. SMPTE time code is the most widely used source for time-stamping events and synchronizing streams of audio. Although straightforward on the sur-



A typical synchronization setup in a large studio. Note that video sync is used as frequency lock in all cases except synthesizers and the analog machine. The latter transport relies on special clocks from a machine synchronizer; the synths do not resolve at all. Machine control signals are not shown in this diagram.

= Composite Sync

= Time code

= 9.6 kHz Sync Signals

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face, in many cases the use of conventional time code is difficult.

If you remember only one concept from this article (and I hope that it will be more than that!), it should be that frequency sync *does not guarantee* time sync, and that time sync at any given point *does not guarantee* frequency sync. They are two different problems with solutions that need to be attained in their own special ways: (1) A system that provides time sync only at any given point can be thought of as a "triggered system." (2) A system that provides frequency sync only can be thought of as one that can be synchronized. However, a system that can do *both* accurately at the same time can be thought of as capable of resolving.

FREQUENCY SYNCHRONIZATION

In order to assure sample accuracy, all digital audio devices should share a common clock. The two problems that arise are: Who should be the master? And, what type of signal should be used to synchronize all elements? A definition of a master device is that it derives its clock signal from an internal source; a slave is, by definition, locked to an external source such as video or a digital input.

A list of common signals and their accuracy and jitter performance is shown in Fig. 1. Any of these sources are acceptable. A video reference or AES-11 Digital Audio Reference Signal (DARS) are preferred, both because they have much tighter jitter/accuracy specifications, and because they are *constant* signals.

Let's take a minute to look closely at a few of these signals. Currently, the most common case of frequency lock between two machines happens through the digital bitstream. This mode of operation can pose problems because such signals can change frequency, or even go away in some mode chosen on the master machine. Choose a source that you can count on through the entire session. Changing frequency sources can cause serious drift and sync problems.

Usually the source machine is automatically designated the master, and the record machine the slave. Frequency lock is attained when the digital input to the slave is selected as the clock reference source (quite often at the same time as digital input is selected as the audio source). The digital audio bitstream outputs by recorders and processors vary considerably in their integrity. They may have high amounts of jitter or be way out-of-spec for frequency accuracy. The AES3-1985/1992 Recommended Practices specify a very tight frequency-accuracy requirement. But, since the AES cannot police equipment manufacturers, many output ports labeled "AES" or "AES/EBU" do not meet the AES3 frequency-accuracy specification.

Consumer standards such as S/PDIF, CP-340 or IEC 958 Type II also contain frequency-accuracy specifications, but many times even these more relaxed specs are not met. The result can be pops, ticks and quite often a total loss of lock. Many times these clock problems are the root cause of sonic problems associated with digital I/Os. Loss of lock is usually caused by the master source not meeting specs, rather than the slave not being able to lock to its bitstream. The only way to solve integrity problems with digital I/O is to choose a master that possesses good frequency accuracy and stability.

Another way of working is to use a high-accuracy video sync generator as a sync source, and then lock everything to the generator. More sophisticated gear will allow a choice of master or slave operation, as well as a choice of external clock sources in slave mode.

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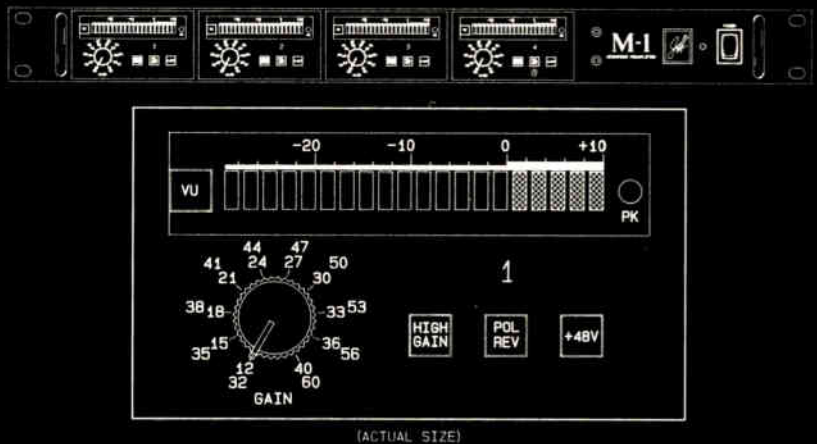

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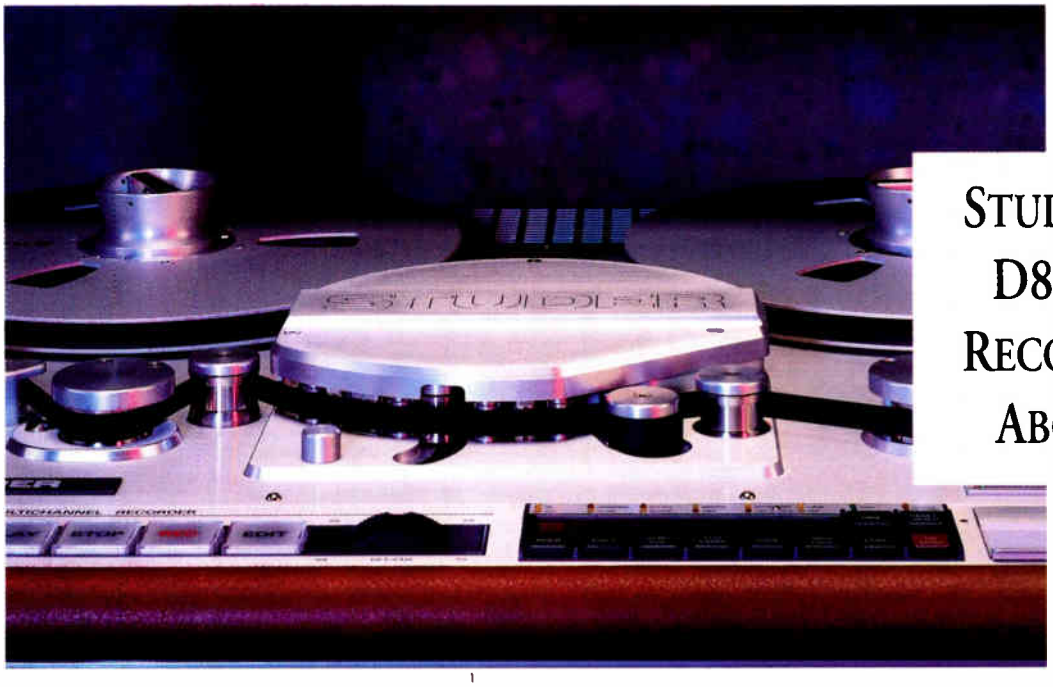

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If two pieces of gear are locked to video and then digital audio is connected between them, the greatest source of sonic degradation, poor clock lock and jitter, is eliminated. In fact, if all the gear in a studio were locked to a video sync source (including the video machine, if used) most clock problems would vanish.

The best advice I can give here is to look for equipment with external sync capability, and check to see that it stays synchronized *in all modes*. Some equipment synchronizes during recording, but free-runs in playback. Other equipment may lock to video for an analog input, but a digital input overrides video sync in all cases. As a user, *you* should be in control and be able to choose the method that works best for your application.

One alternative that has created interest lately is to use a clock source from an AES11-compatible generator. Currently, few pieces of equipment support this type of setup, but it may become more common in the future. Basically, the AES11 generator replaces the video sync generator in the above scenario and provides a highly regulated DARS. Sometimes a DARS is referred to as "AES Black" because on a 'scope it looks like a conventional AES3 digital audio signal but without any audio information present.

Either AES11 or video sync signals are perfectly acceptable from a frequency-lock point of view. The selection of the proper signal to use has more to do with phase and time synchronization, which are covered later.

Another common source of frequency lock is the time code bitstream. MIDI synthesizers do not resolve to external clock; instead they depend on sequencers triggered to time code as their only source of lock. Because most MIDI events are short, this is a reasonable technique. But, if long-event devices are not locked to time code—or the time code used to trigger MIDI events is not locked to the same source of lock that everything else is using—true sync is simply impossible.

Some workstations allow the sample clock to be derived from time code, thus providing true resolving. Because of variations in time code quality, the better solution is to lock all time code devices to video or AES11 sync. Quality synchronizers allow all of the controlled machines (master or slave) to lock to an accurate source. In this way all devices resolve, and jitter is kept to a minimum.

PHASE SYNCHRONICITY

Once a common frequency lock has been attained, most of the battle is won. There are still places where problems can arise, however. The term "phase locked" is used many times, usually referring to Phase Locked Loops (PLLs) used in most clock circuitry. This really means frequency lock. Phase lock is an entirely different issue. Phase lock means that sample edges, channel status block edges and video sync edges all happen at the same time. All of this seems simple until you realize that there is a non-integer relationship between virtually all these signals.

For example, at a sampling rate of 44.1 kHz, there are 1,471.47 samples per NTSC video frame. At 48 kHz, there are 1,601.60 samples per NTSC video frame. This means that sample edges only align every ten frames at a sampling rate of 44.1 kHz, or only once every 100 frames at 48 kHz. When a system claims to be sample accurate, this anomaly can pose real problems. (Note: PAL-based European video systems do not have this problem. Both 44.1 and 48 kHz possess an integer number of samples per PAL video frame.)

Even when well-behaved systems

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are asked to chase from the middle of a file, and sample accuracy dictates which particular sound sample lines up with the first video edge, there can be an absolute jitter of 0.5 samples, depending on how the samples lined up to the frame boundaries from the beginning of the recording. It can lead to a 90-degree phase shift between machines at 20 kHz, and this is the best case assuming real sample-accurate time code trigger. You can start to imagine subtle audio degradation even with some "sample-accurate" systems.

A more serious problem is the Channel Status sub-block boundary employed in AES3- and IEC 958 Type II-compatible I/Os. Each CS block runs for 192 samples and might carry a variety of useful information, such as emphasis, stereo/2-channel flags, source/destination labels, time-of-day count, and so on. If two different, but sample-synchronous, signals are being mixed, assigning certain information to the mixed output is difficult if the blocks were not channel-status phase synchronous when they were input.

How does the number 192 fit into the above problem of sample and video alignment? Unfortunately, not too well. At a sampling rate of 44.1 kHz, we can only align sample clock, channel status and video sync about once every 20 minutes! Clearly, it is not possible to synchronize all these signals exactly.

Usable synchronization can be attained with current equipment, but there are still some things that manufacturers must agree on before true subsample lock can be attained. Because there is not an integral number of audio samples per NTSC video frame at either 44.1 kHz or 48 kHz, some point *must* be chosen where the video sync used for time code phase accuracy and the sample clock used for the audio phase accuracy are tied together absolutely. As an example, if the audio community adopted a standard, which stated that all Channel Status blocks, sample clocks and video vertical sync must be phase aligned at 00:00:00:00 (midnight), studios could be assured of true, absolute subsample lock under all conditions.

TIME SYNCHRONIZATION

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equipment must coexist, and that means each must have a sense of time. This synchronism usually comes from SMPTE time code. In tape-based systems, because of the linear model used for recording and playback, time code values are physically locked to the audio.

If two events on different machines need to be synchronized, an external synchronizer will try to time-lock the two machines. The synchronizer will examine the time code and control the machines such that the time codes are played back as required. By inference, the sound should then happen at the correct time; with a quality synchronizer the error is really quite small.

A digital audio workstation has the added advantage of allowing any recorded event to be played at any time code location. The relationship between time code and audio is soft. If care is taken in frequency- and phase-lock, sample-accurate time lock for every single event is not out of the question. A workstation that can provide sample-accurate time lock of any event is a very valuable tool in any facility.

As with a frequency master, the most reliable situation is created by following the simple concept that there is a time code master, and all other devices watching the time code source are slaves. A time code master does not need to be the frequency master; again, these are two separate concepts. But the idea that a time code master must be assigned at the beginning of a session—and must remain the master throughout the session—is important. Changing time code masters can cause the same problems as changing frequency masters.

Let's say, for example, that you have laid down some basic tracks on a hard disk, and then created dozens of short events like MIDI notes using the basic tracks as a sync reference. Now if the sync source changes, the long events that were fired off it will be a slightly different length compared with the new sync source, and all the short events will be out of sync with the basic tracks. Think through the session. *Don't* use a computer's internal clock if anything outside the computer will need to be synchronized.

Many sources of time code have poor jitter characteristics. Hopefully, the time code is not being used as a source of frequency-lock or absolute-time information. It is best if all the equipment is frequency- and phase-locked to video or AES11, and the time code is only used as a reference to video sync. The time-lock information is then just used to define a number for each video edge, and sample accuracy can be attained. This is really an exciting way of working. Workstations can then allow any sample of any event to be exactly time aligned to a specific video edge. In this case, two machines could be exactly time aligned. Tracks or channels can be added from different equipment without flanging or comb problems.

This ability separates professional equipment from wanna-be professional equipment. There are many ways to test the accuracy of time code lock. Most studio engineers can devise tests for this and evaluate equipment.

SUMMARY

There are just a few straightforward guidelines to follow for repeatable and accurate locking of sources:

- Remember that frequency and time lock are *different*. They can be accomplished by two different masters. Choose the frequency and time masters carefully, and use them consistently throughout the session.
- The frequency master should be chosen so that the source is accurate, jitter-free and constantly present. Ensure that all equipment is locked to the frequency master in all modes. Choosing a digital audio signal as the master is a bad idea, because it can easily be interrupted or may go away completely if someone removes the source machine. Choose either an AES11 signal or video sync as the master source of synchronization.
- Buy equipment that accepts an external video or AES11 sync signal and locks to it in all modes.
- Think carefully about the master source of time synchronization for any given session. The best equipment can be configured as master or slave for both frequency and time code. While locking to AES11 or video sync are the best solutions, digital audio bitstream lock or time code lock can fix problems where no other solutions will work. If MIDI or SMPTE time code is used, try to make sure it is locked to video sync and that slave devices use the video edges for absolute time synchronization. ■

David Haynes is VP of engineering at Studer/Editech.

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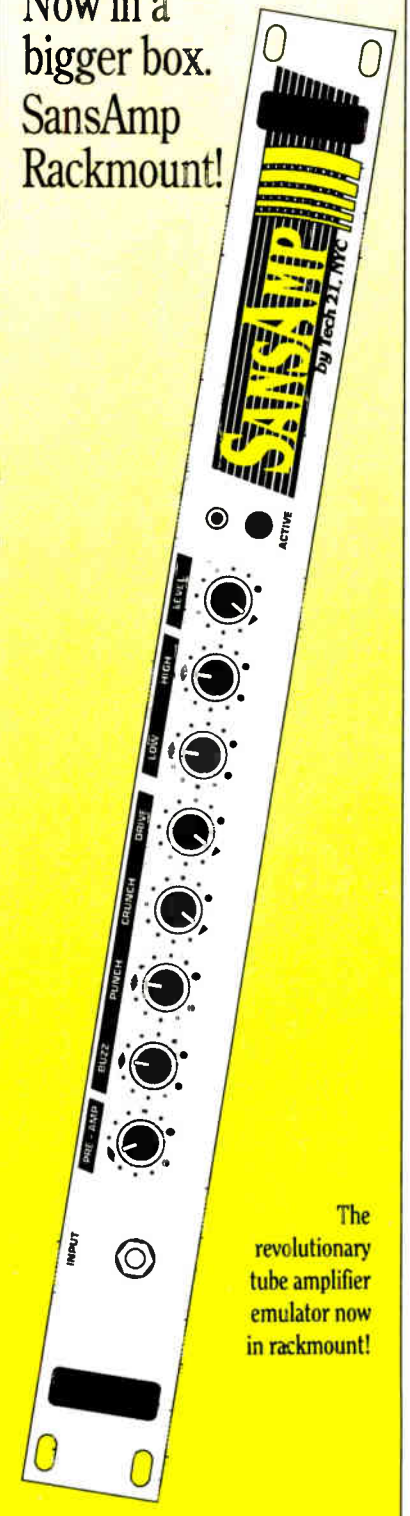

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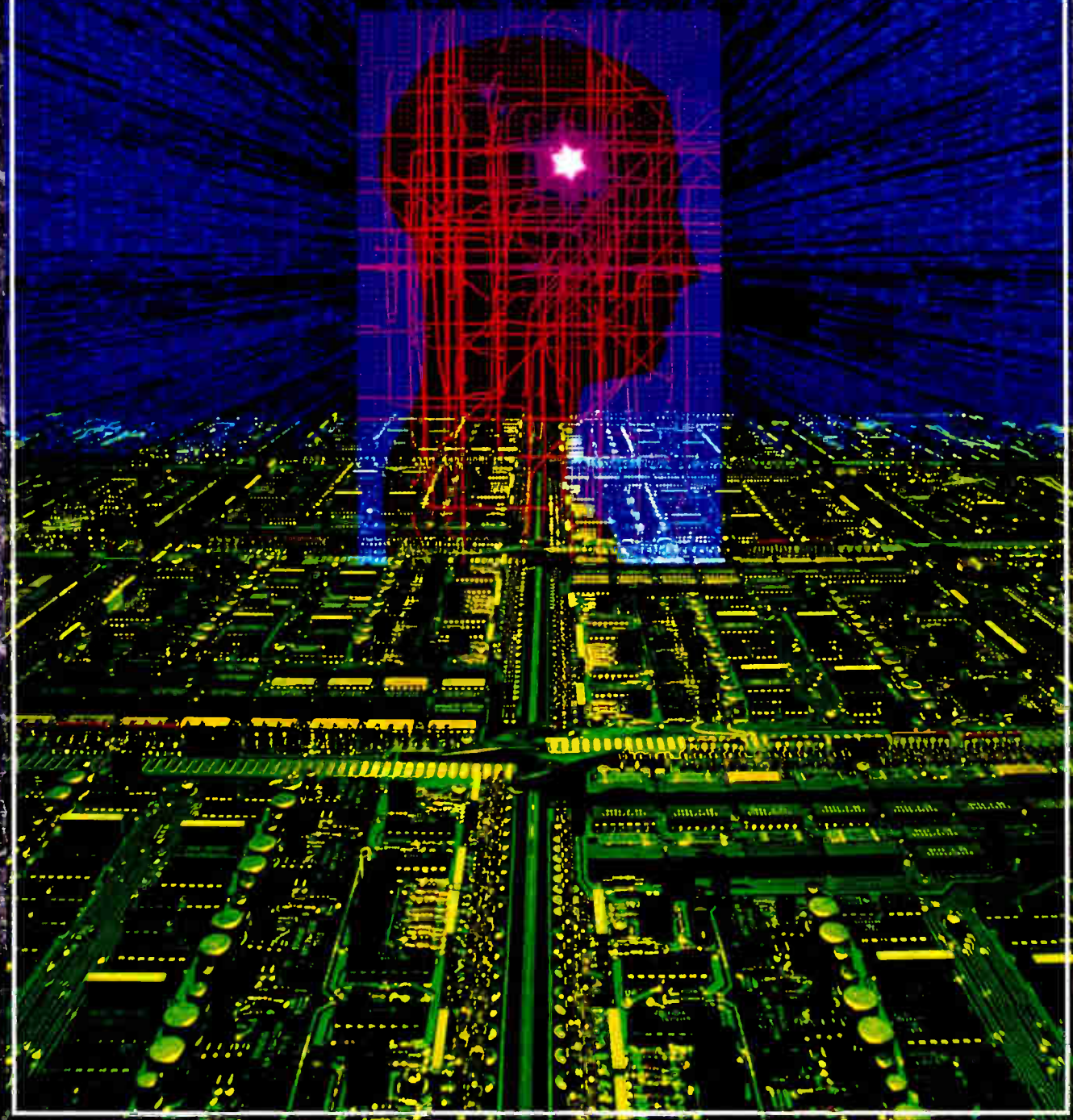
TOOLS
FOR THE DIGITAL STUDIO



World Radio History

Nagra-D 4-channel self-contained Professional Digital Audio Recorder

MFX 16-track disk-based recorder/editor

THE following directory lists hardware tools suitable for the all-digital audio production facility. Included are digital consoles, tape- and disk-based recorders, editing/workstation systems, and signal processors equipped with ports for transferring information entirely within the digital domain.

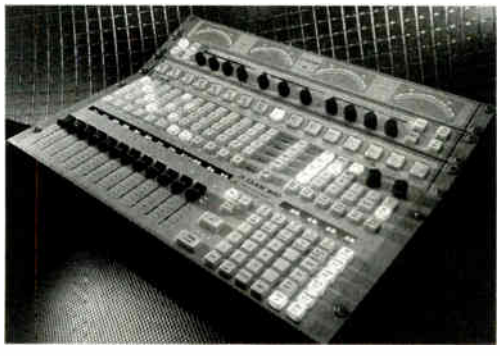
Therefore, products such as Lexicon's Model 300 effects processor—which is equipped with digital I/O—are included, while the same company's PCM70 effects processor (with analog I/O only) is not listed. We hope you find this index useful.

JVC DS-DT900N DAT Machine

Alesis adat 8-Track Professional Digital Aduio Recorder

New England Digital's PostPro™ Digital Multitrack Recording/Editing System

Graham-Patten D/ESAM 800 Digital Mixers



Otari DDR-10 Digital Disk Recorder/Editor

PHOTOS AT LEFT: PETE TURNER/IMAGE BANK (BOX INSET); BORDER MARBLE: JOHN BANAGAN

World Radio History

TOOLS FOR THE DIGITAL STUDIO

A DIRECTORY OF HARDWARE TOOLS SUITABLE FOR THE ALL-DIGITAL AUDIO PRODUCTION FACILITY.

Abaris Inc.
7573 Pinesprings E. Drive
Indianapolis, IN 46256
(317) 576-8042
* Stereo mic preamp with AES/EBU digital output

Adams-Smith
34 Tower Street
Hudson, MA 01749
(508) 562-3801
* F.E.G. Audio Solution 2/4-track magneto-optical recorder/player

Adaptive Digital Systems
2146 Michelson Drive, Suite A
Irvine, CA 92715
(714) 955-3116
* TDAP 408 4-channel adaptive equalizer/noise remover
* JBTRD 2-channel solid-state recorder

Akai Professional
1316 East Lancaster Avenue
Ft. Worth, TX 76102
(817) 336-5114
* A-DAM 12/24/36-channel digital recorder
* DD1000 4-channel optical disk recorder/editor ▼

AKG Acoustics
1525 Alvarado Street
San Leandro, CA 94577
(510) 351-3500
* DSE7000 8-channel digital sound editor/workstation

Aiwa America
800 Corporate Drive
Mahwah, NJ 07430
(201) 440-5220
* HD-X3000 professional portable DAT recorder ▼

—CONTINUED ON PAGE 121

Dreamhire

PROFESSIONAL AUDIO AND MIDI EQUIPMENT RENTAL

NEW YORK CITY, NY, USA
Phone: 800-234-7538 or 212-691-5544 in NYC
Fax: 212-627-4783
Chris Dunn:Donna Winfield:Brian Macaluso

NASHVILLE, TENNESSEE, USA
Phone: 615-321-5544
Fax: 615-321-0578
Patty Bossert:Paul Simmons

LONDON, ENGLAND
Phone: 081-451-5544 (from USA dial:011-44-81-451-5544)
Fax: 081-451-6484 (from USA dial:011-44-81-451-6484)
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- AKAI DD1000 magneto optical disk recorder/editor
- SONY PCM7030 professional DAT recorder with time code
- PYGMY ADI & APOGEE AD500 stereo analog to digital converters
- KORG T1 88-key weighted workstation keyboard
- YAMAHA SY99 AWM/AFM digital synth
- MEYER HDI powered nearfield monitor speakers
- DRBAN 290Rx adaptive enhancement processor
- NEVE 33609C latest revision stereo compressor
- LT SOUND VE2+ Thompson vocal eliminator
- DIGITECH VHM5 "The Vocalist" harmony processor
- DEMETER VTMP2 microphone preamp
- TC ELECTRONICS 1140HS 4-band parametric equaliser
- SOUNDCRAFT 200 DELTA 24-4-2 mixer with sweep eq
- EVENTIDE SP2016 reverb/effects (we have the last one made with all updates!)
- AMPEX ATR102 1/2" 2-track recorder
- SONY DRE2000 digital reverb (we combed the world and finally found one!)
- BOSS SE50 stereo effects processor
- OPCODE STUDIO 5 MIDI/SMPTE interface for MAC computers
- AKAI-LINN MPC60II latest revision drum machine/sequencer
- AKAI S1100 rack sampler with 8 meg memory and IB104 digital I/O

(Don't forget that we carry the largest selection of digital multitracks in USA)

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Aphex® Modular System ... One Size Fits All

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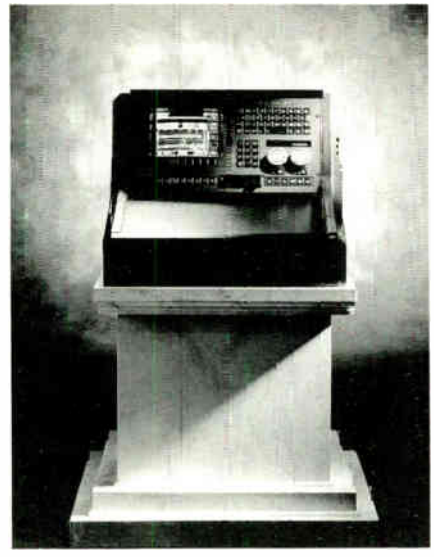
—FROM PAGE 118

Alesis
3630 Holdredge Avenue
Los Angeles, CA 90016
(310) 467-8000
* ADAT 8- to 128-track digital tape recording system

AMS Industries (Siemens Audio)
7 Parklawn Drive
Bethel, CT 06801
(203) 744-6230
* Logic 1 digital console for AudioFile
* Logic 2 large-format digital console
* AudioFile Plus disk-based 2- to 16-track digital recording/editing workstation
* AudioFile Plus Spectra (improved controller for AudioFile Plus with color graphics)
* AudioFile Optica 4-track optical recorder/editor

Apogee Electronics
2103 Main Street
Santa Monica, CA 90405
(310) 399-2991
* AD-500 analog-to-digital converter
* DA-1000 digital-to-analog converter
* Retrofittable anti-aliasing filters for digital recorders



Ariel Corp.
433 River Road
Highland Park, NJ 08904
(908) 249-2900
* DSP development tools and subsystems
* Digital Microphone with onboard A/D converter

Audio Animation
6632 Central Avenue Pike
Knoxville, TN 37912
(615) 689-2500
* Muse digital mastering console

Audio + Design: see Gotham Audio

Augan Instruments, B.V.
Distributed by A/Z Associates
Box 357
Needham, MA 02192
(617) 444-0191
* Augan 408 OMX optical multitrack recorder/editor

Audio Precision
Box 2209
Beaverton, OR 97075
(503) 627-0832
* System One+ DSP: PC-based, digital domain test system

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Our sincere thanks and congratulations to the publishers and staff of MIX Magazine for 15 years of dedication and service to the pro audio industry.

ALESIS

World Radio History

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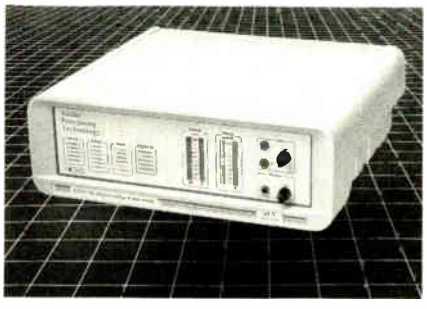
—FROM PAGE 121

Augan 408 OMX optical multitrack recorder/editor

Audio Processing Technology (APT)
6255 Sunset Boulevard
Los Angeles, CA 90028
(213) 463-2963
* DSM100 digital audio coding transceiver
* ACE100 PC-based digital audio data compression/decompression card ▼



BEC Technologies
Box 618066
Orlando, FL 32681
(407) 422-7310
* Fiber optic systems

Broadcast Television Systems (BTS)
94 West Cochran Street
Simi Valley, CA 93065
(805) 584-4700
* BAC-3000 stereo analog-to-digital and digital-to-analog converter

By The Numbers
Box 8359
Incline Village, NV 89450
(702) 831-4459
* Colossus 4-channel digital recording system

Carver Pro Audio
20121 48th Avenue West
Lynwood, WA 98046
(206) 775-1202
* CD recorder

Cedar Audio: See Gotham Audio

Data Conversion Systems (DCS)
Distributed by Sonic Image
1100 Wheaton Oaks Court
Wheaton, IL 60187
(708) 653-4544
* Model 900A analog-to-digital converter

Creation Technologies
400 Brooksbank Avenue
North Vancouver, B.C. V7J 1G9 Canada
(604) 980-6850
* RADAR digital 8/16/24-track recording and mastering system

Digital Audio Research (DAR) ▲
2 Silverglade Business Park
Leatherhead Road
Chessington, Surrey KT9 2QL England
(44) 372 742848
USA Distribution: Sam Ash, (212) 719-2540; Audio Intervisual Design, (213) 469-4773
* SoundStation Sigma 8/16-track digital recorder/editor
* SoundStation II 8/16-track digital recorder/editor
* Digital Audio Synchronization System (DASS) format and sample rate conversion, mixing/level adjust, sample clock generator

Denon America
222 New Road
Parsippany, NJ 07054
(201) 575-7810
* DN-7700R CD recorder

Digidesign ▲
1360 Willow Road, Suite 101
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(415) 688-0600
* Sound Tools II 2/4-channel digital recording/editing system
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—CONTINUED ON PAGE 124

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The Peavey DPM® SP/SX Sampling Combination

"The Peavey DPM SP has enough sound-processing power to generate incredible sounds.... Overall, the SP represents tremendous value for the money....The engineers at Peavey are to be commended for building a highly capable sound module into a cost-effective, upgradable package."

Electronic Musician
May 1992 Issue

"The SP offers ambitious programmers the potential for creating new signature sounds. Particularly considering its low price, expandability and first-rate storage and loading capabilities, the SP gives a musician more than just an introduction to sampling. With the SP, Peavey moves the flexible-architecture philosophy to new frontiers."

EQ Magazine
February 1992 Issue

The DPM® SP/SX sampling system is a phenomenal value. Costing thousands less than comparable units from our competitors, and hundreds less than most low end systems, the SP/SX combination represents the most powerful, yet affordable, full-featured 16-bit sampling system on the market today!

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Up until now, high-quality sampling has been something that was out of reach for most people. Not only because of the expense, but because of the tedious time and effort required to create good samples. The union of the SP/SX finally brings together high-end full-featured sampling with ultra affordable pricing for the working musician.

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—FROM PAGE 122

* AD-IN analog-to-digital interface
* DAT I/O digital interface
* Pro I/O analog-to-digital interface

Digital Audio Labs
6311 Wayzata Boulevard, Suite 200
St. Louis Park, MN 55416
(612) 559-6104
* CardD PC-based recording system

Digital Domain
309 East 90th Street
New York, NY 10028
(212) 369-2932
* FCN-1 bidirectional AES3-to-consumer-digital format converter

Digital Expressions
14150 NE 20th Street
Bellevue, WA 98007
(206) 389-9895
* SoftSplice 2/4-track digital editing system

Digital Integration
3530 Forest Lane, Suite 38
Dallas, TX 75234
(214) 350-2230
* SRC-1000 Universal Sample Rate Converter

Dolby Laboratories
100 Potrero Avenue
San Francisco, CA 94103
(415) 558-0200
* AC-2 digital coding/transmission system

Doremi Labs
4927 Glen Arden Avenue
Covina, CA 91724
(818) 966-2454
* Digital Audio Workstation Nucleus (DAWN) 8- to 48-track disk-based recorder/editor

Drake: See Redwood Marketing

Ediflex Systems
1225 Grand Central Avenue
Glendale, CA 91201
(818) 502-9100
* Optiflex 4- to 32-track magneto-optical recorder/player
* Audiflex 4/8-track magneto-optical recorder/editor

Electronic Digital Innovations
169 Bank Street
South Melbourne, 3205 Australia
(61) 3690-8488
* Edi-Tracker 4- to 24-channel digital recording/editing system

Fairlight ESP
30 Bay Street
Broadway, NSW 2007 Australia
(61) 2212-6111
* MFX 16-track disk-based recorder/editor
* MFX2 24-track disk-based recording/editing system

Fostex ▲
15431 Blackburn Avenue
Norwalk, CA 90650
(310) 921-1112
* PD-2 Portable time code DAT
* D20/D20B Studio time code DAT

Gefen Systems
6261 Variel Avenue, Suite C
Woodland Hills, CA 91367
(818) 884-6294
* NSM CD2101-AC 100-disc CD changer

Gotham Audio
1790 Broadway
New York, NY 10019
(212) 765-3410
* Cedar Audio System (Computer Enhanced Digital Audio Restoration)
* Gotham CD recorder
* Harmonia Mundi Acustica BW102 (sample-rate converter/level control/parametric EQ/dynamics digital control system)
* Audio + Design ProDAT 1B studio DAT
* A+D SmartBox digital interface
* A+D Copy-Rite SCMS remover
* A+D MasterClock master clock generator
* A+D Level ModeFier digital fader
* A+D ProBox 3 SDIF/AES interface
* A+D ProBox 6/7/8 digital distribution boxes

Graham-Patten Systems
Box 1960
Grass Valley, CA 95945
(707) 273-8412
* D/ESAM 400 8- to 32-channel digital mixer
* D/ESAM 800 8- to 56-channel digital mixer

Harmonia Mundi: See Gotham Audio

International Audio Technologies
13897 Williard Road
Chantilly, VA 22021
(703) 378-1515
* StellaDAT portable DAT with time code
* StellaMode digital-to-analog converter
* StellaWord CD recorder
* StellaMaster studio DAT recorder with time code option

—CONTINUED ON PAGE 127

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Discover a digital recording universe.

There is a wonderful place where the powers of digital recording exist in harmony with the powers of digital mixing. You are there.

You have found the DMR8. Yamaha's self-contained, full-featured digital mixer and multi-track recorder. At last, recording, overdubbing and mixdown can take place without ever departing the digital realm.

The DMR8 gives you real-time automation of all mixer parameters. The recorder, the mixer and internal effects can be controlled with perfect repeatability and precision. The mixer provides digital processing with up to 32 bit resolution. And the eight-track recorder stores an astounding 20 bits of digital audio data on tape. The resulting dynamic range is 16 times greater than that of compact disc.

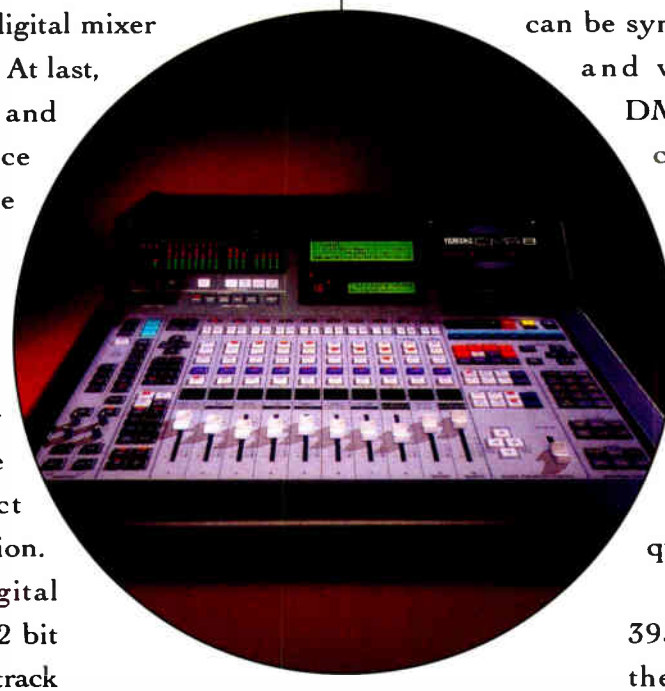

Figure A. 27x27x10 in.

On board synchronization allows the system to be expanded to 24 tracks with the addition of our DRU8, eight-track recorders. Or it can be synced to external recorders and video equipment. The DMR8 allows unlimited track combining with no audible signal degradation. And Moving Fader Automation is one of the features that are, frankly, too numerous to mention here.

The DMR8 is a flawlessly integrated, transportable unit and the sound quality it offers is unequaled.

Call Yamaha at 1-800-395-1313, ext. 100 and ask them for more information about the DMR8. Tell them you have made quite a discovery.

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THE YAMAHA DIGITAL MIXER/20-BIT RECORDER

TEC 1992 NOMINEE

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The other guys missed the bus. Actually, 2 of them.

Why waste your money on a 2-bus mixer when you can get the new 1642 from DOD? It's the only 4-bus mixer for under $1300.

The 1642 boasts 16 line and 8 balanced mic inputs. High-precision, monolithic preamps ensure ultra-low noise and distortion, and extremely-high input bandwidth.

The console may be used as a 16X4 for recording or a 16X2X2 for sound reinforcement. For recording, four discrete outputs (Sub 1, Sub 2, Left and Right) can be assigned, or each input may be routed through the 2 sub groups to the mains. That means the 1642 delivers more sound options than any other mixer in its class.

Each channel in the 1642 has a 3-band EQ with Adaptive Q circuits for a contoured response that adds clarity to the highs and warmth to the lows.

We're so confident you'll love our new 1642, that we'll back it with a 2-year warranty.

If you want a killer mixer for a low fare, don't miss the bus. Check out the 1642 from DOD.

	DOD 1642	YAMAHA MV 1602	TASCAM M-1016	MACKIE CR 1604
Price	$1099	$1299	$1295	$1099
Bus	4	2	2	2
Discreet mix bus out	4	2	2	2
Mic Inputs (Bal)	8	8	8	6
Line Inputs	16	16	4 Stereo	16
Phantom Power	Yes	No	Yes	Yes
Sends	6 Pre or Post, configurable.	2 Pre 2 Post	2 Pre 4 Post	1 Pre/Post 5 Post
Sub groups	2	2	None	None
Console convertible	Yes	No	No	Yes
Solo to mains	Yes	No	No	Yes

DOD

H A Harman International Company

© 1992 DOD Electronics Corp. 5639 South Riley Lane, Salt Lake City, Utah 84107 / (801) 268-8400 Comparison based on information from the 1992 Music & Sound Buyer's Guide.

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—FROM PAGE 124

StellaDAT pro portable DAT recorder with time code option

JVC Professional Audio
41 Slater Drive
Elmwood Park, NJ 07407
(201) 794-3900
* DS-DT900N DAT recorder with time code
* DS-LC900U digital equalizer

Kenwood USA
2201 Dominguez Street
Long Beach, CA 90810
(310) 761-8287
* DA-7000/DD-7200 CD recorder system

Korg USA ▲
89 Frost Street
Westbury, NY 11590
(516) 333-9100
* A1 digital effects processor
* SoundLink 8-channel disk-based recorder/mixer

Lester Audio Labs
1111 West Mockingbird Lane
Dallas, TX 75247
(214) 637-9311
* Fiber optic systems

Lexicon ▲
100 Beaver Street
Waltham, MA 02154
(617) 736-0300
* LFI-10 digital format converter
* Opus 8-channel disk-based recorder/editor/mixer
* Opus/c 8-channel disk-based recorder/editor
* 480L digital effects system
* Model 300 digital effects system

Magna-Tech Electronic
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New York, NY 10036
(212) 586-7240
* InterlockDisk 8-track magneto-optical disk recorder and player

Manley: see Vacuum Tube Logic

Marantz Pro Products
Distributed by Dynascan
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Aurora, IL 60504
(708) 820-4800
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* PMD-700 portable DAT recorder

Micro Technology Unlimited (MTU)
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Nagra: see Phi Technologies

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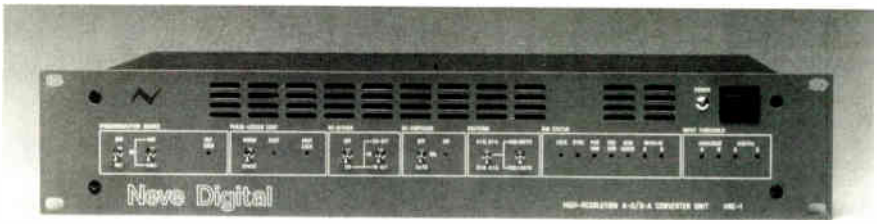

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* PCM-2300 studio DAT recorder
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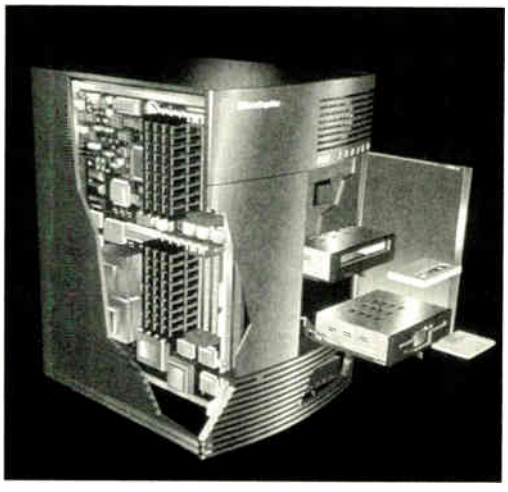

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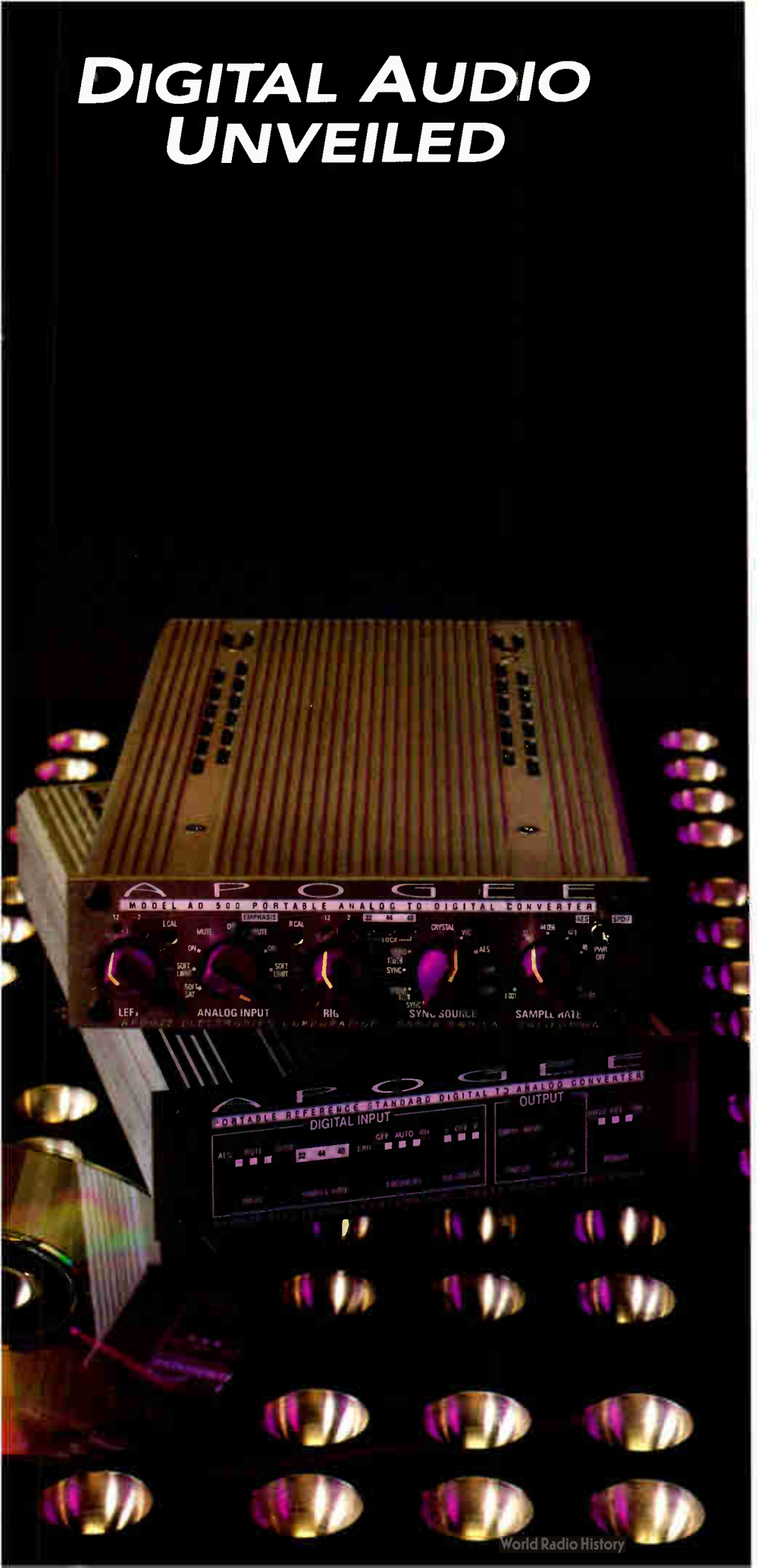
DIGITAL AUDIO UNVEILED



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* DTA-2000 digital tape analyzer
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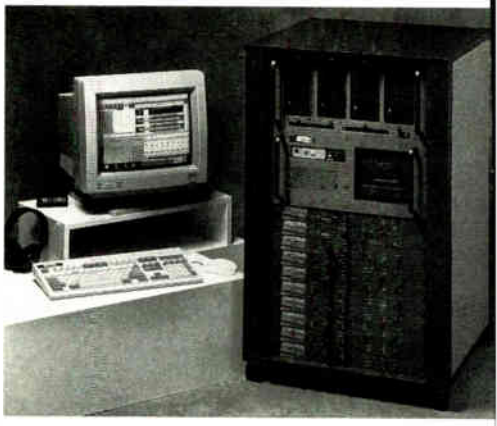

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* Studer D780 studio DAT recorder
* Dyaxis I 2-track disk-based recording/editing system
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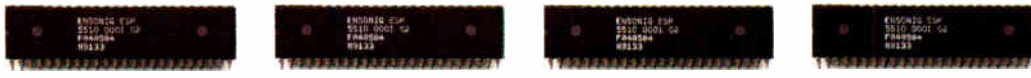

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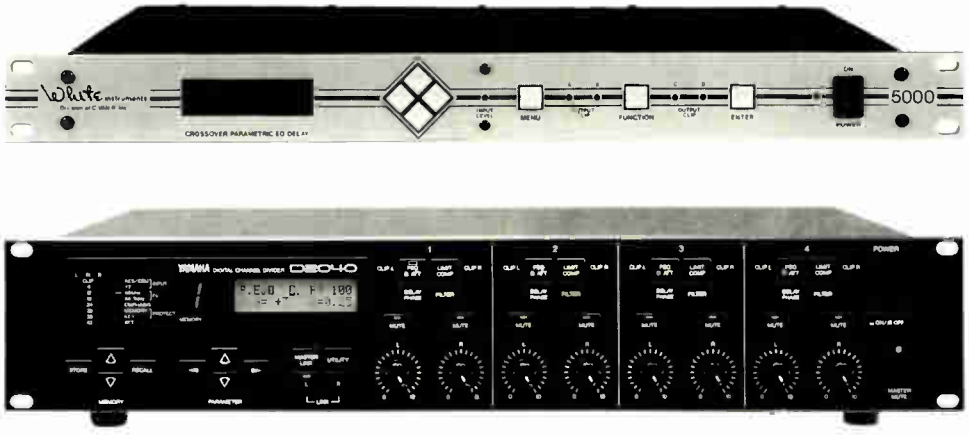
by David (Rudy) Trubitt

DIGITAL LIVE SOUND APPLICATIONS



Both White's DSP 5000 and Yamaha's D2040 provide a myriad of drive rack functions, including crossover, EQ, signal delay and limiting in the digital domain.

While the uses of digital technology are becoming increasingly clear in today's recording and production studios, digital sound applications in sound reinforcement are another matter. Those developing digital gear for live settings are focusing on several areas: DSP as a replacement for current analog gear, semi-automated mixing, acoustical measurement and networked communication of digital audio and control data between equipment. Let's look at some current developments that could set the future direction of sound reinforcement.

Signal Processing Developments

Digital signal processing has been a part of live sound since the first digital reverb escaped the confines of the studio. Since then, digital audio has dominated the effects complement of nearly all live systems. As digital's specs improved, the technology started making inroads into drive electronics, once solely the domain of analog gear.

"Every system is different in terms of how much EQ, crossovers or limiters you need," says Rane's Bob Moses. "[Today] we have analog modular systems. The reason they're in separate boxes is due to the constraints of analog technology, not because that's the only way it should be. In the future, since DSP products are software-based, we can still provide

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the same modularity within a single box. Then, you wouldn't necessarily need an EQ box, a crossover box, a limiter box, etc.

"You could have one box with all these resources in it, and the required modularity becomes a software function that lets you patch together what you need," Moses continues. "There's a lot of economy in that [design approach] because you don't have all the metal, interconnects and power supplies. There's also a lot of other benefits. We can perform many of the functions [like EQ and crossovers] better using DSP."

JBL's Bill Gelow agrees. "Instead of having a collection of analog boxes," he says, "I think you'll have a digital box for the drive system that'll do the time correction, equalization frequency dividing and limiter functions. Our 52000 [digital controller] allows you to fine-tune things that you couldn't otherwise do in the analog domain.

"We see DSP as a requirement for loudspeaker [processing] because it works so well," Gelow adds. "It helps clean things up in arrays. [With very steep crossover slopes made possible through DSP], you're out of the woofer and into the horn so rapidly that they don't really know that the other guy exists. In the vertical plane, if they're mounted on a vertical axis, you don't end up with the usual lobing and tilting. Analog crossovers can't sum [to flat] power response and not have tilt. With digital, you can get both flat power and very predictable polar response."

Mixing Automation

Digital technology is also making inroads into live mix automation. MIDI offered one of the first practical applications in this area, making it a simple matter to instantly call up a complete group of effects settings with a single program-change command. Today, there is a movement toward more sophistication, but not without some skepticism.

"People have traditionally resisted [live automation]," says Charlie Richmond of Richmond Sound Design, "because the nature of live sound is so variable. You can't predict from one moment to the next what you'll need to change. You can memorize all mix parameters, but many people are uncomfortable if they can't instantly grab a particular control to adjust."

And what will you grab when the instant arrives?

"People prefer moving faders as visual feedback," Richmond says. "But I think moving faders haven't caught on in sound reinforcement because setting live levels is very different than in a studio. Automated mixes are usually referenced to time code, and live sound, if anything, is done on a snapshot or cue basis. And it's more than just the faders you want to control—it's the EQ, the sends, the matrices. You can have control over all of this, but how easy is it to alter a setting in a show that has been preset?

"It's a question of applying digital control technology where it's appropriate," Richmond offers. "A lot of people fail to understand this initially. They think, 'My God, they want to take all my controls away from me!' That's not what it's all about. A good, but hardly typical, example is an industrial I recently worked on where the audience sat in two groups of 700 people each on two huge turntables, which rotated to four different positions. There was a huge matrix of speakers above the audience, aimed in all different directions. The delays had to be changed for each audience position, and the stereo image had to track as the audience moved. It meant changing relative levels, delays and mixes of all the loudspeakers.

"We created cues that made these changes dynamically while the audience moved. No operator in their right mind would want to manually control that. But at the same time, we chose to keep the live mic levels under manual control."

Improved Measurement Systems

DSP should also influence the development of better test equip-

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ment for measuring system performance and room acoustics.

"I think there's going to be a point where you put up your loudspeaker system in any venue and tell your computer to make it right," Gelow muses. "It'll apply test signal monitored by an array of microphones spaced in the room, and it will adapt the loudspeaker array to the venue. It will do what it needs to in the time domain to have correct frequency response and coverage for the venue."

TOA's John Murray concurs. "I think the next generation will provide devices capable of creating the inverse transfer function of your entire system," he says, "from the mic to electronics and right on through the speakers.

"Then, do you just do it for the signal chain with the speaker in an anechoic chamber, or do you back out into the venue and try to fix some room problems? And what would you fix?" he asks rhetorically. "Everybody's so busy trying to remove room acoustics from the signal, but if you've ever heard a speaker in an anechoic chamber, you're glad we have room acoustics! When we do this adaptive filtering, we have to decide what part of the signal chain we are going to correct for."

Digital Snakes

Another area of interest is the use of digital snakes, both fiber-optic and copper. Michael Creamer of manufacturer BEC Technologies sees several applications: "One is a digital snake as a replacement for incoming mic signals. The other is drive-line technology for amp racks and cross-stage patching. Let's say you have ten or 20 amplifier racks, and you need the same crossover signals to arrive at four amps in each rack. The problem is one of noise floor related to the distribution and regeneration of that signal. With a digital snake, you can regenerate the same quality over and over, and each

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amp can receive an analog signal from a converter less than a foot away.

"I think that we can improve the dynamic range and performance of an overall touring system more dramatically on the return line side, rather than on the mic input side," he adds.

If the approach proves successful, we can expect to see digital ins and outs appearing on mixers, amplifiers and other pieces of gear. "All the little links in the chain we have now are gradually going to change," TOA's Murray predicts. "The different signal processors we have now are going to boil down to one box, although you might use multiple copies of it. Everything will be digital from the output, or even the input of the console, until it hits a power amp."

Toward the Future

So, how do we progress from here? One direction seems likely: As more and more gear goes digital, the need for control across manufacturer's lines will grow. JBL's Gelow probably speaks for many when he says, "There's going to have to be an interface standard. The problem is, of course, who defines it?"

"If we're going to get any benefits from this technology," adds Creamer, "various manufacturers are going to have to take an active role in the definition of interface and system integration standards and protocols. Some people are inventing platforms to keep tight hold of the marketplace. We're seeing that in the video world, and I'd hate to think audio will go that way."

Rane's Bob Moses is a key player in the AES Working Group addressing the problem of standards and protocols. "Systems that need more than one box will be sharing data with each other," he says. "That's inherently a networking problem that is much more complex than MIDI or PA-422. Instead of just telling something to change its level, you're sending segments of programs and real-time digital audio between boxes.

"Some of us are looking to establish a protocol that's open-ended enough to carry this more futuristic data five years down the road," Moses adds. "But it remains to be seen how this will progress —I may be full of it!" (See "Current," p. 10, for a report on developments from the NSCA show in Anaheim.)

"We're going to digital control of loudspeakers and electronics," concludes Murray, "because it enables you to have better control. Instead of tweaking a potentiometer that has a variance of 20 percent, you can adjust down to a gnat's ass with DSP. We've been using analog level controls for years and years, and we don't know what the levels are until we get an SPL measurement from a calibrated mic. Digital equipment gives you much more exacting control over your signal."

Rudy Trubitt is Mix*'s sound reinforcement editor.*

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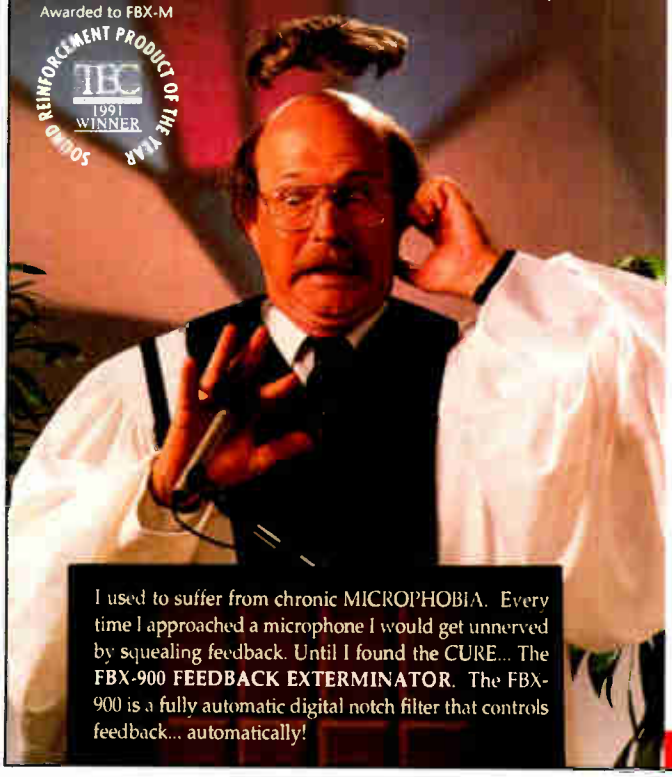

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U2 Zoo TV Tour

Performer: U2
Venue: Oakland Coliseum, April 19, 1992
Sound Company: Clair Brothers
FOH Crew: Joe O'Herlihy, Robbie Adams, Jo Ravitch
Monitor Crew: Steve McCale, Dave Skaff

Above: Zoo TV FOH crew: Jo Ravitch, Joe O'Herlihy, Robbie Adams; Right: Bono emotes; Opposite page top: "Heads, hands and feet"—O'Herlihy and Adams during the show; Center and lower: U2 monitor crew—Steve McCale and Dave Skaff.

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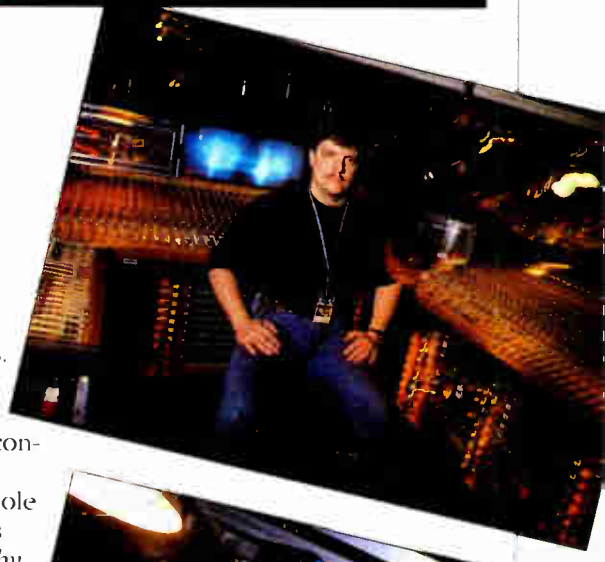

U2's

massive Zoo TV Tour rolled into Oakland near the end of their U.S. arena leg carrying a veritable showcase of new equipment and techniques. Gear highlights include an ATI Paragon console, Clair P-4 front-fill loudspeakers and Future Sonics Ear Monitors,™ not to mention an enormous video production rig. From a technique point of view, some of the show's most dramatic and intimate moments took place *in front* of the P.A. on the "B stage," a small stage and runway dozens of rows into the audience. At the helm of the mammoth production's sound is Joe O'Herlihy, who's been with the band since 1978.

"Production-wise we've always had the P.A. system, a few lights and, as Bono used to say, 'three chords and a throat,'" O'Herlihy comments. "Now we've got the ultimate in production values. When taking all those aspects into consideration, the sound is still a huge part, but there are a whole network of priorities. It's U2's response, as the *Achtung Baby* album was, to the '90s.

"It's a performance mix," continues O'Herlihy. "There's three of us working—it's heads, hands and feet, legs, elbows and arms." Joining O'Herlihy in the tangle of limbs at FOH is Clair system engineer Jo Ravitch and second engineer Robbie Adams. "Jo and I have worked together for the last ten years—it's a long-stand-

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ing partnership," O'Herlihy explains. "Robbie worked as an assistant engineer on the album and he documented everything, so he's responsible for recalling all the effects, and he serves as a good buffer for me, watching what's going on because there's so much activity." Adams agrees: "Sometimes you lose the bigger picture. It works quite well to have somebody who can stand back and [listen]. I also get a chance to walk [the room] and make sure everything's happening up there as well."

The centerpiece of the house position is the aforementioned Paragon console. "I think it's a step in the right direction," says O'Herlihy. "All the onboard dynamics give you everything right there in front of you. In my case, I have to have visual contact with Bono at all times. Sometimes he sticks the microphone right in [to the deck speakers] to see if I'm awake! It's difficult to chase him if you're looking at stuff that's over your shoulder in a rack. The Paragon seems to be designed from an engineer's point of view—it's very practical. I also find the EQ to be very musical, very transparent. Some consoles you dial up +16 before you hear a hair of difference. [The Paragon] is right on the money. It reminds me a bit of the Clair board (the tour's second house console) in the transparency of the EQ section. And, of course, you've got those 16 auxes, and *Achtung Baby* is treatments a-go-go!"

The crew did a remarkable job of re-creating the album's tones, although many of the effects needed tweaking to work in an arena setting. "You have to roll off a lot of brightness from the distortion effects we used on the album," Adams explains. "You've got to use lower, harder sounds to create the same effect. The high, sizzly distortion stuff just

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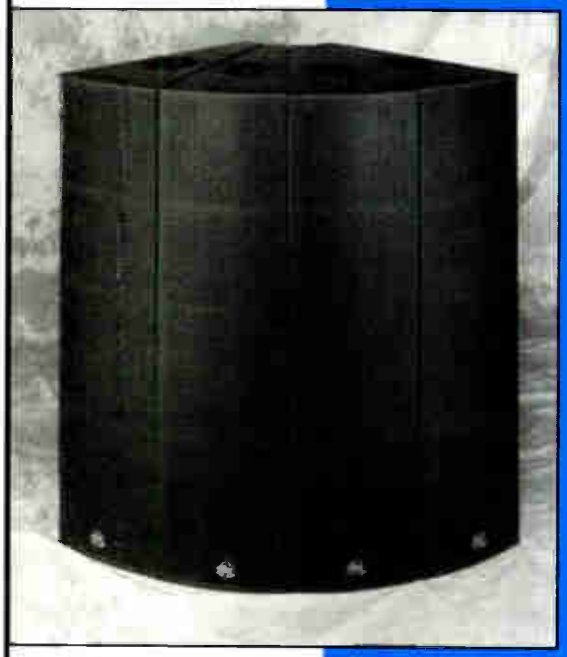

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doesn't do it—it just sounds like something's broken." An SPX1000 with a chorused-distortion patch was used for the distorted vocal processing.

On the loudspeaker side, the tour is using an S-4 rig (see photo) in a 360-degree hang, as all the seats around the back of the stage were sold out. On the deck, a very tightly wrapped group of P-4s sat above four Intersonics subwoofers on either side of the stage. "The Piston boxes," O'Herlihy says, "cover all the front-fill area. It has an incredible effect from an image point of view—it brings the image from overhead right down to you. The [Intersonics] subwoofers are new and quite devastating, to say the least! They're used for effect. They're activated by the kick drum, and Adam [Clayton, the bass player] uses Taurus bass pedals. Overall, it's the Rolls-Royce model we got out from Clair, so we've been getting good sounds."

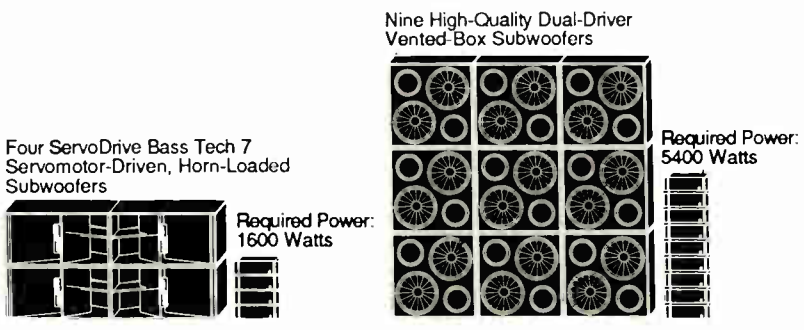
The afternoon's soundcheck gave the band a chance to fine-tune some video camera moves and spend time jamming, the source of much of their music. "We record all the shows and all the soundchecks—everything as soon as the guys step onstage," confides O'Herlihy. "When I finish a tour it takes me months to go through the tapes and put together the jams and concepts. 'Pride,' for instance, was [first] recorded at a soundcheck at the NBC arena in Honolulu."

Surprisingly, the FOH's complexities pale in comparison to the two monitor mix positions. Steve McCale and Dave Skaff provide dozens of monitor mixes to the band's four players. McCale mixes for Bono and Edge (vocal and guitar) while Skaff covers Adam Clayton and Larry Mullen Jr. (bass and drums). The pair use seven consoles and a *lot* of inputs. "The number of channels is actually theoretical—we can't count that high," laughs Skaff. "We were in Ireland trying to figure this out—we were making phone calls and sending faxes back to the shop, and they were saying, 'What? Are you nuts?' "

"There are a lot of inputs that are used only once during the show," McCale explains. "The band tries to make themselves perfect, and [they want their monitors] to be perfect. So, just having something in the mix isn't good enough—it needs to be proper, which is fine, but it takes a lot of channels. Bono really likes a full house mix. That's why I'm here actually—because I don't normally do monitors—I'm a house mixer. But Bono is looking for a house mix with lots of effects, so I spend most of my time mixing for him."

The stage's open, 360-degree look ended up requiring both monitor positions to be beneath the stage. And how is it being out of eye contact with the players? "In a word, horrible," McCale says. "It's like watching the show through a peep-hole. But the band knows I can't see,

When is 4 greater than 9?



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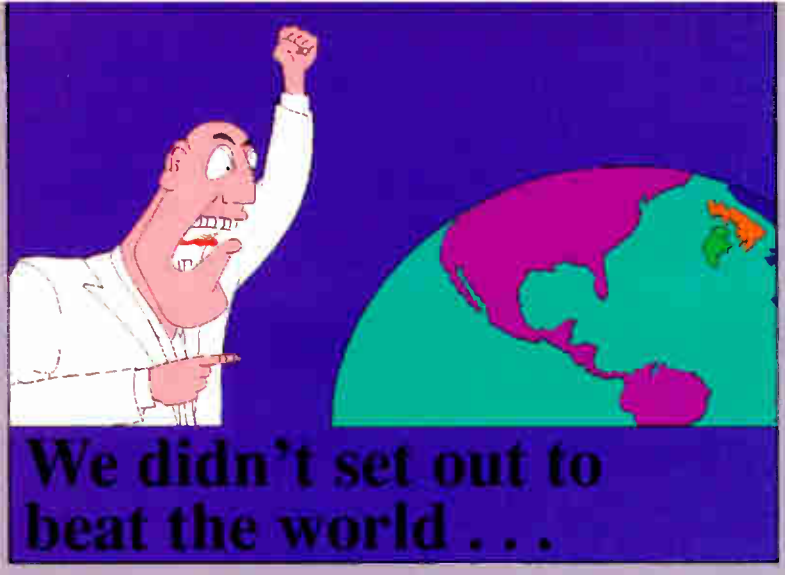

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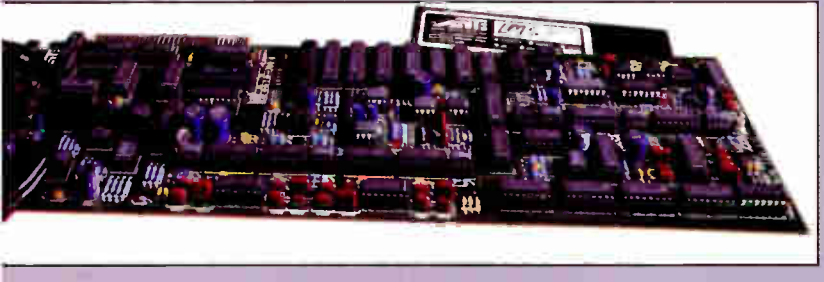

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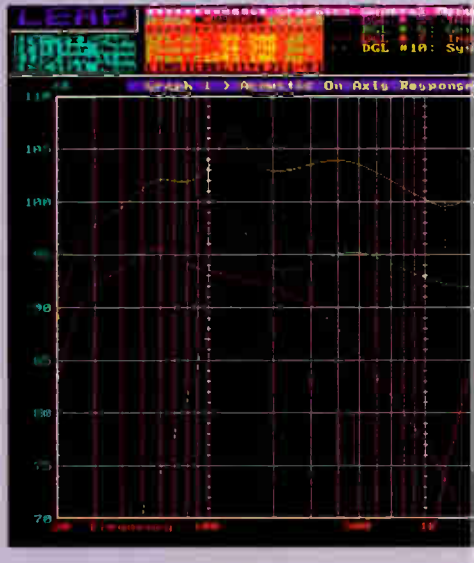

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and if I miss something I'm not expected to work miracles. And we've got good coverage: I've got three cameras watching the show all the time."

The design of the monitor system was being continually refined, even at this point in the tour. Part of the ongoing changes are related to the tour's increasing use of Ear Monitors. "They came in very late in the game," says McCale. "For the first few shows, they were strictly used for B-stage stuff. But, Bono started liking them, and they went from a very small sideline specialty thing to being a very large part of the show. Bono now wears his for anywhere from half to three-quarters of the set, and Edge is starting to wear his more and more. With the earphones on, all the effects and real subtle stuff that you do to a vocal is very clear and apparent—it doesn't get lost in the wash. So actually, I do a lot more for him in his headphones than I can without.

"[The Ear Monitors] take some finesse," McCale continues. "It took me several weeks to feel like I really knew the units. I get kick and bass into the earphones, but only their top-end, because the sidefills and P.A. carry so much of the low end. But the most critical thing is getting the gain structure throughout the entire system, from the way you drive it to the Aphex Dominator, which comes with the system, to how hard you drive the transmitter input and the actual gain on the beltpack. It's possible to overload one stage of it, but once you get it dialed in it does real good."

However, wedges and sidefills have not been displaced. "These guys always want the flexibility of being able to pick and choose from different feels all the time," Skaff says. "You can get something that they like in the wedges or something they like in the ear monitors. It's a question of deciding which paintbrush to use today."

"It's a difficult tour that we're doing," McCale concludes. "If it wasn't for the band's drive to do the best that they can, it wouldn't push all of us to do our best. The main thing is it's not just me or Dave or Jo out there. We've got nine people on sound for this show, and everyone puts in long hours and does a really good job. It's all a big teamwork thing, and I want to make sure that the credit gets passed down the line where it's deserved."

Although the show's technological bombast had the potential to swamp the music's rich emotional content, that didn't happen. Instead, the excellent sound and dramatic visual elements of the production contributed to the ultimate purpose. "The intention is to communicate," O'Herlihy notes. "I just look around and see the expression on people's faces, and to me, that fulfillment is worth its weight in gold. That's why I do what I do."

In case you can't tell, David (Rudy) Trubitt enjoyed the show.

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by Philip De Lancie

DIGITAL ARCHIVING

SLOW PROGRESS TOWARD SOUND PRESERVATION

The advent of affordable digital recording systems comes as some of the best-preserved early analog recordings near the end of their usable lives. With the current proliferation of digital formats, new tools are now available to those who hope to preserve the wealth of analog recordings by transferring them to digital media.

Questions remain, however, about digital formats for archival use. Are they sufficiently reliable to be entrusted with our entire recorded heritage? Which is most appropriate for archiving: prerecorded, write-once or rewritable media? Which, if any, of the promising systems on the market today will still be around in 20, 50 or 100 years? And is it time for the music industry to commit to a single archival standard, or is it better to wait and see what new technologies are just around the bend that may better meet archival criteria?

A clear consensus on these and related issues has yet to emerge. And while efforts have been made by various interested organizations to establish archiving standards, they have yet to yield any uniform methods of evaluating the suitability of prospective archiving formats for a particular application. Nor has there been established a comprehensive single source from which anyone could get information to guide them in their choice of formats.

In the absence of an industry-wide effort, individual manufacturers and users of digital media have been gathering their own answers to some of the unresolved questions. In the interviews that follow, I've asked four industry professionals for their observations on the current state of digital archiving.

At 3M, I spoke with Bob Schoonover, lab manager, 3M Prerecorded Optical Media, about archiving on optical discs. The company has developed a methodology for projecting disc lifetime and has released the results of a series of tests on CD-ROM. Results of similar testing on magneto-optical discs will be available later this year. For an additional manufacturer's viewpoint, primarily focused on WORM discs, I contacted Rich Millett, a senior engineer with Pioneer's Optical Memory Systems Division.

For a user's perspective, I turned to John Arrias, president and engineer at B&J Studios in Hollywood. His archiving experience grew out of work for Barbra Streisand's *Just for the Record* four-CD box set, and includes the entire Neil Diamond catalog. And Dan Imel, operations manager at Loran Cassettes, spoke with me about the tests he's been conducting to determine the expected lifetime of DATs.

What criteria are most important in evaluating the suitability of a given recording format for archiving use?

Schoonover: It has to be something that is going to be stable and retrievable. We make media, but part of the package is the total system to retrieve the data, which means you must have the hardware to play the media when you want to retrieve the information.

Millett: One thing you've got to worry about is whether you can read the data in 15 years. Will the media last that long, and will there still be drives available to read the data? Another thing is the reliability of the drive and the media. Also, what are the storage requirements? With tape, you have to send it off to a temperature- and humidity-controlled vault. Whereas our WORM lifetime is quoted as shelf life under normal office conditions, with a specified range of 5° to 50°C and 10% to 80% relative humidity, non-condensing.

Imel: Clearly, you have to maintain the sound quality. But the format with the longest life is going to be the one that is the most desirable. So the number one criterion would be the actual physical durability of the medium.

If you are looking at tape formats, the biggest problem you will find is dropouts. Tapes have a tendency to

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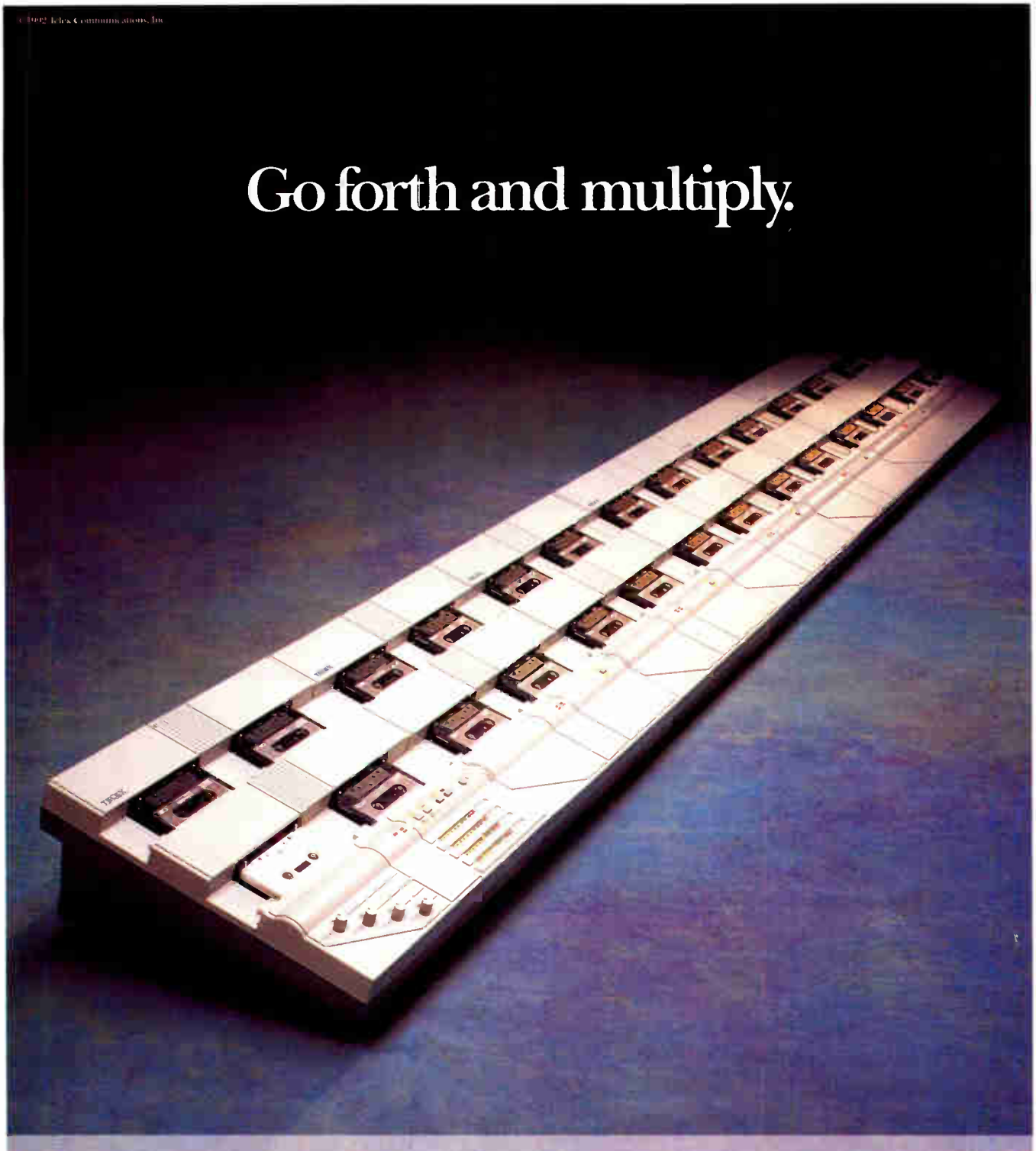

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shed particles. Given the packing density of DAT, the loss of a small particle, which wouldn't be noticeable with analog tape, can cause a problem. Those are the kinds of things that are going to happen as the tape gets older, whether you're looking at DAT or any other kind of digital tape.

With optical discs, you'd be concerned about any physical problem, be it oxidation or whatever, that would cause it to be unusable as a mirror reflecting a laser beam.

Arrias: First of all, you want a format that is going to maintain the fidelity of the original material. Second, you want to know the life expectancy of the material you are transferring to. Third, you want to make sure that when you want to retrieve your material, you are able to do that. You don't want to end up with something that's so outdated that you can't find a machine to play it back on. Of course, that's a tough call to make, considering that the technology keeps changing daily. Finally, I like to be able to transfer the entire length of an album in one pass, without stopping. Not all of the optical systems are able to do that.

To the extent that you've been able to test various potential archiving media, describe the parameters tested and procedures used.

Schoonover: Our studies were made on 3M-made CD-ROMs, so the characteristics that we keyed on were those uniquely important to that product, though they would be equally relevant to CD-Audio. Of all the parameters of the disc, we believe the key characteristic is error rate. In a CD, it's called Block Error Rate (BLER) because the data is present in blocks. We've found that BLER is the parameter that correlates best with the performance of the disc. There are always a very few blocks that are in error in a product, and you monitor how that changes over time.

The most critical portion of a disc is the metal reflective layer. We stressed discs at a variety of temperatures and humidities, from 40°C at 90% humidity up to as high as 85° or 90°C. We tested nine different combinations of conditions with 16 discs in each batch. And we monitored the rate of change in BLER as a function of those conditions. The higher the temperature and humidity, the faster the discs changed.

Millett: We do accelerated lifetime testing by subjecting the discs to environmental conditions beyond the limits of our specification. The test conditions are 60° C, 90% humidity. We do this for a length of time, measuring the deterioration in reflectivity and signal-to-noise ratio.

Imel: Early on, we did a tremendous amount of environmental study on DAT and found that metal tape in general, and particularly DAT, due again to the packing density, is pretty suspect when you get it above 55°C. That's well below dashboard temperatures, which, in reality, according to the Society of Automotive Engineering, run about 235°F. You run into trouble with the tape deteriorating to the point that it becomes unusable. This was short-term exposure in the 24-hour range.

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counting errors was the way we wanted to evaluate the tape.

Because of the professional uses of DAT, we assumed an office environment of 70°F at 50% humidity. Our DAT-production area is temperature- and humidity-controlled, so we have a real good control environment. We have a sample size of 30 pieces. Every year, we monitor the error rate and statistically evaluate losses in playback capability.

Arrias: When we started working on the Streisand project, we transferred everything directly from the analog originals with no processing onto the New England Digital PostPro Direct-to-Disk at a 50kHz sampling rate. So everything was on hard disk. And our backup was Patriot drives, which use a 1/2-inch digital tape cartridge. Then we switched to DAT digital backups, which hold more material and are faster and more reliable. At the same time, I decided that optical was the way to go for archiving. So we also started transferring to the NED optical disc, which is a 12-inch WORM platter.

My main criterion is fidelity. To test that, we compared various optical systems by listening to the original, the transfer to the Direct-to-Disk hard drives, the transfer into the optical recorder, the transfer out of the optical back to the Direct-to-Disk and out through the analog ports. And the two systems that I liked that use optical recording were the Akai and the NED.

How do you move from test results to actually predicting life expectancy for a given format, and what did you come up with for the formats you tested?

Schoonover: With the proper software program and a lot of manipulation and use of theoretical equations based on temperature and humidity relationships, you can take data determined over a period of several thousand hours in a chamber and extrapolate from that back to any temperature and humidity condition you are interested in to come up with answers in terms of years of life. In this case, we extrapolated back to 30°C (86°F) and 90% humidity.

The other thing we needed to do was define what the end of life is. None of the discs failed. They changed a small amount, but they all played. We decided to be conservative, so we chose an average error rate of 50 per second, which is less than one fourth of the errors allowed under CD specifications. Based on that, we ended up with a very specific statistical statement, which reads like this: "With 95% confidence, we estimate that 99.5% of 3M CD-ROMs will survive 100 years at 86°F and 90% relative humidity before reaching a mean BLER of 50 counts per second." (See Fig. 1, p. 154.)

Millett: We use the Arrhenius plot, which is an accepted system for extrapolating lifetimes and reliability based on accelerated testing. We consider the media to be bad at the point where the bit error rate exceeds our published specification, which calls for not more than one error per 10^{12} bits. We figure the discs will take between 15 and 30 years to reach that point. Our published specification for WORM shelf life is over 15 years at 20°C and 50% relative humidity.

Imel: We use a statistical method called a Weibel chart. When you start seeing failures, you put them on the chart, and depending on the slant of the chart and the number of units involved, it will extremely accurately tell you what the projection of failure is going to be. And it looks like after five or six years, we are going to start seeing unacceptable failures in our DATs.

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Unlike the progressive effects one finds in analog media, the effects of deterioration in digital media tend toward catastrophic failure. Given what is known so far about the reliability of digital media, is it overdue or premature for the music industry to wholeheartedly commit to digital archiving?

Schoonover: The results we came up with in our tests were only for 3M-manufactured CD-ROMs. But we do test everybody's discs that we can get our hands on, both Audio and ROM. That includes more than a dozen different manufacturers. And one of the things that really motivated us to develop a methodology for predicting CD lifetimes was the vast differences in performance between different manufacturers (see Fig. 2, p. 156). So I would say that the CD medium can potentially be a good archival medium, not generically but with proper testing. If I had some information that I really wanted to last a very long time, I would test the medium in a manner very similar to what we did, to find out quickly whether it will last.

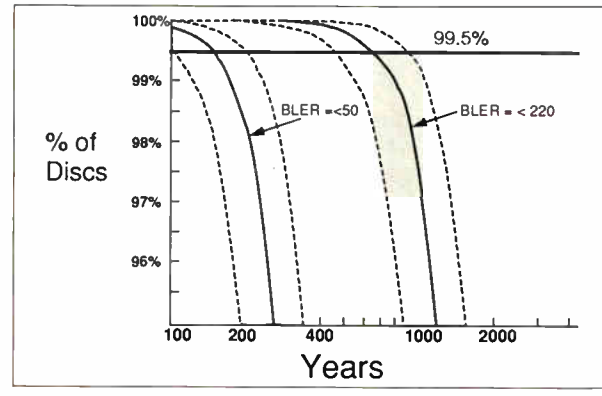

Figure 1: CD-ROM lifetime study results.

Millett: I don't think it's premature. The recording industry has been doing it for years with digital tape. And drives are very reliable. Also, the WORM media is ablative, meaning that to record we actually burn holes into a layer of organic dye. That gives us a very, very high signal-to-noise ratio, which is how we can get the lifetimes that we get. The material doesn't oxidize, and once recorded, it is very stable.

Imel: I don't think that it's premature. There is a trade-off between the sound quality of digital compared to the reduced likelihood with analog that you will see problems early on from tape shedding. So it's premature to assume that you are actually going to be any better off using a digital tape than an analog tape, because they are both basically made in the same process. But I wouldn't hesitate to use DAT. It's probably not going to be any worse than present day analog as far as archival problems in the future. And at least you have a nice, clean recording.

Arrias: The type of failure you could have with digital is the reason we use several digital formats. We have the DATs, which we renew every five years, and two optical discs. So we feel pretty secure about it.

As far as the industry taking the plunge, degradation on analog tape starts on day one. And if you have any kind of distortion, it will get worse with time. Ten years or even six years ago the technology wasn't there to warrant starting to archive. However, if you archive now, even by transferring to digital tape, you will at least preserve the material in the state it is in now. If you wait one more day, it will be that much worse. So to me, it is so important that

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every artist take their material and transfer it—to get it archived immediately.

Having decided to archive digitally, how should music industry archivists choose among the digital recording media available today?

Schoonover: As of today, it's difficult to answer that question, because you don't have a government- or association-recognized standard for performance for CDs, let alone for cross-format comparison. First, there needs to be a definition of what is meant by archival: How long, and what is expected at the end of that time period? And secondly, there needs to be some comparative testing. The way the question could be answered in the future is with a standardized test to which all manufacturers would be graded.

It becomes even more difficult when you start trying to compare between different formats, because you don't have common denominators. There isn't any standardized method to do that, and I'm not aware of any activity to create that comparison. I think

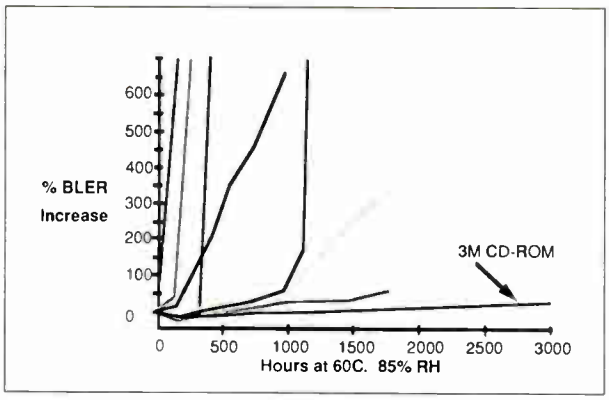


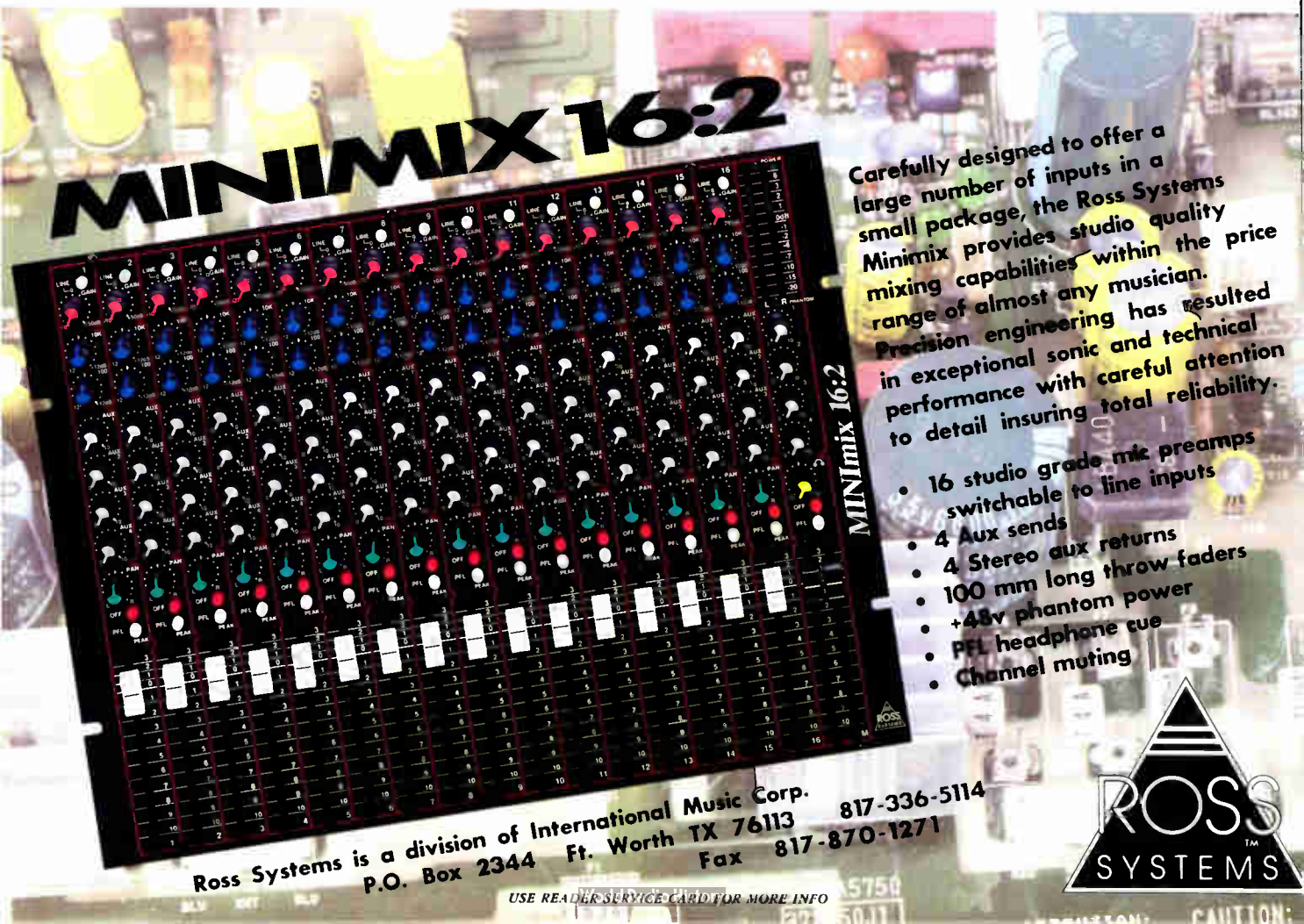
Figure 2: CD-ROM manufacturer's durability comparison.

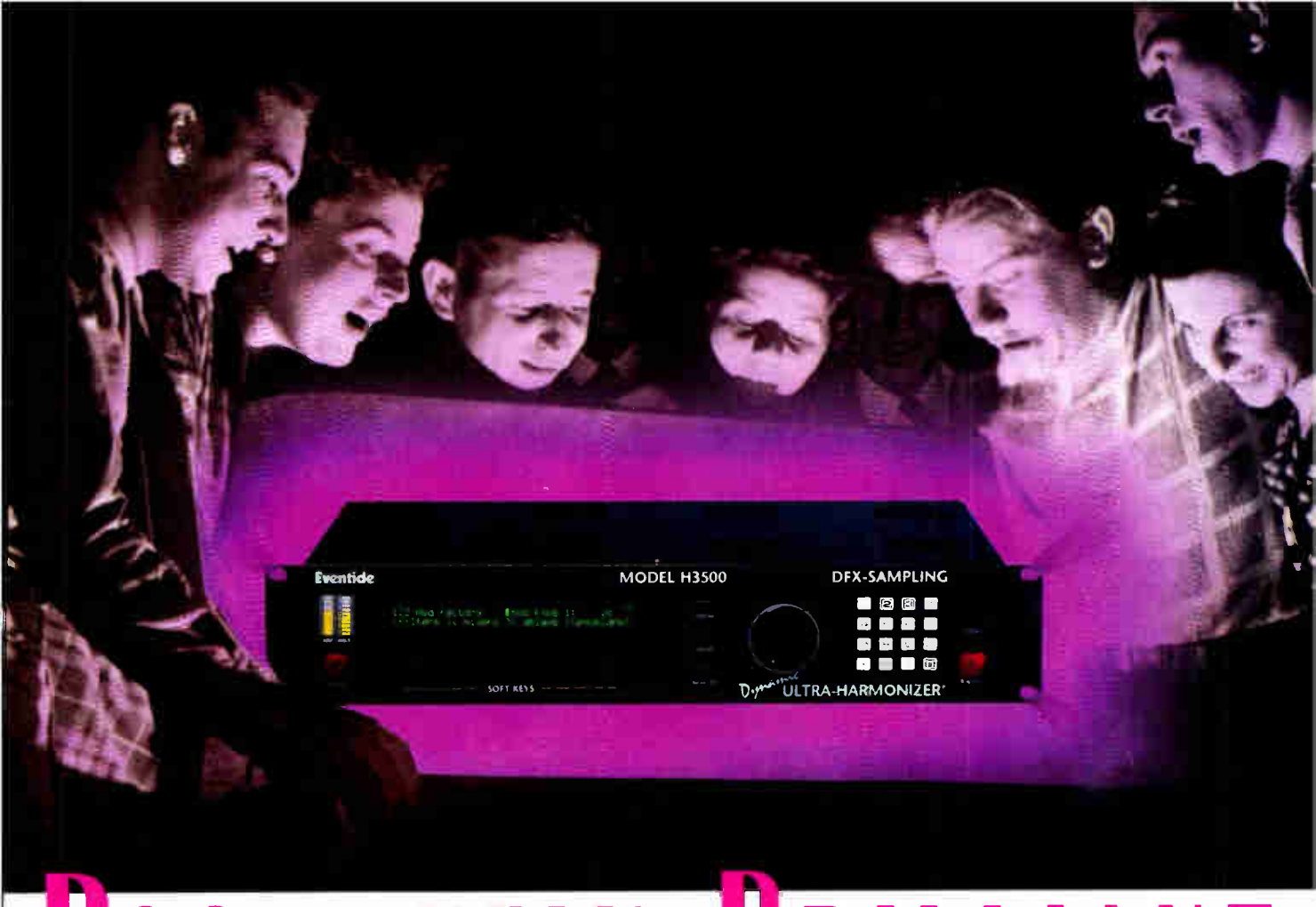
the first step is a recognized, accepted test method for comparing within formats. And I think we are close to that. There are proposals that have been offered in that general area, and I expect to see and hear about that sort of thing this year. Once that step is taken, the next logical step would be a similar approach that would allow comparison between formats.

Millett: I'm not that familiar with the audio industry as far as all the formats that are currently being used. I have some friends who own a studio, and they use DATs a lot, but not for long-term storage. One advantage of optical discs over tapes is that the discs are much smaller, so you can store a lot more data in a smaller area. And it's easier to manipulate, because you get random access.

Between the various optical disc formats, I think WORM is more reliable for archiving than MO. And CDs are good. In the past they had some problems with oxidization, but the material science wasn't as good back then as it is now. The materials have been refined for improved lifetime.

Imel: The basic things to consider are what is being archived, the amount of data, the retrieval speed, and how often you plan on retrieving it. Are you just making a safety copy that will sit for years? Then you might consider a medium that lets you put a lot of data on a single unit. If you want to retrieve





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Clearly, not everyone can handle this much Ultra-Harmonizer power. That's why the new H3500 *Dynamic* Ultra-Harmonizer will only be available from a select group of Eventide dealers. Before you can explore the new direction in world-class multi-effects, you may have to do some traveling. But we assure you, it's worth the trip.

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it constantly, you might want something that has a real fast retrieval rate.

There's no question that if you have the option of storing on optical CD-type products, that would be my recommendation. At this point, optical discs probably have the best chance of giving a long archival life. In the future, some other type of electronic storage will probably be the medium of choice.

Arrias: Some people say, "My stuff is on CD. Aren't I archived?" Well, CDs are made of plastic. And plastic will deteriorate and change its consistency. So it's not a good format to stay on for archiving.

I decided not to go with magneto-optical because it has the word "erasable" in there, although you can't erase it unless you put it back in the system and un-write-protect it. Once it is out of the system, it's as permanent as the WORM. But it still has magnetic properties, and that worries me for archiving. The 12-inch WORM disc from NEI is made of glass with aluminum. The data is ingrained on the WORM. Unless you break it or scrape it completely, you're not going to lose that information. ■

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Tape & Disc News

DCC Debuts Continue

Lyrec has joined the handful of companies that have introduced equipment specifically designed for DCC duplication. The duplication gear manufacturer, which had previously signed an agreement with Philips for the right to produce DCC equipment, has shown a dedicated DCC duplication slave. It also came up with a DCC version of its TR55-QC deck for pancake testing, incorporating read/write DCC electronics for integration with Philips' DCC QC system.

In describing the new slave, Lyrec places great emphasis on accurate track placement and the absence of stationary guides in the transport design. The machine uses cleaning tape to clean the duplication stock on both sides as it enters the head stack, as well as a laminar air stream that flows through the head area to move away dust. The air flow is generated within the slave without any external supplies. The machine also features status data on connectors at the rear to facilitate computerized system integration.

The Lyrec slave deck for DCC high-speed duplication.

Lyrec also announced upgrades to its existing analog cassette systems. The PP-4400 master loop bin is now capa-

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ble of operating at 375 ips for a 100:1 duplication ratio with a 3-3/4 ips master. For those who prefer digital bins, Lyrec appears to be working closely with Duplitronics, showing systems in tandem at industry exhibitions. As for upgrades to Lyrec slave units, these include new packer arms, record amplifiers, capstan control and Dolby HX-Pro circuits. The company also placed ferrite heads on its TR55-QC deck.

Meanwhile another European manufacturer of tape machines, Revox, announced its acquisition of a DCC license from Philips. The company says it intends to "complete its product line in the high-end and upper-mainstream segments," but specific products have yet to be detailed. And another company, audiopak, announced that it will be expanding its line of cassette duplication supplies to include components for DCC.

Music Units Decline Is Worldwide Trend

Last month, in reporting on the RIAA 1991 U.S. prerecorded music sales figures, we observed that the total units shipped had declined, while the list value of shipments had increased. Considering the recession, the modest rise in revenues was good news for the major labels. But if less music is actually getting into the hands of the public, it could have disturbing implications for an industry whose long-term health depends on a broad base of habitual music consumers.

Is the decline in units a trend or an aberration? And is it confined to the U.S., or is it going on around the world? Official 1991 worldwide sales figures are not expected to be available from IFPI, the RIAA's international sister organization, until September. But *Billboard* recently published a look at 1991 shipments in several key overseas markets, and concluded that units fell 2%-8% while revenues rose several percentage points.

Part of the units-down/value-up phenomenon is a move away from lower-priced singles to higher-priced albums. But it's mostly the increasing percentage of units sold on CD that tends to mask the underlying reality of fewer units sold. It may be, as explained by RIAA president Jason Berman, that the recession forced cutbacks by those at the bottom of the economic ladder, who tend to buy less-expensive formats. But it may also be true that the CD has inadvertently spawned a new class of consumer, no longer satisfied with the sound of cassettes or LPs, but unable to afford (or turned off by) the high price of CDs.

Is the music industry in the process of losing touch with the populace that put the *pop* in pop music sales, concentrating instead on a smaller group of techno-elite consumers? If so, the erosion in unit sales could persist after the global recession is over. And if it does, new formats like DCC and Mini Disc may not help much, because they are expected to sell for nearly the same price as CDs.

BASF Honors WEA

BASF has named WEA Manufacturing as recipient of its 1992 Inventor's Award. The award, created in 1984 to recognize major contributions to audio or video duplication, goes to WEA for its leading role in development of the DIGalog cassette. WEA has been pushing for industry-wide adoption of the DIGalog logo to promote consumer awareness about the advantages of analog cassettes duplicated from a digital bin. BASF has been giving WEA space in its booths at industry events to showcase the DIGalog product.

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Video Rental Chains Look Into Spoken Word

While prerecorded cassettes have been losing ground to CDs in the music market, the conventional wisdom is that some of this loss will be made up by growth in spoken word cassettes. Unlike the music market, there's no industry group tracking spoken word sales. But signs of mounting interest in spoken word continue to show up here and there. The latest is the news, reported in *Billboard*, that the 2,000-store video chain, Blockbuster Entertainment, is mounting a test of "audio book" rentals at up to 180 of its locations. Blockbuster would probably rent the books for about $1 per night. The company reportedly joins Sound Warehouse, Trans World Entertainment and Wherehouse Entertainment in investigating expansion into spoken word rentals.

SPLICES

The ITA has observed the tenth anniversary of the introduction of the CD with presentation of its Outstanding Technology Award to CD co-developers Sony and Philips...**Concept Design** (Graham, NC) introduced a new cassette duplication loader at the European AES convention in Vienna. Dubbed the CD 9002, the machine features a dual-pancake design...**Gauss** (Sun Valley, CA) sold a high-speed cassette duplication system, including test equipment, to Takt Audio in Poland. The company also sold gear to Kincar in Taiwan for expansion of its duplication capacity...**CEDAR Audio** (NYC) reports that two of its new digital Phase/Time Corrector modules, accurate to 1/200 of a sample, have been sold to facilities operated by Digipro in Paris and Brussels...The **3M** tape manufacturing plant in Hutchinson, MN, has achieved registration to the ISO 9002 standard. According to 3M, the standard, promulgated by the International Standards Organization, is among the highest certifications of manufacturing quality attainable. Among other products, the Hutchinson plant makes audio and video tapes in a variety of formats...**Sound/Video Impressions** expanded its audio cassette duplication department to include high-speed duplication. The Des Plaines, IL, company added a Magnefax 1/2-inch stereo bin duplicator and increased the size of the department by 2,000 square feet...**Musicon** of Wilsonville, OR, added to its duplication capacity with the acquisition of four more slave recorders for its Versadyne 1500 system. The move gives Musicon a total of 12 slaves...**Digital House** (NYC) has completed work on a four-CD set of 80 historic recordings made during World War II for distribution to overseas troops in the form of "V-Discs." The set, released by Time-Life Music, includes performances by the Dorsey Brothers, Duke Ellington, Glenn Miller, Benny Goodman and a host of other greats of the era. Digital House also confirms that Elvis is back, this time in the form of two rare interviews mastered by the company for CD release by the Great Northwestern Music Co....**Barry Diament Audio** (Riverdale, NY) reports mastering work for the new Domino label, including albums for Rusty Kershaw and John Mooney ...At the **Rocket Lab** in San Francisco, Gold Money were in to work on their latest for Tommy Boy Records with engineer Kenneth Lee. ■

Philip De Lancie is a mastering engineer at Fantasy Studios, Berkeley, Calif.

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THE MOST INFLUENTIAL PRODUCERS OF THE MIX ERA

The problem, of course, is the word "influence." This isn't just about record sales—although all of the producers here have sold millions of records. It's about making records which have, for whatever reason, affected the way other people make records, either sonically or philosophically.

BY BLAIR JACKSON

World Radio History

When we first formulated the idea for this article many months ago, I thought it was going be a stroll in the park. After all, wouldn't it be *obvious* who had been the most influential producers during the 15 years *Mix* has been around? Alas, after considerable research, countless phone calls to other writers and various record company types, and a lot of internal wrestling, I was still adjusting the main list midway through writing it up. It turned into quite a bear.

The problem, of course, is the word "influence." This isn't just about record sales—although all of the producers here have sold millions of records. It's about making records which have, for whatever reason, affected the way other people make records, either sonically or philosophically.

In terms of sheer numbers of records sold, Quincy Jones would have to be the reigning champ of producers during what I will pompously call the *Mix* Era (1977-1992). The Michael Jackson records he produced in that time span have probably been heard by more people around the world than any other production ever. (Yes, even including George Martin; the Beatles never had the *global* impact of Michael Jackson.) But have those records been particularly *influential*? As well-recorded as they are (hats off to Bruce Swedien and all the other top-notch engineers who've helped make Jackson's records sound so good), I don't hear much of a ripple effect in other artists; perhaps Jackson is too singular a talent to emulate or rip-off.

To further complicate matters, it's often difficult to assess whether a given record is influential because of an artist's songs and overall style or because of something the producer did to give it a particular sound. And how often is that sound really more a function of an engineer's ideas and control room savvy than the producer's own input? And is it necessarily a good thing for a producer to have a sound? I suppose it depends on who you talk to. Certainly, many of the best producers of both yesterday and today are people who impose little other than their sterling judgment on the music. They know a great performance, and they're able to elicit the same from the artists with whom they work. In that category I'd put veterans like Phil Ramone and Tom Dowd and less seasoned producers like Don Was and T-Bone Burnett. In fact, my own personal taste runs much more toward this style of producer than some of the people spotlighted below.

So with all those caveats out of the way, I (very) humbly present my list of some of the greats from the past 15 years who have helped shape the music we all hear. Keep in mind that

PHOTO: JAY BLAKESBERG

Above: Narada Michael Walden

Left: Producer Bruce Fairbairn

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PHOTO: RON DELANY

Left: Producer and artist, the inimitable Prince

ultimately these are just *my* judgments, for whatever that's worth, and they don't necessarily reflect the opinions of anyone else here at *Mix*. As always, we welcome any input you might have on the subject.

THE TOP TEN (OKAY, ELEVEN)

JIMMY BOWEN

It's not that there was anything *wrong* with the way people in Nashville made records before Jimmy Bowen came to town almost 15 years ago, but there's no question that Bowen upped the ante for Nashville producers by importing many of the techniques and attitudes he learned from years of working in Los Angeles studios. Of course, there are many people out there who *don't* think that spending hours getting a snare drum sound is a valuable use of studio time, but few would argue that Bowen's scrupulous attention to detail generally improved the way records were made in Music City. And he was one of the first in town to push for digital recording in the '80s. As a producer, his track record has touched almost every style. Early on he was known for his work with pop vocalists such as Dean Martin and Frank Sinatra; later it was L.A. songwriter-types. In Nashville he's best known for his work on a number of Hank Williams Jr. and George Strait albums, and records by everyone from Reba McEntire to Crystal Gayle, the Oak Ridge Boys to Waylon Jennings.

Below left: Hugh Padgham, pictured with Sting.

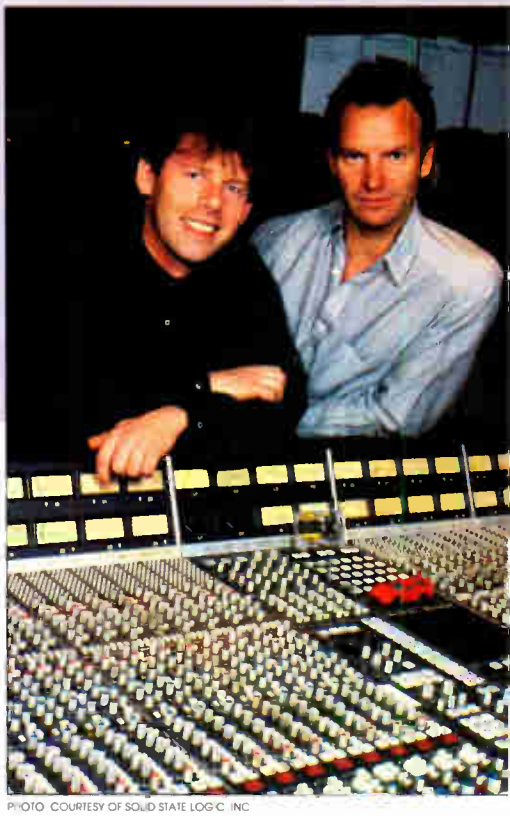

PHOTO: COURTESY OF SOLID STATE LOGIC, INC.

Bowen has long worked as a top executive in Nashville, too, first at MCA, then Elektra, then MCA again, and most recently as president of Capitol-Nashville, now called Liberty Records. Liberty, last time we checked, had sold a few records by a fellow named Garth Brooks.

BRUCE FAIRBAIRN

Arguably the current king of hard rock producers, Bruce Fairbairn has managed to cut albums that rock ferociously *and* appeal to mainstream audiences because of their clarity and precision. The Vancouver-based producer worked on some of the biggest hard rock albums of the late '80s,

PHOTO: MARK ABRAHMS

Left: Daniel Lanois

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including Bon Jovi's *Slippery When Wet* and *New Jersey*, and Aerosmith's *Permanent Vacation* and *Pump*. Not surprisingly, the success of those projects has spawned countless lesser imitators. Fairbairn's also worked with Poison, AC/DC and Krokus, among others. I suppose it was really Ted Templeman, working with Van Halen in the late '70s, who first helped make hard rock palatable to a mass audience, but the sheen of Fairbairn's productions has taken that style of music to a new place. "Production should always come secondary to capturing the moment," he says. "The production is just there to enhance what the band has done. It's like baking a great cake with a lot of icing. I like a lot of icing!"

DANIEL LANOIS

Canadian Lanois is that rare producer who has his own identifiable "sound" while still emphasizing the musicality of the acts he produces. He presided over several of the most popular and influential albums of the '80s, including Peter Gabriel's *So* and U2's landmark LPs *The Unforgettable Fire* and *Joshua Tree*. But he also brought his airy, atmospheric touch to sterling albums by the likes of Bob Dylan (*Oh Mercy*, his best album in years) and the Neville Brothers (*Yellow Moon*, their commercial breakthrough). Clearly influenced by the spare, tasteful productions of Brian Eno (with whom he has worked), Lanois is also one of the new breed of producers who eschews using traditional recording studios in favor of houses, castles—in short, recording *environments*—to bring out the best in the musicians. Lanois and Eno co-produced U2's recent hit, *Achtung Baby*.

STEVE LILLYWHITE

Few producers have had the mood and texture of records they've worked on emulated as much as Steve Lillywhite. As producer of the first three U2 albums in the early '80s (*Boy*, *October* and *War*), Lillywhite helped shape the sound of an entire subgenre of rock 'n' roll in England: the moody, post-punk, guitar-driven music taken up by so many bands on the heels of the original, less commercial, purveyors of the style, Joy Division. Before linking up with U2, Lillywhite produced Siouxsie & the Banshees' influential breakthrough record, *The Scream*. Also in the early '80s, Lillywhite produced two successful albums by another of the era's most popular and copied British bands, Psychedelic Furs. Lillywhite's first production work was with Brian Eno on an Ultravox album in the late '70s, and it's clear that Lillywhite learned a thing or two about minimalism and the use of spatial ambience from Eno. Among the other artists Lillywhite has produced are the Stones (*Dirty Work*), Joan Armatrading (*Walk Under Ladders* and *The Key*), Talking Heads (*Naked*), David Byrne (*Rei Momo*), Big Country (*The Crossing*), Simple Minds and Pretenders (the underrated *Roomful of Mirrors*). He also mixed U2's *The Joshua Tree*.

HUGH PADGHAM

Love it or hate it, in the late '80s there was almost no way to escape what became known in engineering circles as "the Hugh Padgham drum sound," that cracking shot booming out of all those Phil Collins and Genesis records, and shortly thereafter, on half the records played on the radio (or so it seemed). Actually, Padgham's engineering prowess had been all over the airwaves before that. He worked on a number of projects for producer Steve Lillywhite at the Townhouse in London, including records by Peter Gabriel and XTC. The LPs that really cemented Padgham's worldwide reputation, however, were the Police's *Ghosts in the Machine* and *Synchronicity*, which Padgham engineered and co-produced with the group. The latter was Number One in *Billboard* for four months in 1983 and remains one of the best-sounding records of that era, a benchmark for other producers to strive for. In 1990 he co-produced Sting's international best-seller, *The Soul Cages*.

PRINCE

Even before his mega-successes with *1999* (in 1982) and the 1983 film and album *Purple Rain*, Prince's smart, sexy funk was influencing the likes of the Rolling Stones (whose 1980 hit "Emotional Rescue" was a nod in the Purple One's direction) and mainstream funksters of the day like one-time rival Rick James. Combining hard funk with Hendrix-influenced hard rock guitar, electronics and some of the wildest production touches this side of psychedelic-era Beatles records, Prince's mid-'80s albums were divinely eclectic format-breakers that encouraged many other artists to be similarly bold and experimental. "When Doves Cry" remains one of the most unusual hit singles of the modern era. The sounds of his late '80s dance smashes were widely copied but rarely equaled, and now, in the early '90s, Prince still refuses to be pigeonholed, as his multiplatinum, tour-de-force *Diamonds and Pearls* proves. Of course, all along he has had great success producing other artists, too, from The Time to Vanity to Sheila E. to Tevin Campbell. Prince is truly one of the few artist/writer/producer/performers who has earned the grossly overused label of "genius."

Right to left: Nile Rodgers and Bernard Edwards in their band mode, "Chic."

PHOTO: HARRISON FUNK

NILE RODGERS and BERNARD EDWARDS

In the late '70s and early '80s, the versatile team of musicians/songwriters Nile Rodgers and Bernard Edwards helped define the dance music of the disco and post-disco era through their exciting co-production work for their band Chic and for a number of other top dance acts of the day. Later on, they separately produced a wide variety of artists: Rodgers worked with Madonna (*Like a Virgin*), Duran Duran

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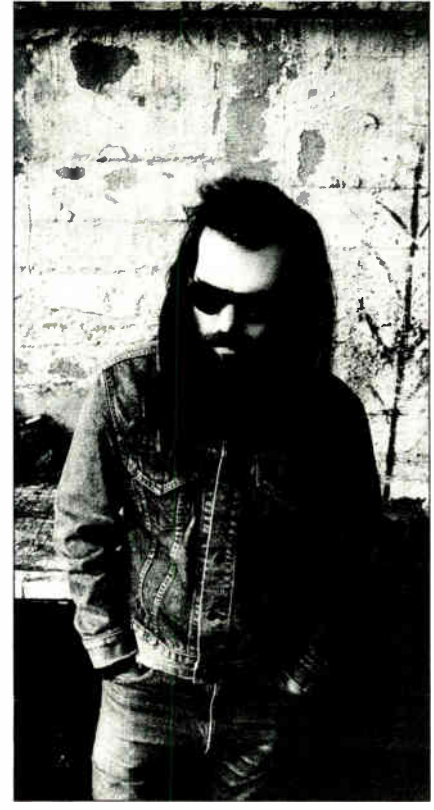
(*Notorious*, *Wild Boys*), David Bowie (*Let's Dance*), Mick Jagger (*She's the Boss*) and many others; Edwards' big successes included Power Station (their eponymous debut smash), Jody Watley, Robert Palmer (*Riptide*), Air Supply and Diana Ross (three albums). Rodgers and Edwards were among the first important writer/producers, which is to say they often (but not always) wrote songs for artists and then produced just the tracks they wrote; of course, that is commonplace today. Is it fair to lump them together here? Maybe not, since their careers have taken somewhat different paths since their early collaborations. But both have specialized through the years in tough but finely crafted dance sides that are strong on both melody and rhythm, without sounding mechanical. Recently, the two got together again to make the album *Chic-ism*, which has already spawned one Top 5 dance hit, "Chic Mystique." Talk about the Midas Touch—these guys have it.



Above: Rick Rubin

RICK RUBIN

From the strange-but-true department comes the fact that one of the first truly influential producers in the predominantly African-American genre of rap was a middle-class white kid named Rick Rubin. Originally a punk and metal fan, Rubin became enamored with rap while in college at New York University, and it wasn't long before he was making remarkably sophisticated records with some of the best of the first wave of rappers, including Run-D.M.C. (their crossover smash *Raising Hell*, featuring the group's remake of Aerosmith's "Walk This Way"), LL Cool J and the Beastie Boys (*Licensed to Ill*). It was Rubin who first grafted hard rock guitar onto rap, and in general his productions have always been forward-looking, with little regard for accepted norms of the day. There's a lot more to Rubin than just rap, however. He's also produced acts as diverse as Slayer, The Cult and the Red Hot Chili Peppers (their 1991 hit *Blood Sugar Sex Magik*). Rubin's Def American label has long been an outlet for some of the most aggressive (Danzig) and controversial (Geto Boys) music out there, as well as one mega-popular mainstream band, the Black Crowes.

CHRIS THOMAS

The year that *Mix* was born, 1977, Chris Thomas produced one of the most important records of that decade, *Never Mind the Bollocks, Here's the Sex Pistols*. While not exactly a producer's

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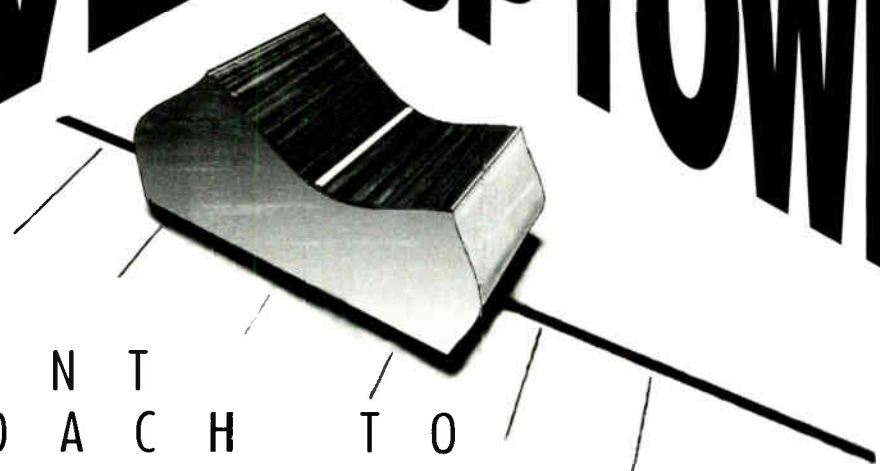

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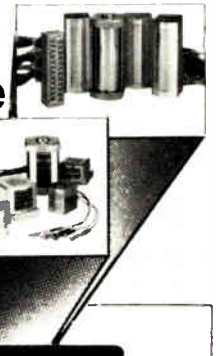

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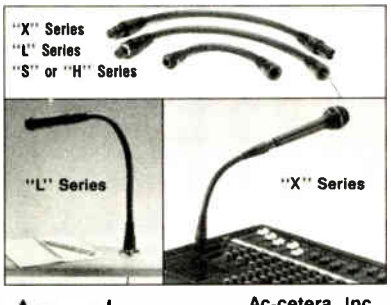

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showcase, the effect that record had on up-and-coming punk and new wave bands everywhere is nearly incalculable. Thomas was already a respected veteran when he tackled that band, having worked with many top English acts, from the Beatles (*The White Album*) to Procul Harum to Roxy Music (all their great early stuff) to Pink Floyd (he mixed *Dark Side of the Moon*). He produced three albums for Pete Townshend, including the amazing *Empty Glass* LP, the first three Pretenders albums and several of Elton John's early '80s discs. More recently, the versatile producer was responsible for shaping the big sound of INXS on three albums: *Listen Like Thieves*, *Kick* and *X*. Thomas has been producing vital albums for two decades now, and he shows no signs of letting up.

NARADA MICHAEL WALDEN
He first made a name for himself as a great young jazz drummer in the '70s, but for the last decade and a half, Narada Michael Walden's name has been synonymous with commercial pop and R&B records. Often writing the songs he produces, Walden has produced close to 50 tunes that have made it into the Top 10, including seven in 1991 alone. He's a master of the big, dramatic ballad—not surprising when you look at some of the singers he's worked with: Mariah Carey, Whitney Houston, Aretha Franklin, Shanice Wilson, Stacy Lattisaw and Angela Bofill, to name a few. He spearheaded Aretha's 1985 "comeback" with his songs "Freeway of Love" and "Who's Zoomin' Who," and he scored hits with such unlikely partners as Starship and Kenny G. As this article was being completed in late April, Walden had three songs on *Billboard*'s Hot 100, two by Shanice Wilson and one by Tevin Campbell. The man who many credit as the technical wizard behind Walden, his one-time engineer Walter Afanasieff, has become an extremely successful producer himself in the last couple of years, too, landing at the top of the charts with sides by Mariah Carey, Michael Bolton and others. Next up from Walden: what is sure to be a smash from Al Jarreau.

THE SECOND TEN (OKAY, ELEVEN)

Tony Brown
Another of Nashville's guiding forces, Brown has specialized in working with some of country music's most interesting and progressive artists, including Steve Earle, Lyle Lovett, Rodney Crowell and Nanci Griffith.

Bob Clearmountain
Probably the single most respected mixer in rock 'n' roll, Clearmountain is a meticulous craftsman who brings out the power of a performance better than just about anyone. As producer, he's helmed projects by Bryan Adams, Simple Minds, Pretenders and a few others, but it's his mixing projects that stand out the most: Roxy Music's *Avalon*, Bruce Springsteen's *Born in the USA*, the Rolling Stones' *Tattoo You* and David Bowie's *Let's Dance*, to name but a handful.

◀ **Jimmy Jam and Terry Lewis**
Influenced somewhat by Prince (*and* vice-versa), this Minneapolis duo has put out consistently high-quality R&B records with a wide variety of artists, including Janet Jackson, Robert Palmer, Alexander O'Neal, Ralph Tresvant, Karyn White and others. Great songwriters as well as producers.

Quincy Jones
If there's a platinum shortage, blame this guy; his Michael Jack-

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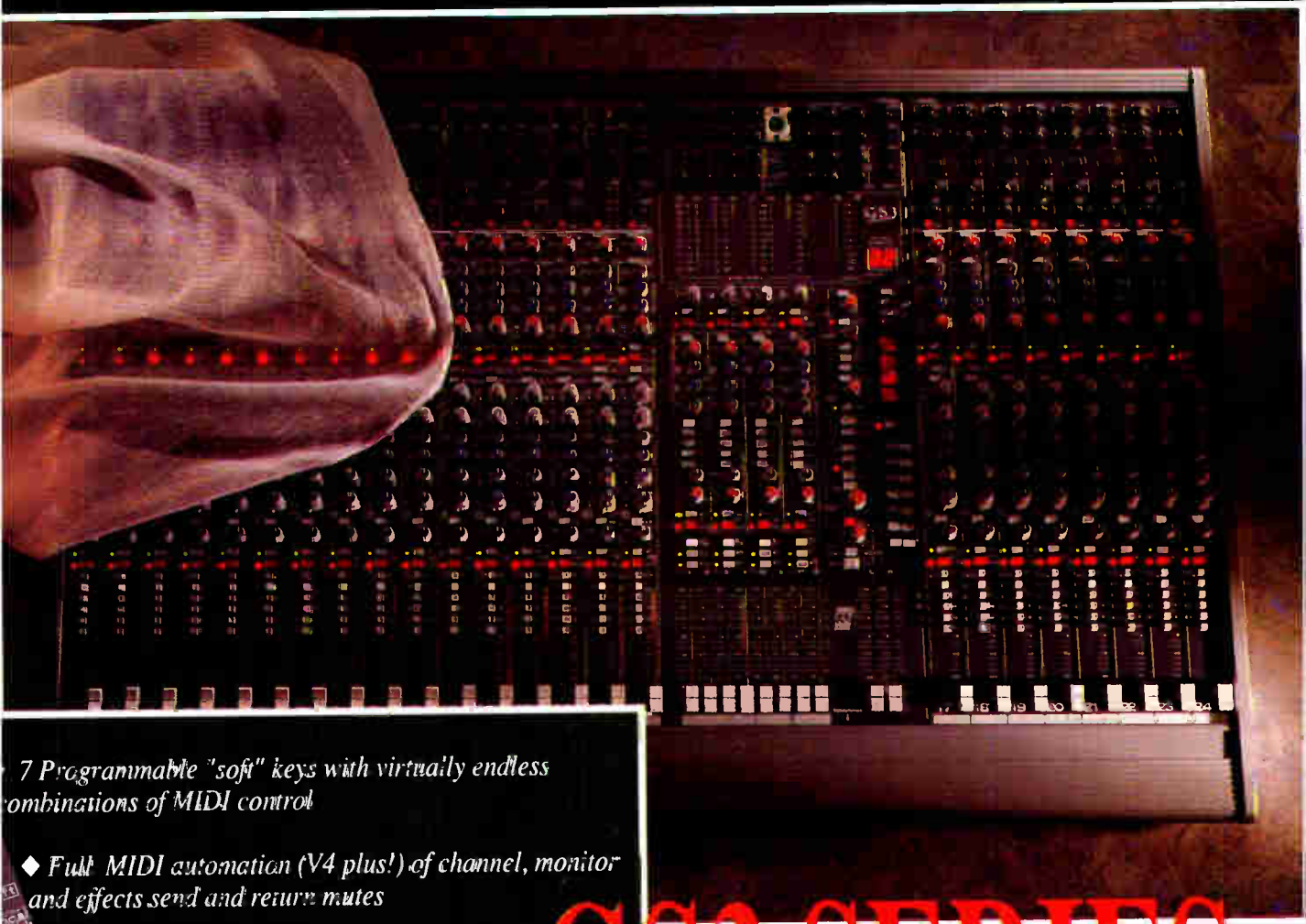

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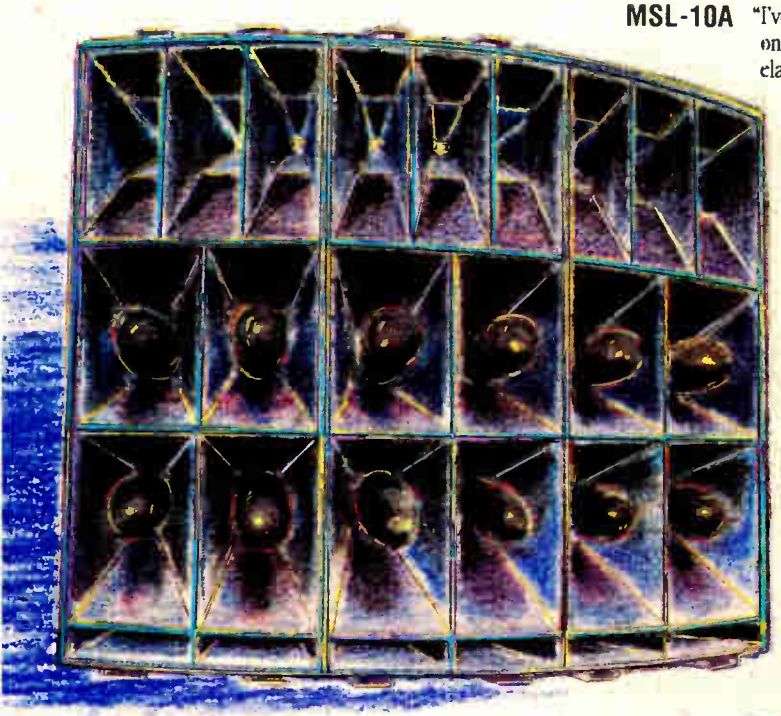

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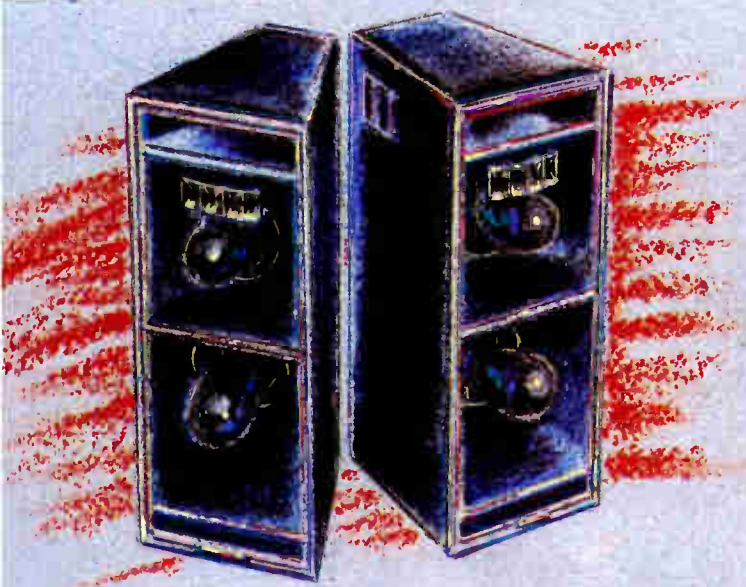

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son albums—*Off the Wall*, *Thriller* and *Bad*—have sold in excess of 50 million copies worldwide. Q is adept at producing every kind of music, from orchestral to small combo jazz. He also produced the "We Are the World" sessions, which influenced many other similarly well-intentioned super-sessions for various causes (though Bob Geldof's "Do They Know It's Christmas" started the trend).

KRS-One
A.k.a., Kris Parker, who was one of the first major producers to emerge from the world of rap. Most of the records he's put out under the Boogie Down Productions name have been tough but sonically cool, and he was among the first to convincingly meld hip hop with reggae (although dub was clearly an influence on hip hop). He produced Sly & Robbie's acclaimed *Silent Assassin* LP. Boogie Down Productions' latest is called *Sex and Violence*.

PHOTO ANDY EARLE

Jeff Lynne ▲
The master of casual precision: He makes records that sound at once intricately crafted (especially those trademark harmonies) and amazingly loose. George Harrison's wonderful comeback with *Cloud Nine*, the two Traveling Wilburys albums and Petty's *Full Moon Fever* and *Into the Great Wide Open* have encouraged other producers to lighten up a little and capture the *fun*.

Marcus Miller ▶
In the world of jazz-funk fusion, the undisputed master for the past decade has been Marcus Miller, who is a real jack-of-all-trades: an extraordinary composer, musician (bass, mainly) and producer. He worked on some of Miles Davis' best later albums (including *Tutu* and *Siesta*, the latter being nearly all-Miller except for Miles' solos) and has also worked his magic with David Sanborn and R&B greats like Luther Vandross, Aretha Franklin and Roberta Flack.

Alan Reynolds
Since the Garth Brooks phenomenon is still in full bloom (it's getting to be like McDonald's—"Billions and Billions Served!"), the height of Reynolds' influence is still to be felt, but you just know there are aspiring record makers analyzing every second of Brooks' albums, trying to decode the winning formula. Reynolds' easy blend of acoustic and electric country has worked for others, too, from Kathy Mattea to fast-rising star Hal Ketchum.

Bob Rock
From the Bruce Fairbairn school of slick but still ultra-heavy hard rock (in fact, Bob Rock engineered on a few of Fairbairn's biggies) comes this bright prospect, who has already produced albums for Motley Crüe (*Dr. Feelgood*), The Cult (*Sonic Temple*), Kingdom Come and, his biggest success to date, Metallica's *Metallica*, which is already something of a standard for how that brand of metal can be made to sound semi-commercial.

Don Was
No one will ever copy his "sound" because he doesn't have one, but in making some of the most natural-sounding, ear-pleasing albums of the last several years—including Bonnie Raitt's last two Grammy-winners, the B-52's and several others—Was is one

PHOTO JEFFREY SCALES

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PHOTO: JAY B. AKESBERG

of the most prominent producers leading a shift toward simple, spare records, and not a moment too soon!

AND TEN (OKAY, ELEVEN) TO WATCH

Walter Afanasieff—Mariah, Bolton; so far this guy can't lose. More than just Narada's protege.

PHOTO: KAREN KUEHN

Malcolm Burn ▲—Out from Daniel Lanois' shadow, Burn has produced Chris Whitley's excellent *Living with the Law* and my favorite Neville Brothers' LP, *Brother's Keeper*.

Robert Clivilles & David Cole—The New York mix kings behind the phenomenally popular C+C Music Factory, they've also shaken up the dance genre with remixes for Lisa Lisa & Cult Jam, Martika, Mariah and others.

Scott Litt—R.E.M.'s *Out of Time* was so popular that it's possible to forget that it is the group's most eclectic and interesting-sounding record to date.

Delfeayo Marsalis ▲—Yes, he's from *that* family, and he's turning into an excellent jazz producer, as his recent work with brother Branford Marsalis, Marcus Roberts and others shows.

Felton Pilate—The man behind much of Hammer's music is smart and supertalented. It will be interesting to see what he can do with other Bust It acts.

Teddy Riley—The king of New Jack Swing is currently hot, hot, hot because of his bold, experimental work on Michael Jackson's *Dangerous*. This musician/arranger/producer also hit big with Keith Sweat and his own outfit, Guy. The upcoming Bobby Brown album is sure to make waves.

James Stroud—One-time Nashville session musician who has been on a winning streak since turning to production. Clint Black, Charlie Daniels, John Anderson and Tracy Lawrence are a few he's hit with.

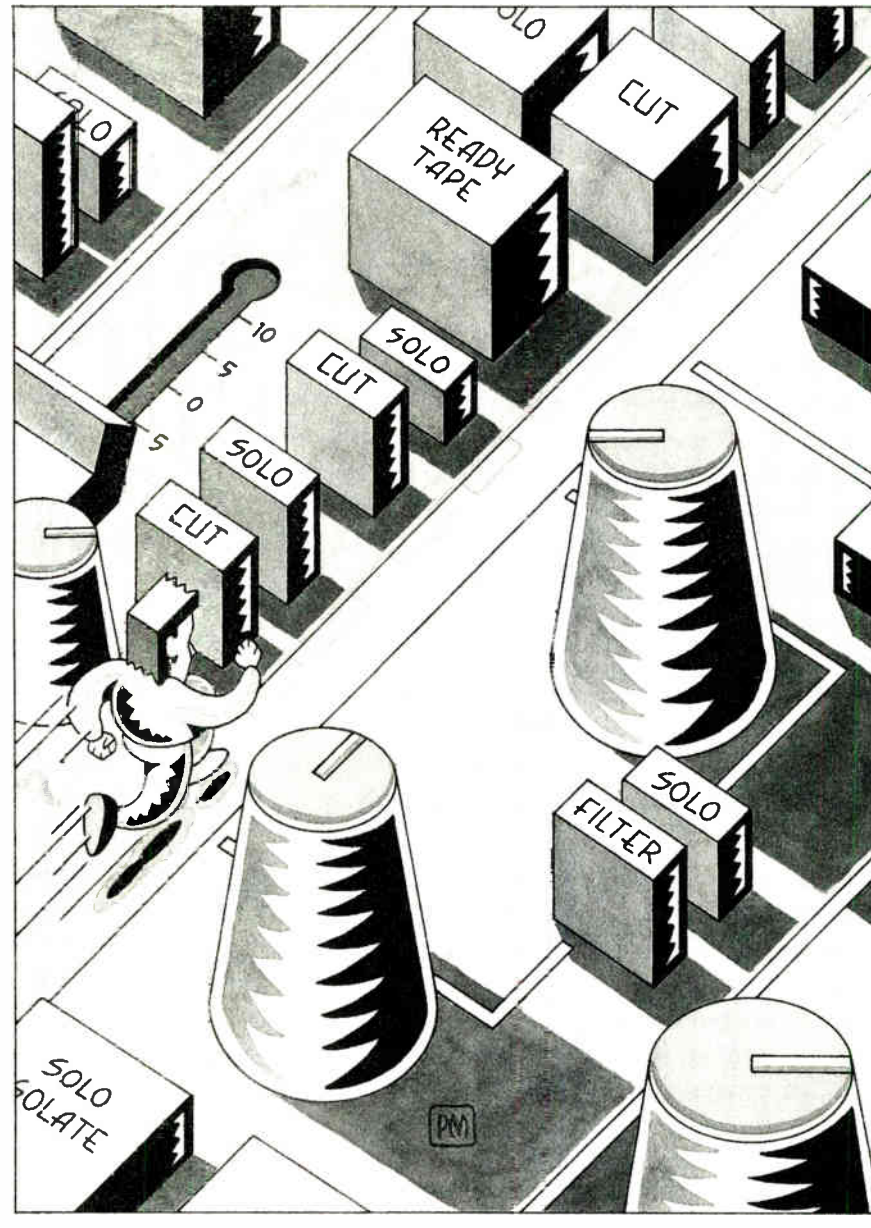
Butch Vig—Nirvana's success has made him an instant celeb. Grunge for the masses? Could Sonic Youth's big breakthrough be next?

Ben Wisch—Mark Cohn's success is no fluke; the album is beautifully recorded and expertly paced. Wisch says he's on a crusade to "keep acoustic-based, artist-oriented music alive." ■

Blair Jackson is Mix's managing editor.

World Radio History

Independent Engineers & Producers



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*; **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.**

TONY ALVAREZ; *Engineer, Producer & Music/Computer Programmer*; **BOOM SONIC MUSIC. Hollywood, CA; (714) 594-3889; FAX: (714) 595-5715. Specialization & Credits:** Roger Troutman (Reprise), Richie Havens (Solar/Epic), A.K. (Elektra), Syd Straw (Virgin), Dinna D. (CBS/Sony), Atoozi (EMI), Gerardo (Interscope), Jennifer Taylor (EMI-France), PolyGram Publishing, Capitol-EMI Latina, Vanity, Mare Winningham, Federation of Love, Babylonia Tiles, Dorian Heart, Mango Bang, The Underthings, Ron Stein's Memories of Elvis, Medieval Times Dinner and Tournament. Tracking mixing, drum programming, guitar. Songwriter/publisher member BMI.

PHIL APPELBAUM; *Engineer & Producer*; **THUNDER DIGITAL. 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.**

PATRICK ARNOLD; *Engineer*; **TRIANGLE AUDIO INC. PO Box 8679, 214 1/2 7th Ave.; S. Charleston, WV 25303; (304) 744-5164; (304) 346-6964. Specialization & Credits:** Engineering: Albums; Ron Soul, *Oil and Water*; Roger Hunt, *Never Too Late*; Cross Country, *Boots*; Jimmy Warren, *Volume I & Volume II*; Appalachian Bible College Gospel Heralds, *Volume II & Volume III*; David Morris, *Song Weaver*; Lefty Shafer, *Mockingbird Hill*; Diamonds and Gold, *Tickle Your Fancy & Dirty Cowboy*; Lisa Thomas, *Believe In Love*; Ethel Caffie-Austin, *Gospel Music...Generation to Generation*; Robert Shafer & Robin Kessinger, *Album of Champions*; Elderberry Records' *The Music Never Dies—A Vandalia Sampler 1981-1987*. Demos: Bob Thompson, The Bobs, Kodac Harrison, The Fabulous Twister Sisters, Larry Groce, Hype Production, Stratus, Ravenslay, Blind Gypsy, Pale Hecate, Blues DuJour, Brian Diller, Mother Nang. Movie Soundtracks: Big pictures productions: *Chillers, Strangest Dreams* and *Paradise Park*. Commercials: W. VA State Fair, Go-Mart, W. VA Lottery, One-Stop Mart, Magic Video.

EDDIE ASHWORTH; *Engineer & Producer*; **ROGUE RECORDINGS. 2629 Manhattan Avenue #202; Hermosa Beach, CA 90254; (310) 372-9327; FAX: (310) 374-5422.**

CURTIS AUTIN; *Engineer, Producer, Technician & Music/Computer Programmer*; **SOUND SERVICES. 39867 Fremont Blvd. #505; Fremont, CA 94538; (510) 657-3079.**

CLIFF AYERS; *Producer*; **EMERALD RECORDS/ENTERTAINER NETWORK. 830 Glastonbury Rd., Ste. 614; Nashville, TN 37217; (615) 361-7902.**

BRITT BACON; *Engineer & Producer*; **6938 Rhea Ave.; Reseda, CA 91335; 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 Out Loaded*, (CBS)(e); Walking Wounded, *Raging Winds of Time*, (Chameleon)(e); Steve Kujala, *Fresh Flute*, (CBS)(e); Van Dyke Parks, *Jump with Whoopie Goldberg*, (HBJ)(e) The Bangles, *All Over the Place*, (CBS)(ae); Chicago, *16*, (Full Moon/Warner Bros.)(ae). Singles: Fear, *New York's Alright if You Like Saxophones*, (Slash)(e). TV/Radio/Films/Artist, etc: 3M, "Steri Strip Adhesive" (ce); Coors, "Original Draft" (ce); *Incredible Sunday (e); In Defense of a Married Man* (Stan Getz)(e); KBIG (recorded and mixed over 120 songs for broadcast). Robben Ford, David Foster, Whoopie Goldberg, Steve Vai, Martin Sheen, Danny Elfman, Eddie Money, Ted Nugent, Robbie Benson, Yngwie Malmsteen, Debra Winger, Humberto Gatica, Davitt Sigerson, Jeff Eyrich.

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, digital editing with Soundtools, pre-production/finished master recordings. Digital mixdown, CD premastering. Producer/engineer/songwriter. Vast experience in synth/drum programming to aid artist in arranging/crafting songs to meet today's standards. SMPTE-based sychronization of multitracks to computer allows for flexible arranging possibilities with virtually no track limitation. Automation and specialized guitar preamps available. 20 synths with extensive sound library. Credits: musical director, associate producer for Rupert Holmes, 3 years; featured guitarist on recording hits *Pina Colada* and *Him*, sound scoring for CBS-TV and FOX TV. Master recordings: Erika Records, Tristan, *Shotgun*; One World Records, Joe Voce, *California*; Macola Records, Michael Christensen, *100 Ways*; MEG Records, Rich Contri, *Everything to Me*. Wrote, produced master recordings for new artist Jodi Bongiovi. Co-produced and mixed Mike Catalano's *Good Neighbors* LP for PolyGram Brazil. Produced and wrote songs for *Police Academy*—cartoon series.

PETER A. BARKER; *Engineer, Producer, Technician & Music/Computer Programmer*; **STORM PRODUCTIONS. 10016 Balboa Blvd.; Northridge, CA 91325; (818) 886-3924.**

KEVIN BEAMISH; *Engineer & Producer*; **KEVIN BEAMISH PRODUCTIONS INC. 4615 Stark Ave.; Woodland Hills, CA 91364; (818) 222-7092. Specialization & Credits:** 19 years of experience as producer/engineer with international multi-multiplatinum success; REO Speedwagon (4 albums including *Hi Infidelity*), Jefferson Starship, Y&T, Saxon, Leather Wolf, MSG and Contraband.

ILLUSTRATION: PAUL MOCH

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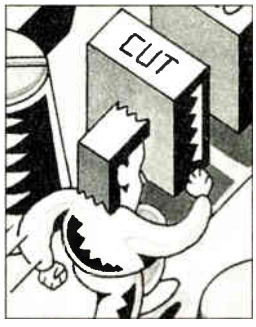

GLENN E. BERKOVITZ, C.A.S.; *Engineer*; **SPINNING REEL SOUND SERVICES. 11929 Windward Ave.; Los Angeles, CA 90066; (301) 313-2776 (L.A.); (914) 429-0493 (N.Y.). Specialization & Credits:** Specializing in audio—production and post-production—for film and television, I bring to my work a thorough knowledge and complete technical inventory of analog and digital recorders and signal paths and a true love for the process. 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.

CARSTEN BOHN; *Engineer, Producer & Music/Computer Programmer*; **BIG NOTE PRODUCTION. Schuetzenstrasse 89; W. 2000 Hamburg 50, Germany; (040) 850-1589; FAX: (040) 850-9490. Specialization & Credits:** The most important service is the direct contact to all major German companies through 25 years in the business and personal expenence from 6 years living and working in New York City.

JOSEPH P. BORGES; *Engineer, Producer & Music/Computer Programmer*; **SANCTUARY PRODUCTIONS. 17 Johnson Ave.; West Caldwell, NJ 07006; (201) 882-6983.**

RICHARD (RICK) 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 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 Rememberance, 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 SENDIT Electronics, line of home and professional studio products. Rates: flexible, reasonable-to-exorbitant for all services, including production. Call for further details.

TIMOTHY BRANNIGAN; *Engineer, Producer & Music/Computer Programmer*; **BRANNIGAN MUSIC. 140 W. 55th St., Ste. 8-B; New York, NY 10019; (212) 307-5372.**

HARRY BROTMAN; *Engineer, Producer & Music/Computer Programmer*; **BROTMAN MUSICAL SERVICES. 19010 Avers Ave.; Flossmoor, IL 60422; (708) 799-7711. Specialization & Credits:** Credits: recent national airplay: Tyrone Davis, *Something's Mighty Wrong* (Ichiban)—engineered; Mac Loving, *Colors*; (Cliquepostive/ATCO)—engineered; L.V. Johnson. *Unclassified* (Ichiban)—engineered; Leo Grahman & Lloyd Taylor, *Whatcha gonna do about it?* (Steeltown)—engineered. Engineered/produced: Housecat, *R U Wit It?*; Friends for Fun, *Jungle Craze*; General Crook, *Too Late Too Soon.* Services: (Sweet) Sixteenth year specializing in the engineering, co-production and programming of music for commercial release. Commander of Time: Linn/Forat 9000, Aphex Studio Clock, Russian/Dragon, T.C. 2290 32sec SIFT. Commander of Space: Dynacord DRP20, Yamaha SPX900, Sony MUR-201. Crunch Factor: Drawmer 1960, Orban 424A, Klark-Teknik DN40, Moog para EQ, Aphex 612, Gatex. Grease Factor: EXR IV, dbx 120XDS. Microphones by: Milab, B&K, Sanken, Beyer. Monitors by: B&W, Westlake Audio.

CHRIS BROWN; *Engineer & Producer*; **PERSON TO PERSON PRODUCTIONS. 342 Norfolk Rd.; Litchfield, CT 06759-0546; (203) 567-9012; FAX: (203) 567-4276. 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. Fourteen albums for the Paul Winter Consort, including 3 Grammy nominees.

GLENN J. BROWN; *Engineer, Producer, Technician & Music/Computer Programmer*; **GLENN BROWN PRODUCTIONS INC. 2211 Seminole Dr.; Okemos, MI 48864; (517) 349-7969; FAX: call.**

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.

RICHARD JAMES BURGESS; *Engineer, Producer & Music/Computer Programmer*; **7095 Hollywood Blvd. #104-345; Los Angeles, CA 90028; (213) 850-7337; FAX: (213) 850-5302. 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.

SCOTT A. BURNETT; *Producer & Music/Computer Programmer*; **DARKHORSE MUSICMEDIA CO. 1201 1st Ave. S., Ste. 307; Seattle, WA 98134; (206) 623-5265.**

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 CANEDY; *Engineer & Producer*; **NEON CITY PRODUCTIONS. 627 Main St.; Simpson, PA 18407; (717) 282-0863; FAX: (717) 282-0362. Specialization & Credits:** *Young Turk*—Virgin/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-*Rods*-Arista/Wild Dogs-Arista/In the Row-Shrapnel/*The Rods Live*-Combat/Let Them Eat Metal-Combat/Heavier Than Thou-Passport/Hollywood-Passport/Thrasher, *Super Session*-Combat/Violent Playground-Big Chief/Phil Acardia-*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. World class production; senstitive to artists's goals. Publishing. Looking for strong new artists. Full in-house 24-track facility with lodging. Resume and studio brochure on request. Contact Dianne Bassett.

PETER M. CARLSON; *Engineer, Producer & Technician*; **HAVE EARS WILL TRAVEL. PO Box 1501; Sonoma, CA 95476; (707) 939-8141; FAX:** can receive at (707) 996-1261.

LESLIE CARRERA-GRIFFITH; *Engineer, Producer & Music/Computer Programmer*; **MIND'S EYE STUDIOS. 169-B Woodward Ave.; Sausalito, CA 94965; (415) 332-1108.**

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 OL1101), 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 video/film footage-to-MIDI sequencer synchronization.

SCOTT COCHRAN; *Engineer, Producer, Technician & Music/Computer Programmer*; **5051 Klump Ave. #207; N. Hollywood, CA 91601; (818) 769-2584; (818) 953-0996 (pager).**

STEVE COCHRAN; *Engineer, Producer & Music/Computer Programmer*; **DALIVEN MUSIC. PO Box 3386; Brentwood, TN 37024; (615) 377-0999; FAX: (615) 377-0999.**

MICHAEL COLLINS; *Engineer & Producer*; **THE COMMERCIAL REFINERY INC. 2105 Maryland Ave.; Baltimore, MD 21218; (410) 685-8500; FAX: (410) 685-0313.**

GEORGE COUNNAS; *Engineer & Producer*; **AVALANCHE RECORDING. 10650 Irma Drive, Ste. 27; Northglenn, CO 80233; (303) 452-0498; (303) 388-8800. Specialization & Credits:** Raised in England with 20 years expenence, I am presently chief engineer/producer for Avalanche Recording. I enjoy a wide range of musical styles, as well as sound sweetening for movies. A partial client list includes projects with The Pretenders, Camper Van Beethoven, INXS, Kip Winger, Fiona, Leon Russell, Fred Wesley, James Brown's All Stars, John Clayton, Jeff Hamilton, Pete Christlieb, etc. Plus the pleasure of working with the best talent in this region. I welcome your projects.

JOE CUNEO; *Engineer, Producer, Technician & Music/Computer Programmer*; **DONNA A. ESTES MANAGEMENT. 52 Mansfield St. #3; Allston, MA 02134-1435; (617) 782-0488; FAX: (617) 783-0662. Specialization & Credits:** Music production and engineering for albums, demos and soundtracks. I have 12 years of experience recording many different styles of music from all over the world. I offer top-quality audio services in all analog and digital formats. I am also a highly trained musician, and I strive to get the best performances from the artists I work with. Production credits: *Like the Idea*—Think Tree (Caroline). *Edelston's Cronos*—Andrew Edelston (Taraka). Engineering credits include: Volo Volo, Tribe, Aerosmith, Meliah Rage, ABC Radio Network, Nils Lofgren, Buddy Guy, Johnny Thunders, K-9 Posse, Skin, Simon Magus and many others. I have over 80 releases to my credit.

DAVID DACHINGER; *Engineer & Producer*; **DEEPRODUCTIONS. PO Box 809; New York, NY 10024-0539; (212) 496-0049. Specialization & Credits:** Was (Not Was), Sheena Easton, Celine Dion, Roberta Flack, Keith Sweat, Michael Bolton, LL Cool J, TLC, Father MC, Jeff Redd, Southside Johnny, Sly Stone, Ernie Isley, Third World, Mtume, The Barkays, New York Voices, Stan Getz, Millie Jackson, The System, The Clark Sisters, Jose Jose, Mijares, Jane Fonda, Arnold Schwarzenegger, Raw Youth. Jingles include: Sprite, Dole Fruit, Burger King, Miller Beer, GTE, Pacific Bell, Kit Kat Bars, Pioneer Stereo. Services: recording engineer and mixer, producer, live sound mixer.

ROBIN DANAR; *Engineer & Producer*; **SQUID PRODUCTIONS. 1689 1st Ave. #1; New York, NY 10128; (212) 289-5868. Specialization & Credits:** The Blue Nile, Suzanne Vega, The Church, Laurie Anderson, B-52's, 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, Peregrins, Walkers, Circus of Power, Longhouse, Urban Blight, Lonesome Val, Joy Askew, Sylvain Sylvain, Richard Lloyd, Chris Stamey, Peter Holsapple, Velvet Rhythm Wranglers, OK Savant, 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.

CHRIS DAVIS; *Engineer, Producer & Music/Computer Programmer*; **SEVERE SOUNDS. PO Box 14250; Austin, TX 78761; (512) 388-3808.**

GLENN DAVIS; *Producer*; **DAVIS SOTO ORBAN PRODUCTIONS. 601 Van Ness #E3425; San Francisco, CA 94102; (415) 775-9785; FAX: (415) 775-3082.**

JIM DEAN; *Engineer & Producer*; **MUSIDEO PRODUCTION GROUP. PO Box 460688; San Francisco, CA 94146; (415) 647-2000. Specialization & Credits:** Credits: Puck 'N Natty, Bongo People, The Square Roots, Kotoja, Hobo, The Leaders (Lester Bowie, Arthur Blythe, Chico Freeman, Cecil McBee, Don Moye, Kirk Lightsy), Loveable Frog, Zuzu's Petals, Joanne Rand, Banana Slug String Band, World Zap Art, Chico Freeman, Jon Jang and the Pan Asian Arkestra, Fred Ho, Patrick Winningham, Ronnie Montrose, SF Acoustic Music Project, Chris Cain Blues Band, Jessica Williams, The Uptones, Lava Magnates, Triple Play, Catapult Music, Earthbeat/Warner Bros., Capitol Records, Enigma Records, Profono/CBS, Blue Rockit Records, Blackhawk Records, Music For Little People Recording Company, Bob-A-Lew Music, Beserkeley Records. Services offered: music production and engineering for albums, demos and soundtracks. I have 13 years experience recording a variety of musical styles from all over the world. I am always listening for new talent and concentrate heavily on artist development while increasing my contacts with record labels.

GREGORY D. DENDY; *Producer*; **JAZMIN PRODUCTIONS. PO Box 6367; Long Beach, CA 90806.**

MICHAEL DENTEN; *Engineer, Producer & Music/Computer Programmer*; **DENTEN PRODUCTIONS. PO Box 1709; Alameda, CA 94501; (510) 521-0321; FAX: (510) 521-0368.**

MARK DERRYBERRY; *Engineer, Producer & Music/Computer Programmer*; **DERRYBERRY AUDIO PRODUCTIONS. 1848 S. Reed Ct.; Lakewood, CO 80232; (303) 986-7166.**

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, commercial music production and songwriting. Additional services in premastering, film scoring and jingle writing. Specializing in pop/R&B, with other styles considered. We are experienced in automated mixing, digital multitrack recording/editing and MIDI. Professional graphic artist and photographer services also available. Experience a Jam with the Factory!

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HANK DONIG; *Engineer & Producer*; **WIZARD MUSIC GROUP. 8033 Sunset Blvd., Ste. 358; West Hollywood, CA 90046; (818) 905-1703. Specialization & Credits:** Kenny Rogers, Lionel Richie, Devo, Air Supply, Crusaders, Egyptian Lover, George Winston, Russ Parr, Kingston Trio, Kin Vassey, Lynda Carter, P.P.I., *Search* G.L.O.W. (musical director for national TV show), *Knockouts* (musical director of national cable TV show), *Platinum Triangle* (musical director for full-length feature film). We also do full-production cue sheets for full-length feature and TV shows. Total production package includes 48+ tracks of digital and analog in state-of-the-art studio, songwriting, all musical instruments, arrangements, and BG vocals; engineering and total package as well as shopping for contracts and/or distribution of master done on a consultant basis. We produce master-quality, radio-ready tapes. Audio post-production for film, including all music cues and sound effects with premix-to-digital format.

BILL DUNCAN; *Engineer, Producer & Music/Computer Programmer*; **G. WILLIAM MUSIC PRODUCTION INC. 1801 E. 12th St., Ste. 1501; Cleveland, OH 44114; (216) 696-8582/ 524-1176; FAX: (216) 696-7929. Specialization & Credits:** Services: commercial music composition, arrangement and production (acoustic and MIDI); engineer/producer; extensive Mac-based MIDI studio in collaboration with Commerical Recording Studios, Cleveland, OH. Credits: four Clios and other various awards for commercial music. Producer for Exotic Birds (Alpha International Records); two Emmys, several ballet scores for the Tom Evert Dance Co.; music consultation for the Cleveland Ballet.

AL EATON
El Cerrito, CA

AL EATON; *Engineer, Producer & Music/Computer Programmer*; **ONE LITTLE INDIAN MUSIC PRODUCTION & RECORDING SERVICE. 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 Publishing & Another Little Indian/Zomba Music Publishing), 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 Little Indian Music is a complete digital and analog (in-house only) production facility that includes 2" 24-track, 2" 32-track, 1/2" 16-track and 2- and 4-track recording. We also offer a Sountracs Quartz console w/automation and over 100 inputs w/EQ and EFX, tons of outboard gear and over 40 synths/samplers and drum machines with thousands of sounds from our massive library, plus digital editing. We are able to handle each project from start to finish and complete the most demanding of remixes and audio-for-video work. Our list of clients include: Too Short, Paris, Kid Sensation, Biscuit, DJ Flash, MC Twist, Jive/RCA Records, Tommy Boy Records, Columbia Records, Atlantic/Rhino/Excello Records, Lethal Beat Records, and we are currently doing a number of music-for- industrial-video projects, as well as other record projects ranging from rap and hip hop to R&B and pop.

ANDY EBBERBACH; *Engineer, Producer & Music/Computer Programmer*; **LAURANDY PROD. 50 W. 72nd St.; New York, NY 10023; (212) 877-5686.**

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 theatre or film. Production, co-production with artist or producer, pre-production planning, arrangement consultation and project management. Experienced in many different musical styles; specializing in recording live instrumentation. Efficient, easy-going atmosphere dedicated to capturing and enhancing artist's sound. Flexible rates. Credits and references available upon request. In this election year, please consider voting for public representatives who have the environment and personal freedom upper-most in their minds.

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MARK EVANS; *Engineer & Producer*; **SILENT PARTNER PRODUCTIONS. 14954 Tulipland Ave.; Canyon Country, CA 91351; (805) 251-7509.**

DALE EVERINGHAM; *Engineer, Producer & Music/Computer Programmer*; **AUDIO VISIONS. 6289 Clive Ave.; Oakland, CA 94611; (510) 482-2338. Specialization & Credits:** Audio Visions production and engineering services offers you over 10 years of full-time experience in all areas of recording production. 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. Artists: Tony!Toni!Tone!, En Vogue, Thomas Dolby, Eddie Money, Too Short, Kenya Gruv, Pooh Man, Samuelle, Mazzy Star, George Winston, Rickie Lee Jones, Spice 1, Pharoah Sanders, William Ackerman, Michael Cooper, David Grisman, Voicestra. Film/video: *Boyz n the Hood*, Levi 501s, *Juice*, California Lottery, Anheiser Busch, Lotus, Longs, Colombo, Gallo, Dep, KPIX, KRON, Capwells, Samtrans, Lucas Firms, NBC.

SHANE H. FABER; *Engineer, Producer & Music/Computer Programmer*; **NOW+THEN MUSIC. 501 78th St. #3; North Bergen, NJ 07047; (201) 854-6266. Specialization & Credits:** NOW+Then 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. He is equally at home on either side of the console, a gifted guitarist and keyboard player and a master of putting the "Human Feel" back in MIDI machines. He has a publishing/development deal with Warner-Chappell Music and has opened SOUND DOCTOR STUDIO, his own 32-track facility, minutes from midtown Manhattan. Produced: *Turtle Power*, rap theme from first Teenage Mutant Ninja Turtle movie (Gold US, Gold UK); *Partyline*, 5th Platoon (SBK); mixed Grammy-nominated *Fly Girl*, Queen Latifah (Tommy Boy); Brand Nubians, Leaders of the New School (Elektra), Shaka (Arista), Fred Estiere (PWL).

JIM FEMINO; *Engineer & Producer*; **JIM FEMINO PRODUCTIONS. 429 S. Lewis Rd.; Royersford, PA 19468; (215) 948-8228; FAX: (215) 948-4175. Specialization & Credits:** Artist/producer just outside of Philly with own 16-track facility. Credits include working with Brad Delp (Boston), Bricklin, Essra Mohawk, Stan Penridge (Kiss). Three solo albums, all charted. ASCAP and BMI-affiliated publisher along with full-service production facility. In-house writers and musicians available. 1991 produced albums by Inhuman Condition, Almighty Shuhorn, Random Chidren, Mother's Garden, Michael Braunfeld. Specializes in country and crossover.

KENN FINK; *Engineer, Producer & Music/Computer Programmer*; **DEEP SPACE RECORDS. 1576 Great Highway #307; San Francisco, CA 94122; (415) 566-6701.**

JIMMY & SUSIE FOOT; *Producer*; **BONGO BOY PRODUCTIONS. 15 Idora; San Francisco, CA 94127; (415) 681-5822. Specialization & Credits:** Specializing in, but not limited to, World Beat and Reggae music. Production Credits: Reggae Jackson (album), The Rhyth-O-Matics (2 albums, 1 single), Borracho Y Loco (album), Rod Deal & The I-Deals *Truth & Rights* (album); ESPN *Surfer* magazine soundtrack, music for the surf film *Bustin' Out* by Chris Klopf, *Storm Clouds and Lightning* by John Dupuy (single). Other Credits: work with numerous artists in the Bay Area including Joni Haastrup, Hedzoleh Soundz, Rambin' Jack Elliot, Holly Near, The Athletes and Jah Love.

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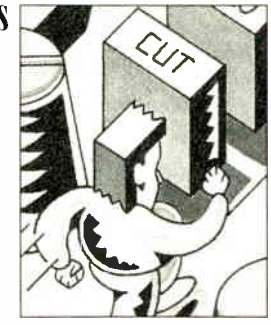

MICHAEL FREEMAN; *Producer;* **PO Box 1308; Barrington, IL 60011; (312) 822-0305; FAX: (312) 464-0762. Specialization & Credits:** Credits: The Bad Examples (Waterdog/CNR Records); Eleventh Dream Day (Amoeba Records); Eddy Clearwater, Magic Slim & The Teardrops, Carey Bell, Hubert Sumlin, Little Mike & The Tornadoes, Joanna Connor (Blind Pig Records); The Reverbs (Metro America/Victor Japan); Paul Castain (Pet Sounds/CBS); The Service, The Hollowmen (Pravda Records); Candi Staton (Source Records).

C.W. FRYMIRE; *Engineer & Producer;* **MODERN MINSTREL MIXING & RECORDING. PO Box 19112; Minneapolis, MN 55419; (612) 824-4135; FAX: (612) 332-6663.**

CHAS GERBER; *Engineer;* **GERBER ACOUSTIC SYSTEMS INC. 513 Rockmill Ct.; Lawrenceville, GA 30244; (404) 339-0708; FAX: (404) 339-7083. Specialization & Credits:** Industrial theatre/show specialist. Sound system design and on-site engineering for large and small corporate events. Sound reinforcement and recording credits too numerous to mention, but include everything from Bruce Springsteen—"Born to Run" tour—to Phonodisk Nigeria Ltd. studio design to Sony Corp. business show. Precision delay speaker alignment techniques performed on site.

PAUL GERRY; *Engineer, Producer & Technician;* **THE CUTTING EDGE. Box 217—Old Route 17; Femdale, NY 12734; (914) 292-5965; FAX: (914) 292-2313.**

TONY GIOVANNETTI; *Engineer & Producer;* **DELTA PRODUCTIONS. 135 MacDougal St.; New York, NY 10012; (212) 473-5385. 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," Miami Beach; Philadelphia, 30th St. Station; Battery Park City, New York International Festival; Bradbury Bldg.-Los Angeles; State of Illinois Bldg., Chicago; Grand Central Terminal, NYC.

RENZO GIROMINI/BARBARA SUE ROSEN; *Engineer, Producer;* **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.

PAUL GOODRICH; *Engineer, Producer, Music/Computer Programmer;* **AUDIO ARTS. 224 Sullivan St., Apt. E-41; New York, NY 10012; (212) 254-1027. Specialization & Credits:** Credits: Michael Jackson, Yoko Ono, Southside Johnny, Buster Poindexter, Run-DMC, Queen, Nona Hendryx, Heather Mullins, John Cale, Frankie Knuckles, John Poppo, Rob Stevens, Freddy Bastone, Bob Riley, Tom Russell, The N.B.A., The Playboy Channel, Japan Radio Network, Bristol Meyers, Forever Plaid in Hi-Fi, Random House Audio, Bantam Audio, Dodge/Chevrolet. Services: From 8-track pre-production to 48-track digital master we can help you get the highest-quality product and keep it within your budget. Digital editing, MIDI production, live tracking, automated mixdown or lock-to-picture, none of this is a problem. Give us a call and let us solve your problems.

ROGER GUERIN; *Engineer & Music/Computer Programmer;* **INNOVASSON. 669 de Gaspe; Nun's Island, Quebec, H3E 1J1 Canada; (514) 952-2669; FAX: (514) 279-0100. Specialization & Credits:** Nominated for a Felix in 1986. Participated in more than a dozen albums, including 5 Canadian platinum albums. Worked with most of Quebec's French and English artists including Leonard Cohen, Raoul Duguay, Michel Lemieux, Michel Pagliaro, Aldo Nova, Robert Charlebois, Men Without Hats, Pierre Letourneau, Claude Leveille, Michael Breen, Joe Bocan, Johanne Blouin, Madame, Passe-Partout. The occasional music soundtrack recording, numerous jingles, a long list of singles and high-quality demos have given me the expertise and know-how to tackle a project from pre-production to the sweetening of the video clip. Familiar with most synchronization systems, I am SSL, MIDI, Synclavier and Direct-to-Disk literate. Send a blank R-DAT for a full resume and past projects examples.

MARK HAFFNER; *Producer & Music/Computer Programmer;* **MARK HAFFNER MUSIC. 3935 La Honda Way; Carmichael, CA 95608; (916) 944-2422; FAX: (916) 944-8449. Specialization & Credits:** Produce commerical ads and television promotion music, news packages for television stations and scoring for feature film. Credits: The Donahue Show, Toyota, New York State Fair, Lee's Chicken, Opryland USA, Caterpillar, The Salvation Army and television stations across the United States. Our company produces music combining Macintosh-based programming and digital editing with the live performances of singers and musicians. Production styles from rock, hip hop, blues and jazz to full orchestral recording and arranging.

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, Empire, EP), UB40, Sir Mix-a-Lot, Kenny G., Slam Suzzanne, The Look, 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.

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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-three years experience in on-location recording projects. Three gold and one platinum RIAA awards and four Ampex Golden Reel awards. Recent projects: Alan Jackson TNN in concert, Preservation Hall Jazz Band Live, Arc Angel ABC In Concert, Farm Aid V, Queensryche *Live Mindcrime* video, American Public Radio *Riverwalk*, Asleep at the Wheel Live, MAZZ *una noche juntos Live*, Bronco Live in Monterrey. 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:** Focusing on international projects with work in progress in California, Europe and Asia. As well as mainstream projects, we are interested in new or established talent and performing artists of diverse cultural and musical origins. Hart Productions also maintains an office at Condulmer Studios in Venice, Italy. Tel: 39(41) 457-370, fax: 39(41) 457-182. Album credits: Hammer, Marky Mark and the Funky Bunch, Jasmine Guy, Sheila E., Vasco Rossi, Next Issue, Neville Brothers, Flora & Arto, Guernica, Steve Smith/Vital Information, UZEB, Hsin-Lien Wang, Will Ackerman, Suzanne Ciani, Chang Yu Sheng, Special Generation, Spinners, Fausto Leali, Kanter/Balin/Cassady, Pete Escovedo, Stein/Walder, Melissa Etheridge, Oscar Peterson/Joe Pass, McCoy Tyner, Andy Narrell, Azymuth, Stephane Grappelli, Kingfish, Buddy Miles, Ray Lynch, John Handy, Andy Summers, Joe Satnani, Branford Marsalis, Billy Idol, Huey Lewis and the News, Steve Perry, Queen Ida, Jan Hammer, Eddie Money, Grateful Dead, Carlos Santana, Micheal Hedges, John Denver, Jimmy Barnes, Journey. Film post credits: *At Play in the Fields of the Lord, Amadeus, Unbearable Lightness of Being, Dead Poets Society, Blue Velvet, Wildcats.*

BRUCE HAVERY; *Engineer;* **ROCK N' SOUND PRODUCTIONS. 99 Thorny Vineway; Toronto, Ontario, M2J 4J4 Canada; (416) 490-7957. Specialization & Credits:** Services include sound engineering for recording projects and live sound. House tech for downtown Toronto club. Rock, hard rock, alternative rock. Mostly mixing original music. Available for one nighters, seasonal, freelance.

GARY HEDDEN; *Engineer & Producer;* **GHL. 2807 Azalea Pl.; Nashville, TN 37204; (615) 269-5183; FAX: (615) 385-0204. Specialization & Credits:** 29 years in professional audio recording. Broad base of technical and musical knowledge and experience. Greatest interest lies in pop-jazz fusion as a technical producer. Services include vast inventory of portable equipment.

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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 digital recording and editing; arrangements and lyrics; music video packages; multimachine lockups, studio and location production services for video and film. MIDI/SMPTE interfacing to video, film and live performance with MIDISCORE™, featuring Macintosh IIcx™ computer. Sample library, sample editing, synthesizer and drum programming, custom signal processor software and unusual equipment rentals.

TOM HERBERS; *Engineer & Producer;* **4410 W. Lake Harriet Pkwy.; Minneapolis, MN 55410; (612) 927-5348; FAX: (612) 870-4367.**

DENNIS HETZENDORFER; *Engineer & Producer;* **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, Lynyrd Skynyrd, Eddie Money, Beach Boys and others. Owner and director of Recording Skills Workshop, a 4 week intesive 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.

DANNY M. HILLEY
Nashville, TN

DANNY M. HILLEY; *Engineer & Producer;* **F.I.R.S.T. ENGINEERING & PRODUCTIONS. PO Box 1121; Nashville, TN 37065; (615) 794-3660. Specialization & Credits:** Credits/services: Neve, Trident, API and SSL projects done in Nashville, NY, Los Angeles, Minneapolis and Europe—digital or analog. Prefer analog tracking with tube and discrete mic pres. Have over 40 available Telefunkens, Langevins and APIs. Also, vintage mics available. Prefer a team philososhpy with my own highly trained second engineer with outboard and technical gear. Also, have designed and built studios for pop producer and musician clients. Have work projects for Ahmet Ertegun/Atlantic Records, George Martin, Neil Young, John Boylin, as well as multiple #1's for Eddie Rabbit/Suspicions, Barbara Mandrel *If Loving You Is Wrong*, Conway Twitty, Ronnie Milsap and many more. Sixteen years experience.

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 Krimsky, Merl Saunders. Services: recording and concert engineering, album, film and demo productions; consulting.

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GORDON D. HOOKAILO; *Engineer, Producer, Technician & Music/Computer Programmer;* **GDH PRODUCTIONS. 4627 Coldwater Cyn. #116; Studio City, CA 91604; (818) 763-4853. Specialization & Credits:** Services include: engineering, production, digital CD editing and mastering, sound design, project management, troubleshooting and MIDI/DAW training. GDH Productions now offers audio sweetening for film and video. The portable facility includes a Pro Tools System resolved to house sync. Comprehensive custom SFX and music libraries are available, as well. Video/film mix for picture, sound design, music editing and score recording include work for ABC, PBS, (NOVA) Nickelodeon Network, many ind. TV stations and producers, LARA Classics features; *The Imported Bridegroom*, industrials and multimedia presentations. Over 15 years of music work including David Bowie, Stephen Stills, Stevie Wonder, Jon Butcher, O'Positive, Allan Zavod, Phish, Jonathon Richmond and many others. I specialize in creative solutions to unique production problems. My goal is to enhance your project and bring it to life so your message, whether it be music, sound effects or dialogue, transcends the limitations of the media.

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STEPHEN G. JARVIS; *Engineer & Producer;* **AKASHIC RECORDS GROUP. PO Box 395; Danville, CA 94526; (510) 837-7959.**

MICHAEL JAY; *Producer;* **CAPTAIN HOOK PRODUCTIONS. 22647 Ventura Blvd., Ste. 251; Woodland Hills, CA 91364; (818) 883-2946; FAX: (818) 883-1778. Specialization & Credits:** Produced and wrote Martika's #1 hit *Toy Soldiers*. Others include Keedy, Seiko, Donnie Wahlberg, Brenda K. Starr, Kylie Minogue, Alisha, Peter Allen, Melissa Manchester, Gloria Estefan, Five Star, Evelyn "Champagne" King, Tracie Spencer, Animotion and Cherish.

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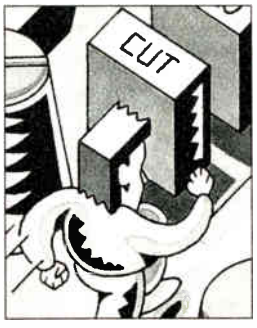

E. KEVIN JONES; *Engineer & Producer;* **SOUND & SOUND ALIKE. 790 Riverside Dr., Ste. MP; New York, NY 10032; (212) 926-8294. Specialization & Credits:** Lisa Lisa & Cult Jam, Hi Five, Melba Moore, The Boys' Choir of Harlem, The Family Stand, Surface, Stephanie Mills, Najee, Club MTV, Palladium, Ashford & Simpson, Eddie Murphy, S.O.S. Band, Harry Belafonte, Atlantic Starr, Johnathan Bulter, George Howard, 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, inlcuding personal security, stage design and tour managing.

KAREN KANE; *Engineer & Producer;* **17 Bodwin Ave.; Toronto, Ontario, M6P 1S4 Canada; (416) 760-7896. Specialization & Credits:** Have been engineering and producing for over 17 years. Have extensive experience with on-location recording and live sound. Originally based in the New England area, I've worked on over 90 albums projects, plus hundreds of demos and EPs including Tracy Chapman and GG Turner. 1991 US chart activity with the new Chad Mitchell album (Silver City Records/Sony Music). Other albums I've worked on have been nominated for Boston Music Awards. Other credits include: Razzy Bailey, Carl Kees, Doug Barr, Close Enough, Fred Small, Linda Worster, Southern Rail, The Chicken Chokers, Matt Glaser, Flor de Cana, Kay Gardner, Judy Fjell, Alix Dobkin, Therese Edell, Laura Berkson, Suede, Robert Gass, Matt Johnson, John Michaels, Jay Smar, Wheeler & Carol and many more.

GEORGE KAZANE; *Engineer, Producer, Technician & Music/Computer Programmer;* **ANYTHING AUDIO/VIDEO LTD. 36-21 165 St.; Flushing, NY 11358; (718) 358-7030.**

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. Specialization & Credits:** Credits incude Suzanne Ciani, Brian Eno, The Fixx, Elton John, Graham Parker, Pebbles, Jean-Luc Ponty, Linda Ronstadt, Veronique Sanson, Slayer, Michael Stanley Band, Wall of Voodoo, Bill Ward (of Black Sabbath). Weather Report, "Weird" Al Yankovic, and in film and TV music, *Bethune, Poison Ivy, Mother Goose Rock N' Rhyme, Thirthysomething.* Services: Music production and engineering in all its forms.

JAMES L. KENNEDY; *Engineer & Producer;* **HEART CONSORT MUSIC-BMI. 410 1st St. West; Mt. Vernon, IA 52314; (319) 895-8557.**

DAVID KENT; *Engineer & Producer;* **MINNEAPOLIS AUDIO GROUP. 11445 Anderson Lakes Pkwy. #207; Eden Prairie, MN 55344; (612) 941-2808.**

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.

EDDIE KRAMER; *Engineer & Producer;* **REMARK MUSIC LTD. Box 838; Rhinebeck, NY 12572; (914) 266-4331; FAX: (914) 266-4332.**

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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 24-year-old producer/engineer, La Serra is earning respect and gaining recognition in the music business. His most recent credits are engineering and mixing of Lynda Nader's *Take Me to the Edge* (Libra); remixing of Robbie Nevill's *For Your Mind* housemix (EMI); production and engineering of M.A.D.A.'s *Feel Like Jumpin* (Nervous); and production and engineering of *Technical Difficulties* (Mic Mac). La Serra and the La Serra Productions family are street smart and pop oriented, specializing in house, freestyle, hip hop, techno and of course pop. Combine the engineering and production specialities of Robert (B.La) La Serra, the street knowledge and mixing talent of Victor "Vicious Vic" Ortiz, the magical keyboard playing of Mark "Mr. Melody" Leonard, and their home base of Strong Island Studios, and you can rest assured you'll have one slammin' track on your hands "guaranteed fresh".

GEORGE LANDRESS; *Engineer, Producer & Music/Computer Programmer;* **6138 Glen Holly; Los Angeles, CA 90068; (213) 462-3220; FAX: (213) 462-3220.**

SCOTT D. LEE-BENNER; *Engineer, Producer, Technician & Music/Computer Programmer;* **LIVING CONDUIT MUSIC CO. 20503 Hamlin St.; Canoga Park, CA 91306; (818) 348-7433. Specialization & Credits:** Ethical, eclectic, creative, competent, state-of-the-art knowledgeable, energetic, musical brother, empathetic to your musical ideas and here to service all your recording needs. I'll go with you through all phases of the recording process, from complimentary preproduction consultations, choosing a studio, down to mastering and tape/CD pressing and release. Analog, digital, MIDI, direct-to-hard-disk. What's your pleasure? (What's your budget?) No project too simple or too complex. The more creative, original and musically virtuosic, the better! Any budget will be worked with. All musical genres acceptable, from acoustic blues to Zydeco and everything in between. You come to me or I'll come to you. From Boston to Bakersfield, from Seattle to St. Augustine. Have tape, will travel. Get in touch. Let's make a HIT! Bam! Zoom! To the moon, Alice.

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. Record live-to-DAT at your home or gig from $20 an hour. Small budget projects welcome. 21 years of audio engineering, broadcast production and voice-over talent for diverse bands and clients like KC and The Sunshine Band, Spanish Dogs, Travis Moon, Double Identity, Shenanigans, Trumpet Jubilees, Masters of Disaster, Metroplex Communications (Y-100/WHYI FM), Video Jukebox Network, J.C. Penney, UNISYS Corporation, Humana, HF Communication Media and Marketing Group, Reflections Development Corporation, Hawthorne Advertising, Miami Video Productions, Beverly Hills Proform and thousands more. Remix, edit and live sound specialist. Reach your goals. Call us. You can't succeed if you don't try. No project too small, no challenge to large. P.S. We can't dance.

JEFFREY LESSER; *Engineer & Producer;* **JET LASER PRODUCTIONS. 232 Madison Ave.; Cresskill, NJ 07626; (201) 816-9144; FAX: (201) 816-0782. Specialization & Credits:** Producer: The Roches, Rupert Holmes, Barbra Streisand, Pat Travers, Head East, Sailor, Strawbs, Straight Lines, Sparks, Starcastle, Hounds, Vivabeat. Co-producer: Jeffrey Gaines, Judybats, Jet Plane Jane, Medicine Men, Eric Bogosian, Timbuk 3, Kool 'N The Gang, Carboy, Won Ton Ton, Colourfield, Chiefs of Relief, Royal Crescent Mob, Will & The Bushmen, 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 Ocasek, Oingo 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;

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SSL "G", 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.

REGGIE LUCAS; *Producer*; **KALISA INC. 512 Paterson Plank Rd.; Jersey City, NJ 07307; (201) 656-7023; FAX: (201) 656-1192. Specialization & Credits:** Also owner of 48-track Quantum Sound Studios. Producer of Madonna, Safire, Stephanie Mills, Randy Crawford, Phyliss Hyman, Lou Rawls, Four Tops, Nick Scotti and others.

GARY LUX; *Engineer & Producer*; **RECORDING ENGINEER SERVICES INC. 399 Southridge Dr.; Agoura, CA 91301; (818) 707-3988.**

NIKOS LYRAS; *Engineer & Producer*; **NEW MEMPHIS MUSIC. 1503 Madison; Memphis, TN 38104; (901) 276-8518.**

DON MACK; *Engineer & Producer*; **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 Bacharach, Barry Eastmond, Aretha Franklin, Dionne Warwick, Jane Fonda, Cynema, Odin, Y&T, Kronos Quartet, Pat Gleeson. 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.

JOSEPH MAGEE; *Engineer & Producer*; **MAGEE AUDIO ENGINEERING. 5614 W. Pico Blvd.; Los Angeles, CA 90019; (213) 933-5147; FAX: (213) 933-0182.**

COOKIE MARENCO; *Engineer, Producer & Music/Computer Programmer*; **PO Box 874; Belmont, CA 94002; (415) 595-8475; FAX: (415) 598-0915.**

CRAIG MASSAR; MPH, CHES; *Producer*; **TURNING-POINT MEDIA. PO Box 574; Van Nuys, CA 91408; (818) 983-0530. Specialization & Credits:** Producer of "Eighties and Beyond," a highly acclaimed informational-health oriented program, which aired for two years on local Los Angeles radio. We specialize in informational-entertainment program development and production for broadcast. We also provide computer automated compostion and arrangement (theme music, jingles), computer generated graphics/animation, video production for any application and voice-over services.

CLIFF MASSIE; *Producer & Music/Computer Programmer*; **THE HIT HOUSE INC. PO Box 102; Bethpage, NY 11714; (516) 735-3452.**

SCOTT MATHEWS; *Producer*; **PROUD PORK PRODUCTIONS. 230 Montcalm 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 and the News, Eddie Money, Van Morrison, Roy Orbison, Bonnie Raitt, Little Richard, 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.

JOHN D. MAYFIELD; *Engineer*; **JOHN D. MAYFIELD SOUND ENG. INC. 3925 Bryn Mawr; Dallas, TX 75225; (214) 691-1420; FAX: (214) 691-6108. Specialization & Credits:** Twenty years experience, recorded and mixed a Grammy nominated album-1991, and come with $85,000 worth of mics and processing. Recent sessions have taken me to London (Lordon Symphony), Tokyo (Disney), Los Angeles, New York, Nashville, Miami, etc. Microphone list includes: Neumann U47 tube, Sanken CU-41, AKG, B&K, Milab, Microtech-Geffel, etc. Processing list includes: Neve mic pre and EQ, Summit mic pre and EQ, Lexicon 480L, Drawmer, BSS, Wendel, Aphex, Rolanc, Dolby SR, Panasonic DAT, etc. Call for travel and rate info: (214) 691-1420.

KENNETH MCGEE; *Engineer, Producer, Technician & Music/Computer Programmer*; **MASTERMIX AUDIO. PO Box 924; Eatontown, NJ 07724; (908) 389-5958.**

SEAN MCNAMARA; *Producer*; **PERENNIAL PRODUCTIONS. Box 109, 73 Hill Rd.; Redding, CT 06875; (203) 938-2962.**

FRANK MERWIN; A&F MUSIC SERVICES. 2834 Otsego; Waterford, MI 48328-3244; (313) 682-9025; (313) 669-3100; FAX: (313) 669-8720.

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BRAD S. MILLER; *Engineer & Producer*; **MOBILE FIDELITY PRODUCTIONS OF NEVADA. PO Box 8359; Incline Village, NV 89450-8359; (702) 831-4459; FAX: (702) 831-4485. Specialization & Credits:** Founder, Mobile Fidelity Sound Lab, Mobile Fidelity Records and Productions, creator of the Mystic Moods Orchestra and producer/engineer of numerous special effects recordings. Principal in development of Colossus digital audio system with Louis Dorren. Location/studio recording where accurate archival of live performance or final mix is required. Production services include the Colossus (4-channel) PCM digital audio system with 1630 compact disc format compatibility; and/or 4-channel "soundfield" microphone (MS-4). Recommend that interested parties inquire as to latest compact disc samples in release by clients utilizing Colossus, MS-4 or both. Conversion of existing sound effects and music libraries into Colossus format and then to optical hard disk also available. Written information package available upon request.

BRUCE MILLER; *Engineer*; **c/o 23 West Entertainment; 71 W. 23rd St. #1611; New York, NY 10010; (212) 627-9570; FAX: (212) 627-0778. Specialization & Credits:** Yes, Mariah Carey, C&C Music Factory, Miles Davis, Duran Duran, Luther Vandross, Billy Idol, Roberta Flack, Robbie Nevill, J Boys, Seduction, David Sanborn, EU, PIL, Roy Orbison, Dr. John, Joe Sample, Natalie Cole, Bros, Ishinobu Kabota, Toshiki Kadomatsu, Teramasu Hino, Kenny Garrett, Tommy LiPuma, Marcus Miller, Chaka Khan, Debbie Gibson, Boy George, Secession, Silencers, Midnight Star, SKYY, Klaus Nomi, Nia Peeples, Noel, Stephanie Mills, Motown remixes (Jackson 5, Marvin Gaye, 4 Tops) Halo Sanshiro, Hurricane Party, T-Square, Minnic, New Kids on the Block.

PAUL C. MILNER; *Engineer & Producer*; **"A" MAJOR SOUND CORP. 7808 Yonge St.; Thornhill, Ontario, L4J 1W3 Canada; (416) 889-7264. Specialization & Credits:** Paul has an engineering background, and has gained credits and experience with Glass Tiger, Queensryche, Men Without Hats, Keith Richards, Eight Seconds, Paul Piche, Luba, Liberty Silver, Andre Gagnon, Vain, Robert Palmer, Brian Greenway, Sass Jordan and the list goes on. Recent work includes Medicine Men, The Scramblers, Kevin Jordan, Andy Morris, Doughboys, Trains of Winter, I Mother Earth, Juno nomination 91/92 Recording Engineer of the Year.

JOE MIRAGLILO; *Engineer, Producer, Technician & Music/Computer Programer*; **FISHBOWL PRODUCTIONS. 89 Clinton St.; Everett, MA 02149; (617) 389-5816.**

BEN MONROE; *Engineer, Producer, Technician & Music/Computer Programmer*; **48 K AUDIO RECORDING STUDIOS INC. 4625 Lee Ave.; St. Louis, MO 63115; (314) 381-0828; FAX: (314) 524-7650. Specialization & Credits:** 24+, also remote recording. Owner: Ben Monroe. Engineers: Ben Monroe, Rob Titus, Al Caldwell, Christian Warren and Stephen Duhart. Mixing console: DDA DMR12 up to 112 inputs, MIDI mute automation. Studio recorders: 24 digital A-dam, (2) Panasonic 3500 DAT, E22 1/2" 30 ips, MR1 Nakamichi cassette, TEAC 1/4" 2-track. Sychronization: PPS100, Syncmanpro. Reverb and delay systems: TC2290, Eventide H3000, Lexicon 200, (2) PCM42, LXP1, LXP-5, (3) Yamaha SPX90II, (2) SPX90, (3) Roland SRV-2000, SDE-3000, (2) SDE-1000, DEP-5, (3) BBE 402, (8) dbx 166, (4) Aphex exapnder/gate, dbx 463x gate, (3) dbx 263X de-esser. Other outboard: Drawmer tube dual comp 1960, UREI 1178 dual comp/limiter, (4) UREI 537 1/3 EQs. Microphones: Neumann U-87, (4) AKG 414, (4) Sennheiser 412, 441, (2) 409, (2) AKG 460, (2) AKG 451, (2) Milab VM44, (2) RE20, (4) AT11, (5) AKG 321, (4) D112, (8) AKG 125, (2) Beyer M88, SM81, (2)SM7, (8) 58, (10) 57. Monitors and amps.: KRK 13000, JBL 4408, Yamaha NS-10, Kenwood 3-way 6x9 car speakers, Bryston 4B, (2) Hafler PRO500, Crest and Crown. Musical instruments: M1, D50, EPS-M, HR16 &16B, Linn 1000, Akai sampler, Kawai-K4, M3R, (2) D110, (2) Sonor drum kits 8 pc., 6 pc., signature series, access to Hammond B3 and much more available.

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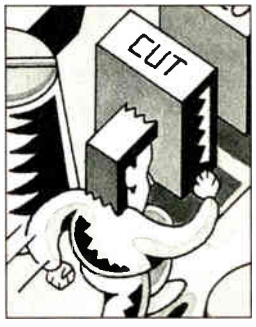

MIKE MOORE; *Engineer, Producer & Music/Computer Programmer*; **MIKE MOORE PRODUCTIONS. 30210 Grandview; Inkster, MI 48141; (313) 722-2053. Specialization & Credits:** Complete multitrack recording services, Base Studios United Sound System and the Sound Suite Detroit Michigan. Credits include: Body, Aretha Franklin, George Clinton, Prince, Amp Fiddler, 4 Tops, Dramatics, Kurtis Blow, Bert Robinson, Howard Huntsberry, Crosswind, RJ's latest arrival Well Red, Giant, Roxanne Jordan, Donny Walberg, Markey Mark, David Peaston, Robert Kelly, Dezi Phillips, Keith Washington, Be Be Winans, Trey Lewd, C.P. Johnson, Herman Harris, Rachel Choate and Chuck Howard. Familiar with all major consoles, SSL, Neve, Sony MCI, Westar, Neotek, Amek, Harrison, Trident, etc.

GEREN W. MORTENSEN JR.; *Engineer, Technician & Music/Computer Programmer*; **AUDIOGENIX PRODUCTIONS. PO Box 1888; Ellicott City, MD 21041; (410) 521-2681.**

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TAAVI MOTE; RUF MIX PRODUCTIONS. PO Box 55878; Sherman Oaks, CA 91413; (818) 760-0269; FAX: (818) 905-7242.

WILLIAM P. MUELLER; SHEFFIELD AUDIO/VIDEO PRODUCTION. **13816 Sunny Brook Rd.; Phoenix, MD 21131; (301) 628-7260; (301) 666-0196; FAX: (301) 628-1979. Specialization & Credits:** 1985 Grammy nomination—best engineered album, Michael Hedges, *Aerial Boundaries*. 1986 Grammy nominated album, Douglas Miller, *Unspeakable Joy*. 1988 Grammy-nominated album, *Seldom Scene Out Among the Stars*. 1988 Grammy-nominated album, *Sweet Honey in the Rock*. Billy Joel, Disney Productions, Vigil, Chrysalis Records, Barry Manilow, Krokus, Aretha Franklin, Beltsleck & The Slacktones, Billy Squire, Jerry Lewis Telethon, The Hooters, Marylin McCoo, SRO Concerts, Ella Fitzgerald, Oscar Peterson, National Symphony, Shadowfax, Will Ackerman, Jim Makay, ABC sports, The Whitbread Sailboat Race, ESPN, CNN. Consoles: SSL 4000, Neve 8068, 5104. Tape machines: Sony 3324, Otari MTR, AMS 1580, RMX 16, LEX 224SL, Sontec Modules, Drawmer CMX Cass editor, on-line editing.

JOSEPH NICOLETTI; *Engineer & Producer*; **CREATIVE NETWORK CO. PO Box 2818; Newport Beach, CA 92659; (714) 494-0181; FAX: (714) 494-0982.**

RICHARD OLIVER; *Engineer & Producer*; 41-33 42nd **St.; Sunnyside Queens, NY 11104; (718) 786-9151; (212) 459-9643. Specialization & Credits:** Engineered Rolling Stones, Yes, B-52s, Ellen Foley, Fleshtones, Toots & the Maytalls, Sting, Pagan, Saphire, 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 features incl.: *Nightmare on Elm Street III*, Le Bain, Amazon, Great Christmas Race, Blair Entertainment, Real Estate Inside, Hall&Oates and Blondie. Also extensive commercials incl.: American Express, Coca-Cola, Burger King, Penthouse, Bain de Soleil, Nabisco, Life, Oreo, Nestle, and much more in all of the above categories. Also power user engineer of SSL, Neve, Trident, Sony, MCI, Synclav & others. Many, many projects 48-track and over. Extensive experience with digital projects, lock-to-picture, MIDI, sequencers, outboard, editing, mastering, sync and resolve and layback etc. Published songwriter. Scoring, orchestration and arranging. Technical engineer and acoustic designer also. New artist production and more.

JEANNINE O'NEAL; *Engineer, Producer & Music/Computer Programmer*; **JEANNINE O'NEAL PRODUCTIONS/GOJO PRODUCTIONS. 195 S. 26th St.; San Jose, CA 95116; (408) 286-9840; FAX: (408) 286-9845. Specialization & Credits:** Produces country, pop rock-hip hop, contemporary Christian, all styles of Latino music, urban contemporary. Top 10 chart-proven producer/musician in *Billboard* and independent charts in Latino and country. Plays seven instruments for live sound or sequencing. Owns two 24-track recording studios, publishing companies, independent record companies, in-house cassette duplication, record/CD mailing and promotions.

DAVE PALMER; *Engineer & Producer*; **1643 Bloomfield Place Dr. #621; Bloomfield Hills, MI 48302; (313) 338-7046. Specialization & Credits:** 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. II (release Sept. 1992), Trio Vol. I, Solo Guitar, Whispers & Promises, Life Stories, Wishful Thinking, Low Ride, Night Songs, Late Night Guitar, Heart String, Soda Fountain Shuffle*; Chek Atkins *Sails, Street Dreams*; Al Dimeola *Land of the Midnight Sun, Elegant Gypsy, Casino, Splendido Hotel* (co-produced); Alice Cooper *Welcome to my Nightmare*; Carly Simon *Carly Simon*; Michael Urburniak *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, MEGA-WAVE CORPORATION. 682 Barton Dr.; Ann Arbor, MI 48105; (313) 665-3325.**

MARK PARTIS; *Engineer & Producer*; **30 Harding St.; Maplewood, NJ 07040; (201) 763-4616. Specialization & Credits:** Credits include mixing for R&B acts such as Heavy D & the Boyz, Jeff Redd, Kool & the Gang, Today, Boyz II Men, Jodeci, Simply Precious, Marva Hicks and Camouflage, as well as extensive engineering for Shawn Colvin, Sinead O' Conner, Tommy Page, Arrow and Cher. TV and commerical credits include the music for the *Cosby Show* and *A Different World* and spots for UPS, Kentucky Fried Chicken and Budweiser, to name a few. I am also heavily involved in the production and engineering of several jazz projects. Services include album productions from demo to pre-production to the final product. Other services include digital recording and audio-for-video synchronization

JOHN M. PETERS; *Engineer, Producer, Technician & Music/Computer Programmer*; **EMERGENT TECHNOLOGIES. 8930 Mills Ave.; Whittier, CA 90605; (310) 698-6354. Specialization & Credits:** Audio Engineering, professional: built two recording studios, previously owned and operated JPM Recording Studios in Los Angeles, chief engineer of countless sessions, sound design for stage, motion pictures and television, created a library of science fiction sound effects on disc and tape which was sold to professional users, composed and recorded several scores in synchronization with action in audio dramas, wrote audio plays, early experience as drummer in numerous bands and gigs, all styles of music, current new work includes audio-post editing and sync sound-to-picture and vinyl record restoration work and own samplers, sequencers and a hard disk workstation. Music Education: piano, drums, accordion and music theory. Technical: new type of automated fader now patent pending. Philosophy: making music "pop" over the air is an art which must begin with knowledgeable instrumentation and arrangement which is complemented by the engineer's microphone and signal processing techniques.

EDWARD S. PETERSEN; *Producer*; STUDIO PRODUCTIONS. **9321 Piscataway Rd.; Clinton, MD 20735; (301) 868-5234; FAX: (301) 868-5234. Specialization & Credits:** Producer and contractor for orchestra, band and vocal recordings using live musicians who play traditional musical instruments. Classical, jazz, commercial, popular, sacred. Music for albums, shows, television and film. Serving music industry clients since 1974. Washington D.C. area.

JON PIKUS; *Engineer & Producer*; **PERFORATED SQUARE ENTERTAINMENT. 5757 Franklin Ave. #304; Hollywood, CA 90028; (213) 463-8767; FAX: (310) 546-8732.**

MARK S. PLATI; *Engineer, Producer & Music/Computer Programmer*; **M.P. MUSIC INC. 201 W. 72nd St., #5G; New York, NY 10023; (212) 580-1609; FAX: (212) 580-1609.**

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GENE PORFIDO; *Engineer, Producer, Music/Computer Programmer;* **SMILIN' PIG PRODUCTIONS. 121 Hawkins Pl., Ste. #124; Boonton, NJ 07005; (201) 625-5333. Specialization & Credits:** 16 years experience Wallowing in the Muck and Mire of the music industry! Extensive live concert, studio engineer, assistant engineer and musician credits include performance, production and participation with: Air Supply, Joe Lynn Turner, Shark Entertainment (Trixter), Kevin Owens (Luther Vandross's band), Princess Pang, Rollins Band, Nikki Records, Cycle Sluts from Hell, Aztec Two-Step, Bobby Mesano, Franke and the Knockouts, Max's Kansas City, and numerous amazing N.Y.C. and L.A. bands, clubs and studios. Current affiliations include: staff engineer, Showplace Studio, Dover, NJ; chief engineer Boulevard Recording Studio, New Milford NJ; chief engineer Nikki Records/New Prospect Studio, Kingston, NY. New services include: digital recording, editing, sequencing and album/CD artwork, 3-D Graphics and animation and Genuine Smilin' Pig Products. This is one happy pig who loves his work!

ROBERT P. PUCCI AND JOSEPH R. MILLER; *Engineer, Producer, Technician & Music/Computer Programmer;* **PMT ENTERTAINMENT GROUP. 4457 N. Menard Ave.; Chicago, IL 60630; (312) 618-0131; FAX: (312) 637-7288. Specialization & Credits:** Credits production: Radakka, Tribe of None, Defcon, Insania, Cianide, Abomination, Matrix, 2-hip, The Ultraviolet, Fresh, The Crew, Cuttlass, Chicago Metalworks, Grindcore Records, Neptune Records, Theatre, The Slam, Crash Alley, Diver, Swivel Rockers, Clinda Pink, Populuxx, Raspberry Jam, Rich Smith. Services: from studio production and engineering to live sound and recording. We realize that sometimes you have to throw theory out the window to achieve the desired final product. Call us, we can help you!

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MICHAEL PUTRINO; *Engineer & Producer;* **1110 Emerald Ln.; Endwell, NY 13760; (607) 786-5881.**

STEVE RASHID; *Engineer, Producer & Music/Computer Programmer;* **WOODSIDE AVE. MUSIC PRODUCTIONS INC. 1618 Orrington Ave., Ste. 203; Evanston, IL 60201; (708) 864-6655; FAX: same—please call first.**

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JEFF RAY; *Producer & Music/Computer Programmer;* **JEFF RAY MUSIC DESIGN. PO Box 2293; San Francisco, CA 94126; (415) 924-6559. Specialization & Credits:** Award-winning musical composition for video, television, radio and individual artists. Owner of Jeff Ray Music Design. Musical director for Sound Cat, sound and music design. Clients include: KRON TV-Channel 4 San Francisco, Coors Beer, Southwest Airlines, KTVU-Channel 2 Oakland, Taco Bell, The Nature Company, CSAA, Ocean Images, NCAA Basketball, CBS, Ford Motor Co. and major ad agencies.

CLARKE RIGSBY; *Engineer & Producer;* **TEMPEST RECORDING. PO Box 1007; Tempe, AZ 85280; (602) 968-9506.**

COLEMAN C. ROGERS; *Engineer, Producer & Technician;* **17 Old Winchester St.; Newton Highlands, MA 02161-1931; (617) 969-3403. Specialization & Credits:** Credits: Between the Lines (What Are Records? Ltd.), *Knots & Crosses*-Creatures of Habit (Crossongs Records), Patty Larkin-*Live in the Square* (Philo/Rounder Records), The Story-*Grace in Gravity* (Elektra Records), John Lincoln Wright-*Honky Tonk Verite* (Lincoln Records). Services: I own a large assortment of tube and solid state microphones, mic amplifiers and equalizers allowing me to get excellent results from most any studio. My acoustic approach to recording preserves the natural musicality of instruments and voices. Give me a call to discuss your next recording project.

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The September issue of *Mix* focuses on film sound: articles and technical features on post-production in LA, time code DAT in film production, and a conversation with film sound guru James G. Stewart. Plus: information about current trends in amplifier design, and tips from LA session players on getting the most out of a recording session.

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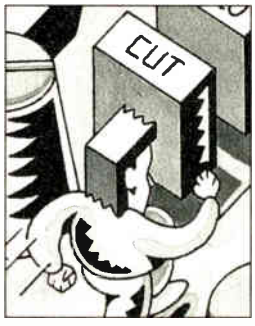

BOB ROSA; *Engineer & Producer*; **BOB ROSA PRODUCTIONS. 143 Fingerboard Rd.; Staten Island, NY 10305; (718) 876-9266; FAX: (718) 876-9266. Specialization & Credits:** Engineer, producer, mixer, remixer. The first with racks and racks of mobile state-of-the-art outboard gear. Also, own 24+ track studio, Profound Sound. Credits include Paula Abdul, Michael Bolton, C&C Music Factory, Mariah Carey, Cheap Trick, Cover Girls, D-Project (Japan), Duran Duran, Sheena Easton, The Family Stand, Fleetwood Mac, Aretha Franklin/Whitney Houston, David Grant (UK), Debbie Gibson, Hall & Oates, James Ingram, Freddie Jackson, Janet Jackson, Mick Jagger, Grace Jones, Shirley Lewis, Lisa Lisa & Cult Jam, Madonna, Martika, Michael Monroe, New Order, Noel, the Ocean Blue, Tommy Page, Paul Pesco, Pet Shop Boys, Lou Reed, Evan Rogers, Seduction, Seikima-II (Japan), Shannon, SoHo, Starpoint, Britt Savage, Stealth, Donna Summer, The System, Tony Terry, Vanessa Williams, Zebra. Management: Ms. Leslie Best, 23 W. Entertainment—(212) 627-9570.

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MIKE ROSENMAN; *Engineer & Producer*; **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. Preproduction including MIDI programming, arranging, sampling and custom sound design. Wide range of vocal talent available. Credits include rock, dance and R&B records, four TV documentaries, numerous radio and TV commercials and radio specials. We deliver musicianship combined with technology, custom-tailored to your project and your budget.

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STEPHEN J. SELTZER; *Engineer & Producer*; **321 W. 90th St., #2C; New York, NY 10024; (212) 362-3209. Specialization & Credits:** Credits include Ashford and Simpson, Smokey Robinson, Philip Bailey, Gerald Levert, Glenn Jones, The System, Kwame and Ratt. Services include tracking, mixing and production.

TONY SHEPPERD; *Engineer & Producer*; **FATHER TIME PRODUCTIONS. 114 Burning Tree Dr.; Hermitage, TN 37076; (615) 883-3379.**

BOB SKYE
Sausalito, CA

BOB SKYE; *Engineer, Producer & Technician*; **THE PLANT RECORDING STUDIOS. 2200 Bridgeway; Sausalito, CA 94965; (415) 332-6100. Specialization & Credits:** Extensive background in remote recording, live tracking and live broadcast. Specializing in live-to-two track recording. Holly Near, Joe Satriani, Charlie Musselwhite, Peter, Paul & Mary, Testament, Yellowjackets, Air Force Symphony, AC/DC, Al Jarreau, Chick Corea, Billy Preston, Jimmy Smith, Judy Collins, Melanie, Grady Tate, David Bowie, Harry Belafonte, Jacques Cousteau, Fishbone, Turner Broadcast, Paul Williams, John Denver, Stanley Turrentine, Kenny Burrel, Ottmar Liebert, Bobby McFerrin, Hawkins Family, Robert Cray, Steve Miller, Crosby, Stills & Nash, America, Eddie Money, Neil Young, National Public Radio, NBC, KRON, KFOG, K101, KSAN, KJAZ, WBGO, WMAL, KOME, KQED, Thursday Night Concerts, DIR Broadcasting (King Biscuit), Chameleon Records, Crescendo Records and the list goes on.

GENE SMITH; *Engineer & Producer*; **ORACLE RECORDING STUDIO. PO Box 464188; Lawrenceville, GA 30246; (404) 921-7941.**

WALTER N. SOBCZAK; *Engineer & Producer*; **WELLESLEY SOUND STUDIOS. 106 Ontario St.; Toronto, Ontario, M5A 2V4 Canada; (416) 364-9533; FAX: (416) 364-7815. Specialization & Credits:** Album/single credits include Dream Warriors, HDV, Organized Rhyme, Maestro Fresh Wes, Rupert Gayle, Sturm Group, Barenaked Ladies, Welt, Paul Raven (Killing Joke), Michie Mee and LA Luv, Scott B. Sympathy, Coupe de Ville Soundtrack, 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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CASEY STONE; *Engineer & Producer*; **ROCK SOLID AUDIO. Burbank, CA; (818) 559-3952. Specialization & Credits:** I offer complete studio recording services for all musical styles at reasonable rates. Clean recording of drums and other acoustic instruments is a specialty. I also have experience recording jazz direct-to-two track. If sonic clarity and instrumental definition are important to you, then I'm the engineer for your next tracking, overdubbing or mixdown session. Call for rates and sample material.

JOHN A. STUART; *Engineer & Producer*; **STUART AUDIO SERVICES. 342 Main St.; Gorham, ME 04038; (207) 839-3569. Specialization & Credits:** Clients include: Noel, Paul Stookey *In Love Beyond Our Lives*-Gold Castle, Bond and Bodyworks—Grammy nominated, Sesame Street, Dave Mason, Dr. John, Jim Newton and Friends-Parents Choice Gold Award, John Gorka, Tuck & Patty, Blue Cross/Blue Shield, David Mallett, Devon Square, Eek-a-Mouse, Peterbuilt Trucks, Timex, Dr. Benjamin Spock, Captain Kangaroo, Schooner Fare, PBS Series *The Sixties*, McDonalds. Whether recording, mix-

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THOMAS TOMASELLO; *Engineer, Producer & Music/Computer Programmer*; **TOM TOM PRODUCTIONS. 478 El Cajon Dr.; San Jose, CA 95111; (408) 578-6901. Specialization & Credits:** As musicians with twelve years production experience, we have produced, arranged and engineered a wide variety of album and jingle projects. Musical styles include gospel (traditional and contemporary Christian), pop, rock, country, Broadway, easy listening, Latin and big band swing, as well as children's music. We have also produced many soundtracks for various shows, touring productions, musical groups and solo artists. MIDI production and pre-production services employing the Macintosh computer running Vision sequencing software, Roland U-220 and Proteus modules, Emax digital sampler, Yamaha DX7IID, Korg SG-1D (sampled grand piano), Alesis and Roland drum machines with Roland Octapads, pedals and drum pads are also offered. With extensive experience in conventional production, arranging and scoring services, we cover the full production range from electronic to acoustic music. Finally, professional yet budget-conscious demo production services are available for both active and aspiring artists and composers. Let us turn your musical ideas into reality.

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BRIAN A. VESSA; *Engineer, Producer & Music/Computer Programmer*; **BV PRODUCTIONS. PO Box 3272; Santa Monica, CA 90408-3272; (213) 826-5902. Specialization & Credits:** Credits: four gold albums, including Jose Jose and Juan Gabriel; Michel Rubini's *Secret Dreams* and Brett Perkins' *Accelerated World*. Films: Michael Mann's *Band of the Hand, Manhunter*, Condor features *Tennessee Night*; Don Johnson video feature *Heartbeat*; Disney's *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 Haunting of Sara Hardy*; HBO's *In Living Color, The Edge*. Electronic sound effects supervisor on *Friday the 13th Part VIII*. Trailers for Cannon Films, Disney. Commercials for Porsche, Del Monte, Tomy Toys, etc. Services: music productions and engineering, Synclavier, music editing, video sweetening and studio electronics. I have well over 20 years experience as a musician, 15 years in the pro audio field 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*; **MAD DOG STUDIOS INC. 1717 Lincoln Blvd.; Venice, CA 90291; (310) 306-0950; FAX: (310) 578-1190.**

DENNIS WALL; *Engineer, Producer & Music/Computer Programmer*; **OFF THE WALL PRODUCTIONS. PO Box 6182; West Caldwell, NJ 07007; (201) 228-4099; FAX: (201) 228-4099. Specialization & Credits:** Anthony and the Camp, Ashford and Simpson, Eric Bloom, Phil Bono, Alex Bugnon, Hiram Bullock, Toni C., Chad, E.G. Daily, Sarah Dash, Doobie Brothers, Alta Dustin, Angel Fereirra, Elisa Fiorillo, Billy George, Freddie Jackson, Jeff Jarvis, Jellybean, Jets, Chuck Loeb, Bob Mintzer, Melba Moore, Najee,Tommy Page, Gary Posner, Nelson Rangell, Brenda K. Starr, Ronnie Spector, John Waite, Scott White. ABC, CBS, CNBC, CNN, Disney Channel, DMB&B, Roy Eaton Music, ESPN, FOX, Kevin Gavin, Grey Advertising, Group W, HBO, Insignia Films, Just Admusic, Kaltinick, Leach Entertainment, Marilyn Levine, Lifetime, Look & Company, Michael Karp Music, MSG, Music Production Company, National Geographic, NBC, New England News, Olgivy and Mather, Plotkin Music, Donald Rubinstein, Russek Advertising, Rock Video International, Jean-Marie Salaun, Score Productions, Showtime, TBS, USA, Westwood One, WWOR, WPIX, Young Rubicam. Services: audio engineering and mixing. MIDI systems design and setup. Computer based sequencer programming and pre-production.

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) 353-3353. FAX: (408) 353-3388.**

DON WEISS; *Engineer, Producer & Technician*; **WEISS SOUND SERVICES. PO Box 800986; Santa Clarita, CA 91380-0986; (805) 259-4881; (800) 540-TAPE (So. Calif. only). Specialization & Credits:** I have recorded such artists as the Beach Boys, Paul Shaffer, Rush, Robert Palmer, Kim Mitchell, The Anne Murray Band, Liberty Silver, Shirley Eikhard, Charlie Harwood, etc. Several of my projects have won JUNO Awards. I also have done live mixing for such performers as: Jerry Reed, Kitty Wells, Tom T. Hall, The Good Brothers, Beverly D'Angelo, Prarie Oyster, Tennessee River Boys, Matraca Berg, etc. I am also a dual citizen of the United States and Canada.

TED WESTMORELAND; *Engineer, Producer & Music/Computer Programmer*; **AKA SOUNDS. 16299 Apricot Ln.; Watsonville, CA 95076; (408) 728-4067.**

KEN WHITELEY; *Producer*; **512 Roxton Rd.; Toronto, Ontario, M6G 3R4 Canada; (416) 533-9988; FAX: (416) 533-9988 (5*). Specialization & Credits:** Producer of folk, blues, children's, songwriters, gospel and all kinds of "roots" music, both acoustic and electric. Ken has produced 45 albums including artists Tom Paxton, John Hammond, Raffi, Fred Penner, Cathy Fink, Paul James and Nancy Cassidy's Klutz Press Kid's Songs series. Plays over a dozen instruments and has played on over 100 recordings. Has own collection of equipment including wonderful microphones. Able to work with both large and small budget productions (and stay within the budget). Both flexible and opinionated to help the artist achieve the best work possible. Sales of Ken Whiteley productions are in excess of four million units.

DARLEEN WILSON; *Producer & Music/Computer Programmer*; **IT ALL STARTS WITH THE SONG. 20 Clare Ave.; Boston, MA 02131; (617) 325-8904; FAX: (617) 323-1570.**

SUSAN G. WINTHROP; *Engineer & Producer*; **WINTHROP PRODUCTIONS. 156 W. 94th St.; New York, NY 10025; (212) 662-8685; FAX: (212) 749-8387.**

CLEVELAND WRIGHT III; *Engineer, Producer & Music/Computer Programmer*; **MOTIVATOR MUSIC PRODUCTIONS. 950 Evergreen Ave., Ste. #15-H; Bronx, NY 10473; (212) 378-3981. Specialization & Credits:** Credits include: Temper, Wayne & Charlie, Masters of Ceremony, True Love, Colin Wade, Russell Patterson, E.U., B.Q.E.

JONATHAN WYNER; *Engineer & Producer*; **50 Amory St., #1; Cambridge, MA 02139; (617) 547-7973.**

DANIEL G. YEANEY; *Engineer & Producer*; **FIRST TAKE PRODUCTIONS. 11140 Westheimer Ste. 181; Houston, TX 77042; (713) 558-0560; FAX: (713) 893-2485. Specialization & Credits:** Album projects for local, national and international musicians including Jennifer Holiday, ZZ Top and Miquel Cassina. Interested in developing artists with songs. Emphasis on pop rock.

HENRY YODER; *Engineer, Producer, Technician & Music/Computer Programmer*; **HEART SONG. 311 Sautte Dr.; Coraopolis, PA 15108-9245; (412) 457-2430; FAX: (412) 457-2431.**

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World Radio History

COAST To

L.A. GRAPEVINE

by Amy Ziffer

The biggest news from L.A. this month was undoubtedly the riots, although I'm not yet aware of any studios that were actually torched. Lots of studios closed temporarily for the protection of staff and clients; the curfew made it rather difficult to conduct business as usual, even for those studios in untouched areas. I'd like to put out the call to all studio owners, however, to let me know about any damages sustained.

On to the more mundane. You've heard me talk before

—CONTINUED ON PAGE 184

Brooklyn Recording (L.A.) celebrated its first birthday with a John Wesley Harding session for his Sire Records release* Why We Fight. *(LtoR) Assistant Scott Tobinsky, chief engineer/GM Bill Dooley, assistant Scott Stillman, Harding and producer Steve Berlin (seated).

SESSIONS & STUDIO NEWS

by Jeff Forlenza

NORTHEAST

De La Soul was at the Magic Shop (NYC) recording and producing tracks with Maceo Parker and The J.B.'s for Tommy Boy Records. Robert Powers engineered with Joseph Warda assisting...Tom Verlaine produced the long-awaited new Television album for Capitol Records at Sorcerer Sound in New York with engineer Mario Salvati and assistant Patrick Derivaz... Guitarist/composer Vincent Nguini (best known for his work on Paul Simon's *Rhythm of the Saints* album) was at Brielle Studios (NYC) cutting tracks for his upcoming solo album. Bill Emmons engineered and Dan Rich assisted on the sessions, which included performances by fellow Simon tour band members Michael Brecker and Chris Botti...Epic Records act Firehouse recorded their new album at Beartracks Recording Studio in Suffern, NY. David Prater produced the album, with engineering by Doug Oberkircher and assistant Stephen Regina...Reggae great Gregory Isaacs was working on a new release at Washington D.C.'s Lion & Fox Recording with producer Clive and engineer Jim Fox...

SOUTHERN CALIFORNIA

At Westlake Studios (L.A.), Wilson Phillips tracked and mixed their recently released album; Vanessa Williams did a remix for *Soul Train*; and Art Garfunkel recorded new material for Sony Records...Webster Communications in Los Angeles completed *Rejoice to the Rhythm*, a black music sampler...RCA recording artists Kik Tracee stopped by Sound City Studio (Van Nuys) to track their next release with producer Chris Coss, engineer Joe Barresi and assistant Jeff Sheehan... Latino rapper Gerardo completed his latest Interscope Records release, *Latin Thang*, at Trax Recording (Hollywood) with producers Alfred Rubalva and David Snyder. Engineer Steve Linsley recorded exclusively in Trax's 24-track Mac/MIDI Studio C...Little Richard was at Studio Masters (L.A.) tracking and mixing for a Toshiba-EMI/Japan-only release of his greatest hits. Joey Carbone produced while Wolfgang Aichholz engineered, and Thomas Mahn assisted...

NORTHWEST

Surf guitar legend Dick Dale was at Studio D (Sausalito, CA) tracking with Bay Area drummers Prairie Prince and Scott Matthews. Joel Selvin produced the project, with engineer Joel Jaffe and assistant Larry Brewer...Marley's Ghost finished their gospel album at Sage Arts (Arlington, WA) with a little help from engineer Daniel Protheroe and assistant Neville Pearsal...Singer/songwriter Kristina Olsen cut her latest release for Rounder Records at Starlight Sound (Richmond, CA) with producer Nina Gerber and engineer Gary Mankin...

SOUTHWEST

At Fire Station Studios in San Marcos, TX, engineer Bill Johnson mixed the

World Radio History

COAST

LA Reid, Babyface and Daryl Simmons were at Studio 4 (Philadelphia) cutting vocal tracks with Boyz II Men for Eddie Murphy's movie,* Boomerang. *Engineers Craig Caruth and Jim Zumpano worked the board.

new Augie Meyers R&B album *White Boy*, produced by Meyers and Lucky Tomblin...Killbilly were at Crystal Clear Sound (Dallas) with producer Sam Berkow and engineer Keith Rust working on their next release for Flying Fish Records...Engineer/producer Nite Bob (Aerosmith, Kiss) was at Houston's Sound Arts producing The Voxxtones...

NORTH CENTRAL

In the Mix Productions of Chicago completed production of Karla St. James's upcoming dance release, *Black Magic*, on Fly Records. Adam Kagan and Brad Spalter produced and mixed the project...Total Look & The Style were at Refraze Recording (Dayton, OH) recording material for their Def Jam debut. The female R&B act was produced by Chuck D. and Professor Griff of Public Enemy, along with Kyle Jason and Edlene Hart. Engineers on the project included Gary King, Ken Lewis and Allen Day...

SOUTHEAST

Syncro Sound Recording (Nashville) was the studio used for all basic rhythm tracks, overdubs and background vocals on the new ZZ Top hit "Viva Las Vegas."...Travis Tritt was at The Castle Recording Studio in Franklin, TN, tracking and overdubbing for a Warner Bros. project. Gregg Brown produced the sessions with engineer Rob Feaster and assistant Clark Hook...Remaining in the Music City area, Golden Pear recording artist Ji Lum recorded his debut album at Nashville's Kaleidoscope Sound with producer Craig Hansen...In Miami, Nick Martinelli finished production on Regina Belle's new release. Martinelli and engineers Eric Schilling and Bruce Weeden completed the "56-track" R&B sessions in Criteria's SSL G Series mix room...

STUDIO NEWS

Imagine Recording Studio recently opened in Nashville. The Steven Durr-designed studio features the original API console used by Elvis Presley and

—CONTINUED ON PAGE 186

N.Y. METRO REPORT

by Dan Daley

AFA/Martin Audio, once considered one of the New York area's largest pro audio suppliers, has been slowly moving to new quarters in New Jersey since last year. In April, it closed down its last remaining Manhattan sales vestige, the parts department. Martin's service department will continue to operate out of the West 55th Street location. Audio Techniques, owned by Manny's Music, bought the inventory, according to A/T executive VP Doug Cook.

Tom Canavan, group vice president at Video Services Corp., parent company of AFA/Martin,

—CONTINUED ON PAGE 185

World-class drummers convene: (LtoR) Billy Cobham, chief engineer Craig Bishop and Sheila E. at Reel World Music (NYC) working on Cobham's upcoming CD.

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—FROM PAGE 182, L. A. GRAPEVINE

about the demand for more and more inputs on consoles, and this month you'll hear it again. Both Johnny Yuma in Burbank and Ocean Way-owned Record One in Sherman Oaks are working on enlarging or combining older consoles. Since very large consoles are made by numerous manufacturers, you might wonder about the rationale for taking this approach.

Ocean Way studio manager Jack Wolf feels that most modern boards don't have the clarity of older ones (although he's quick to add that this doesn't apply to the Focusrite, one of which Ocean Way owns) and cost more. Record One's techs are currently working to increase the inputs of an API console. At this same facility several years ago, two Neve 8078s were combined to create an 80-input board. At Johnny Yuma, the former private studio of Patrick Leonard that's about to offer commercial bookings, head engineer Marc Moreau says Leonard acquired three Neve 8068s last year while in England working on a Roger Waters project. "We put two of them together to form a monster 72-input board with GML automation," he says. Seventy-two monitor inputs effectively double the number for mixdown. The third board will probably go into an artist development/budget room, to be built in an adjoining building for which the lease was just acquired.

Meanwhile, the original room was just overhauled by John Storyk of Walters-Storyk. While in London, Leonard admired Waters' custom Ted Rothstein-designed monitors and asked Rothstein to design a similar system at Johnny Yuma. "He did a system tailor-made to the room," Moreau notes, "and it became apparent that if we were going to take things that far, we should consider updating the acoustics as well. Ted recommended John Storyk to come out and make suggestions on how we could improve the room. We've rewired, added RPG Diffusors, and built a tape/MIDI room where we have all the keyboards and tape machines [Studer 827s]."

During the stay in London, it also became apparent that Johnny Yuma wasn't being used to capacity. "Since Patrick enjoys traveling to new places when he works," Moreau says, "he wanted to create an atmosphere here that would be easier for someone else to come into." The studio can be reached at (818) 848-8782.

At One on One, which you heard about back in April, more changes are taking place. The main room's 56-input E Series SSL is being swapped for an 80-input G Series with Ultimation, and the second room is getting a 72-input G Series, also with Ultimation. More outboard equipment is being added to both rooms. "As time goes on," says chief engineer Joel Soifer, "it appears that business is going more and more toward larger consoles." (You may remember that One on One installed an outboard rack of Neve input modules in that room earlier this year.) "We've had to turn away sessions that required a very large console. We will still accommodate the smaller sessions, but now we can do both."

One on One will also be going down in the middle of June for a two- to three-week period of intense reconstruction on its main studio. L.A. studio-design group studio bau:ton—which got a bullet through the window during the recent riot, but, thankfully, no one was hurt—have designed a decompression ceiling-style space to replace the older compression ceiling design. "The room will be the same in ways that it's really good, but will be redone in ways that it's lacking," Soifer stresses.

Finally, a smidgen of news from the old Soundworks West: Recently acquired by The Signature Group, a real estate investment company, it's been rechristened Signet Sound. Andrew Golov has been named president. The studio can be reached at the old phone number. There are some changes being made in the rooms at the facility, and I'll have more information as it becomes available.

Had I not had so much material last month, I would have told you about 3M's Lyra Awards, honoring nominees in Academy Award sound categories. Held at the Toluca Lakeside golf course, it was one of the most enjoyable industry events I've ever attended. Guests talked to and learned a little about all the nominees, not just the lucky winners. Thanks, 3M, for a great evening!

Attention Angeleños: The annual *Mix* focus on Southern California recording and film sound is slated for September. Please send me info by July 10 for this issue.

Send L.A. studio news to Amy Ziffer, c/o *Mix* magazine, 19725 Sherman Way, Suite 380, Canoga Park, CA 91306, or telephone (818) 567-1429 or fax (818) 709-6773. ■

World Radio History

—FROM PAGE 183, N.Y. METRO REPORT

says the move to close the parts department was fueled by a lack of profitability, a weak area economy and a lack of new audio/video start-ups in the region Martin served. He adds that Martin's equipment sales operation has been strong since the move, and it now is the exclusive representative in the area for high-end Otari products. Doug Cook says Audio Techniques will make the parts division profitable by means of new management approaches.

Other area suppliers will likely try to take up the parts slack, as well. Tim Finnegan of Sam Ash Professional says his company has considered increasing its presence in that area for some time, and this move will probably accelerate that process. Both Sam Ash and Manny's Music have opened professional sales/marketing departments, and as a result both are well-positioned to reach the fastest growing segment of the region's studio industry: project studios. Many of the principals of those down-sized facilities grew up buying their musical gear on West 48th Street.

Greg Hanks' New York Technical Support opened a Manhattan office during the spring, which also happened to be the maintenance company's tenth anniversary. The company will also keep its original Chappaqua, N.Y., office. Hanks says that Manhattan is a more central location for his mix of clients around the tri-state area. Interestingly, Hanks further notes that most of his clients now are personal recording-type facilities. "The future belongs to home recording," he says. "The number of those types of studios that I service has increased from a linear rate to a geometrical one." Hanks is also offering a line of products through his DSP Manufacturing division, including a speaker switcher, tape/monitor selector and transformer-mounting system.

"Check the mail and see if the drummer's here" department: The temporary reunion of seminal alternative rockers Rubber Rodeo took place through the mail with New York as the halfway point. Former members Gary Lieb and Bob Holmes are living in Chicago and Providence, R.I., respectively, and have been sending time code-striped tapes back and forth through New York for a new project originally created on a Fostex A80 8-track. There, the tapes were worked up by local ex-members Doug Allen and Trish Milliken after being slaved to a 24-track by Manhattan engineer Tony Maserati. Working both in Maserati's apartment through a Tascam mixer and John Hardy mic preamps, and at Broadway's This Way Studios, the group have already completed several tracks.

JSM Music's new John Storyk-designed recording facility opened its doors in late April. The 13,000-square-foot Flower District space has three SSL consoles, two main studios, a pair of Synclavier suites and five MIDI suites. Storyk was involved in the interior design as well as the acoustic implementation, and he went with "one of the traditional New York looks," he says: high ceilings, exposed metal flashings and brick. Very downtown.

JSM is all-jingles, a mega-project studio used entirely by owner John Silberman's in-house writing staff. That staff, as well as other New York writers, get to show off their stuff at RSVP "writers nights" held in the new studio's huge commissary, dubbed "Club JSM." Silberman says he's not limiting appearances to the staff only, lining up local jazz and jingle talent for future performances. Writer's nights aren't just for the Bottom Line and the Bluebird anymore.

Speaking of the Bottom Line, Bruce Springsteen and his stripped-down new band chose that venue for a full day's rehearsal and an invite-only, dry-run-cum-party a couple of nights before his *Saturday Night Live* appearance May 9. Springsteen, who last appeared at the Line in 1975 (when the room didn't yet have a separate monitor system), didn't bring any extra SR gear into the club, opting for the club's in-house mains and monitors. According to house engineer Neil Lifton, Springsteen's crew modified their input list downward to accommodate the house's 24-input Soundcraft 500 board.

The main demand of the Springsteen camp was secrecy; even the Bottom Line crew was not to know whose party it really was until it happened. Thus, Lifton dubbed the show "Operation Bar Mitzvah," telling his crew the club was being rented for a private party. When Springsteen's crew showed, he announced them to his staff by saying, "The caterers are here." Only when The Boss himself strolled in did they realize it was a different kind of party. "It's New York," says Lifton. "No one ever doubted the cover story."

Fax New York studio news to *Mix* East Coast Editor Dan Daley at (212) 685-4783. ■

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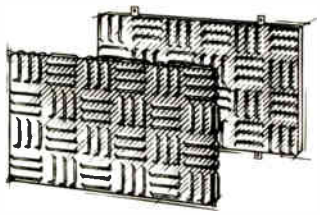

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—FROM PAGE 183, SESSIONS & STUDIO NEWS

the Everly Brothers at the old RCA studio. **Steve Henning**, a native of Austin, TX, will serve as studio manager. Recent sessions at Imagine included **Emmylou Harris** and **Mary Chapin Carpenter** doing overdubs for a Disney project...**Purple Dragon Recording** (Atlanta) completed a renovation with the **Russ Berger Design Group** and now have a new SSL 4048 G-equipped control room, "Atlanta's only" Otari 24-track with Dolby SR, a new machine room and isolation booth...

Send nationwide sessions and studio news to sessions editor Jeff Forlenza, c/o *Mix*, 6400 Hollis St. #12, Emeryville, CA 94608. ■

INDEPENDENT LABEL SPOTLIGHT

Black Top Records

Black Top Records out of New Orleans was born in 1981 when brothers Hammond and Nauman Scott decided to start a label focused on the blues and R&B music that is so abundant in New Orleans. Since then it has gone on to become the only New Orleans-based label to make an impact nationally.

Both Scott brothers are ex-lawyers from a family of lawyers, their father making it to federal judge. In 1974, Hammond even blew off his law school exams to go on the road managing Slidell, La., bluesman Clarence "Gatemouth" Brown. In 1981, Black Top Records released its first album, from Texas blues-rockers Anson Funderburgh & the Rockets, and later the label signed a national distribution arrangement with Rounder Records.

Black Top artist Lynn August at Tipitina's.

Black Top features some true New Orleans legends, like guitarist/songwriter Earl King (whose two Black Top releases were nominated for Grammys) and Snooks Eaglin. Eaglin was disenchanted with record labels and hadn't recorded a studio effort in over ten years before Hammond convinced the wildly original guitarist to record *Baby, You Can Get Your Gun* in 1987.

Black Top is run out of a house at the corner of Camp and Leontine Streets that is also the Scott brothers' residence. Keeping things down on the bayou, most Black Top releases are recorded in New Orleans studios, or live from New Orleans clubs such as the legendary Tipitina's where Black Top's "Blues-A-Rama" series of live recordings are made.

Black Top's recording philosophy is simple: Use a studio with a live, ambient sound, select a good engineer, select the right material for the artists and hire the right musicians for the session. "The greatest blues and R&B records had a magic about them," Hammond explains. "We strive to achieve that same magic by retaining the spontaneity of a live studio session."

The fact that there's a nationally visible label in a city where the number one industry is tourism is a boon for the New Orleans music/recording business. Though they only record ten to 12 releases a year, the Scott brothers are dedicated to reviving the careers of unrecognized blues artists. Robert Ward had an R&B hit in 1962 with The Falcons' "I Found A Love." Though his Magnatone vibrato has influenced many guitarists, he hadn't recorded in 20 years. Now Ward has a Black Top release (*Fear No Evil*) and a resurgent popularity.

—Jeff Forlenza

World Radio History

The annual Society of Professional Audio Recording Services' Digital Audio Workstation conference was held at the Beverly Grand Hotel in May. This year's event was the largest in its four-year history, drawing nearly 200 attendees. Pictured outside the convention hall are SPARS board members and representatives from Akai, AMS, Digidesign, Fairlight, New England Digital, Otari, Roland, Solid State Logic, Sonic Solutions, Studer-Editech and WaveFrame. For more coverage of the DAWs Shootout, see this month's "Current" on page 10.

—FROM PAGE 90, CLEARMOUNTAIN

not—I don't know—is not really fair. Because hopefully, the people that buy CDs are buying them for the music, not the technology. I'm not interested in selling technology. I make records. I like to record songs and people singing and people playing instruments. I'm not saying you should buy this record because it was recorded a certain way. I think they should enjoy it because they like *the music.*

Robertson: It's for the audiophiles, for people who say, "I not only enjoy a good song and good playing, but I love when the sonics blow me away, too."

Clearmountain: Then they should go by what they hear. By telling them how it was recorded, you get back into prejudices. You know, it's amazing what you can do in the mix stage with an analog recording. Granted, it's easier if it's recorded digitally; it's going to sound better right away, but I don't turn down mix projects because they're analog. I just mixed an album by Amiee Mann that's tremendous, and it's all analog. Your first solo record, which isn't too shabby, was all analog. Really, there isn't any reason to be biased in either way. ■

—FROM PAGE 83, BEGINNING

so, and Ry Cooder's *Bop Till You Drop* album was selling quite well.

A year had gone by since hitting the field, and 3M was still the only game in town with a digital multitrack. Beginning in February 1980, 3M introduced systems into England and Japan. By the following year systems were placed in France, Germany and Sweden. By 1982, however, various internal and market conditions combined to force 3M out of the digital multitrack market, and its historical position has since been usurped by others.

But there have been numerous golden ear shootouts between the various digital machines over the years, and guess what consistently ranks as one of the best-sounding machines? The 15-year-old, 16-bit, non-oversampled, passive, anti-aliasing design of the 3M DMS. And, believe it or not, there are still many of these 32-track machines rolling and turning out hit records. ■

—Ron Ensminger

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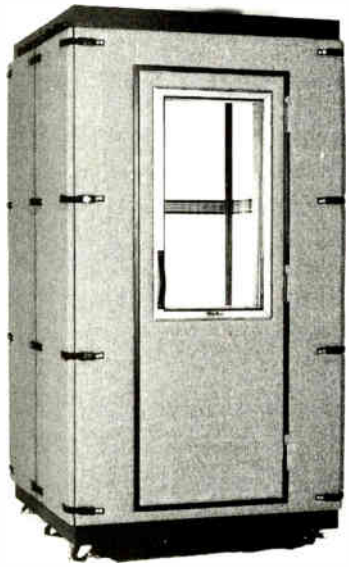

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—FROM PAGE 132

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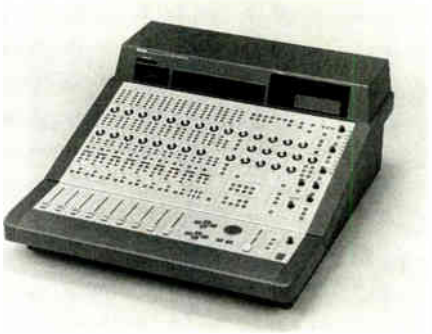

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MIX

—FROM PAGE 12, CURRENT

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"We're extremely pleased by the early response to our sponsorship program," says Hillel Resner, publisher of *Mix* and TEC Awards Executive Producer. "We're also excited that several companies are joining us for the first time."

The Mix Foundation for Excellence in Audio, the official sponsor of the TEC Awards, was established in 1990 as a nonprofit, public benefit corporation in the State of California. Since 1985, the TEC Awards have contributed nearly $200,000 to the House Ear Institute of Los Angeles and audio recording scholarship programs throughout the United States.

A limited number of sponsorships remain. For more information or for ticket information, contact Karen Dunn, TEC Awards Executive Director, at (510) 939-6149.

Siemens Audio Names New President

Gerhard G. Gruber has been named president of Siemens Audio Inc., replacing Barry Roche. Gruber is a 17-year employee of Siemens AG, most recently holding the position of executive vice president of Siemens Audio. Hans Haider, chairman of Siemens Audio, announced the executive change to employees as part of a company restructuring plan. No further details were available.

Siemens Audio is the North American distributor for Neve and AMS professional audio products, with offices in Bethel, Conn.

K-T Now Pinnacle Audio

To eliminate confusion surrounding the various brand names distributed by the company, Klark-Teknik Electronics recently changed its name to Pinnacle Audio. According to vice president Sam Spennacchio, the change was necessary because of the addition of the Dynacord line, the growth of existing lines such as K-T, DDA and Midas and because of the company's goal of reaching markets outside pro audio and sound contracting.

Pinnacle Audio is now the official U.S. distribution and marketing arm of all foreign-made Mark IV Audio products.

Grammy Awards Back in L.A.

After two straight years in New York City's Radio City Music Hall, the National Academy of Recording Arts & Sciences has moved the Grammy Awards back to Los Angeles for 1993. The site will be the Great Western Forum, the first time the Grammys are to be broadcast live from an arena.

"With the Academy membership doubling in the last few years, and music industry participation at an all-time high," says NARAS president Michael Greene, "demand on tickets to the awards show has become immense, and unfortunately many music people are unable to attend. Our plans to transform the Forum into a magnificent musical environment, and our ability to accommodate twice as many of our music people's ticket requests, will make the 35th annual Grammy Awards the most exciting ever."

Convention News

Pro Audio Asia, now called Pro Sound & Light Asia '92, is to be held in Singapore, July 8-10. For more information, contact Business & Industrial Trade Fairs Ltd. at (852) 575-6333; fax (852) 834-1171.

The fifth annual International Teleproduction Society Forum and Exhibition has been set for July 16-20 at the Beverly Hilton Hotel in Los Angeles. The ITS International Monitor Awards will be held on Saturday, July 18, at the same venue. For registration, call (212) 877-5560.

Corrections

In the May Northeast Studio Directory, the listing for Voices Recording Studios in New York City contained some inaccuracies. The manager's name is Phil Gordon. Chris Drozdowski is no longer a staff engineer, but Bruce Emerick and Ben Pizzato are. The word "tapeless" following the NED PostPro should not be there, and the 1-inch video decks are Sony BVH-3100s. ■

World Radio History

—FROM PAGE 78

Bonzai: Did you ever have the feeling that people thought you might be...
Botnick: A little out there? Oh yeah, but I never let that bother me. When I have something I want to do, I do it.

Before this *Star Trek* project, I had gone to the AES Convention and Sony had a prototype digital editor on a pedestal with a keyboard attached to it. I convinced Sony to let me have it by saying, "Why am I recording in digital if I can't edit it?" In those days, you had to edit with control track, you couldn't edit with time code, you couldn't do crossfades, you couldn't do much at all.
Bonzai: It was basically like video editing, wasn't it?
Botnick: It was video editing. I've got the old BVE-500 editor out back, just a control track video editor.
Bonzai: You had to edit on the frame?
Botnick: Yeah, if you were lucky. You put the audio, as well, on the analog tracks, and you'd find the spots you wanted. You couldn't rock and roll; you just found the spot. Then you'd do a preview, and you would be able to hear it going into input. You'd say, "Well, that works." Then you'd try to do it for real and the machines wouldn't necessarily park in the same spot. So, in Record you could lose a frame or two.
Bonzai: Could you cite a couple of milestones in digital audio that you've experienced?
Botnick: We had the first prototype digital mixing console, which led to the ones we have now, the [Sony] K-1105, an 8-channel digital console. At the time we bought it, the cost was $80,000—that's $10,000 a fader. It was pretty high, but I think the new board will be considerably less. But this one still works extremely well—40-bit, which was quite a step ahead at the time.

We've never had any problems. Ever since we started putting a system together, each piece of equipment has talked to the others. Then we started building digital patch bays—we still think of everything in the analog domain because that's how we learned. Patching is patching, and signal flow is signal flow.

You ask about milestones in digital—the tape still plays after ten years—that's a milestone.
Bonzai: Do we have good D to A and A to D interfaces?
Botnick: They're making better ones all the time.
Bonzai: What is the secret to a good one?
Botnick: That it doesn't sound digital.
Bonzai: What is the "digital" sound?
Botnick: Everybody construes bad digital as sounding hard. The reason it sounds hard is that it is lacking overtones, harmonics and ambience. The better the resolution, the more you hear. Now, with the oversampling that is available, and better filters and higher sampling rates, it's getting to the point—and I'm sure it's going to get a lot better—where you can take a digital machine and put it on E-to-E, input-to-output, and listen straight through. Compare it to another source, and you have trouble hearing the difference. It's not all the way there, but it's getting quite good. I've been using digital 48-tracks for a long time, and they really sound good.
Bonzai: Is synchronization a problem?
Botnick: All the machines that are made these days are user-friendly as far as hooking up to the Lynx synchronizer. All the video machines, the BVU-800s and the DMR-4000s, have standard Sony video interface, which is a 422, 9-pin, and they can be controlled by almost any video editor in the world. All the multitracks can be controlled by Lynxs. It's really not a problem, and they all hook up to either video editors or Lynx controllers or you name it.
Bonzai: So the machines are having a conversation these days.
Botnick: Absolutely. The only problem we have is when there is bogus code. Or they will record on an analog 24-track with code and not resolve the code when they mix to digital. Basically, digital only knows how to run at one speed, and then you have to go through a process of transferring and resolving that code and getting everything back into sync again.

As far as doing live shows and doing audio-for-video, we have no problems whatsoever. We use all formats, from digital multitracks to DASH 2-tracks to PD systems to R-DATS with code, even optical disk. It's real easy.
Bonzai: Regarding the progress of technology, do you think the situation will ever stabilize?
Botnick: I think it's been pretty stable for a long time. To be honest, the fact that we are able to use an eight-year-old digital console, which still plugs into everything else and everything is still talking to everything, tells me there is some stability. If it were changing daily, then we would be in trouble.

I hope no one gets offended, but the AES digital format is a real bastard. No two companies implement it the same way. It would be wonderful if everyone would get together and talk the same language.
Bonzai: Do you think this will happen?
Botnick: I hope so. I hear a lot of rumblings about it. I hear a lot of complaints from video people.
Bonzai: What do you think the future holds for the large, traditional recording studio?
Botnick: Well, I like the Ocean Way approach—not only because they use old equipment, but because they have original rooms that were designed to record acoustic instruments. Here in town [L.A.], I see more and more new rooms being built for acoustic instruments. It's not a throwback; it means that good sound is more than just an instrument with a microphone. It's environment as well, and I hope that this is a growing trend.

Shawn Murphy is involved in restoring the old Radford Stage, which was the original scoring stage at Republic Studios. It was designed and built by the Army Signal Corps to support the propaganda effort during WWII—a great room and the only stage specifically designed and built for the recording of orchestras for motion pictures. All the other rooms were just converted shooting stages.
Bonzai: So you see the old tradition of recording studios surviving?
Botnick: Yes, I do. We go in cycles—orchestras are in, then electronics are in, and I believe it will continue in this way until something comes along and we make a major shift. That's when the Krell come from a distant galaxy and bring the new music.
Bonzai: Are you still intoxicated with this business?
Botnick: Always. I'm sitting here with this Sonic Solutions hard disk editing system, learning it. I almost couldn't go home last night. Thank God my wife understands. I had to force myself to turn it off and go home. It's just the way I am. I want to know everything about it, and I want to play with it.
Bonzai: Sounds like you're still a kid.
Botnick: Yeah, I love the toys. ■

Tune in next month, when Mr. Bonzai lunches with Gergi, leader of the Krellian Intergalactic Orchestra.

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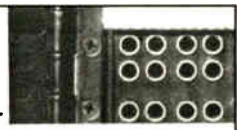

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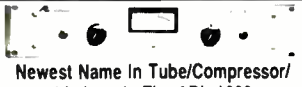

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INSIDER AUDIO

—FROM PAGE 30, OPTICAL STORAGE

In short, coexistence, instead of rapid obsolescence, is predicted.

The future beyond optical disc recorders? One possibility is photo refractive volume holographic storage (PVHS), sometimes called holostore. This technology stores digital data as three-dimensional optical holograms, and data is written and retrieved as two-dimensional patterns of laser light. A light-sensitive crystal serves as the medium for holostore. A 10x10x0.5-centimeter, nonvolatile module might hold 100 GB and provide a data transfer rate of 1 terabyte per second. It's hard to say when storage technologies such as holostore will be available for audio applications, but several things are certain: Recording engineers will complain that it doesn't hold enough data, it's too slow and it doesn't sound as warm as vacuum tubes. ■

Ken Pohlmann's very first article for Mix *appeared in the fifth anniversary issue in 1982, in which he made predictions for that faraway, distant year of 1992.*

THE FAST LANE

—FROM PAGE 27, VIRTUAL STUDIO

solution to a virtual problem. The real power of these systems lies in the fact that they *are virtual*. Each function can be totally optimized, not held back by the fact that there may be only seven knobs available for compression because you used seven knobs for EQ last time. No thanks.

Give me a glass visual interface with a new hybrid physical interface, hooked to an engine so damned powerful that everything I dream of is done as soon as I ask. I refuse to wait for *anything*, and I won't pay money for the privilege of doing so. I will not accept spending 30 seconds on an edit that I could have done in ten with a razor blade, just so I can tell everyone how cool I am because I own a digital editor.

It's very sad that there are so many bad virtual recorder/editors on the market now. I can only hope that the people shopping today will not become so discouraged that they won't give it a chance again when machines that work come out soon. New machines will come out. Look at simple hard disk recorders now. They already work (well, recent ones, anyway).

I have heard specific complaints from others about the shipping units, such as lousy machine control or bad-sounding EQ or loose lock. To me this is a bit like walking up to a car that doesn't run and commenting on how bad the paint job is. All of these specific problems are indicative of a common underlying problem that becomes visible if you step back enough: inadequate power.

I am not complaining about the others because I have designed a competitive product; I have designed a competitive product because I don't like the others. I guess we'll have to see if my ideas are right when the Symetrix comes out. If it is stupid and wrong, then just tear this column out and throw it away.

The only other high-powered holistic approach I know of today that may turn out to be correct is the future version of the SSL Scenaria. Dimes will tell. ■

Stephen St. Croix is, therefore he writes. He either rights all wrongs or writes all wrong.

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Vocalist named Product of the Year!

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The Vocalist from Digitech

The Vocalist™ has two new features for 1992. *Most Innovative Product of the Year* and *Most Innovative Effects Device* from *The Music & Sound Retailer Magazine*. It's the only voice processor that really sounds like human voices, not like chipmunks.

The Music & Sound Retailer Magizine, 1992 Most Innovative Product of the Year. 1992 Most Innovative Effects Device in the category of signal processor.

The Vocalist from Digitech delivers *real* voice harmony and pitch correction. It even remembers every song and never gripes about rehearsal time.

The Vocalist is perfect when you need one or two harmonies for back-up, or when you need up to five harmonies to save time in the studio.

No other harmony processor can give you natural sounding, human voice harmony and can compensate for off-key voices.

If you want award-winning harmony, check out the Vocalist from Digitech.

Send $10 for the Vocalist Video Demo.

DigiTech

A Harman International Company

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World Radio History

The 4200 Series. Designed For The Control Room, Not The Living Room.

Today's recording studio has evolved into a multi-function facility which simultaneously addresses the specialized needs of music recording, film and video post, and radio production. In this environment, where the most critical listening often occurs in the final mix, close proximity monitors are often more important than the mains. The problem: most console top monitors, unfortunately, were designed for the living room not the control room. Until now.

With the 4200 Series we're taking our stand from where you sit: right where you work at the console. Designed, engineered and tested from this position, the 4200 Series is the first console mount monitor created specifically for the professional recording environment.

Both models give you pin-point imaging by delivering high and low frequency information to your ears at precisely the same instant. By virtue of their symmetrical design the 4200 Series monitors are mirror imaged. And so nothing gets in the way of your music, the 4200 Series introduces our uniquely sculpted Multi-Radial™ baffles incorporating newly designed pure titanium tweeters and low frequency transducers. The combination of these technologies successfully corrects time arrival anomalies and eliminates baffle diffraction distortion.

4200 Series: console top monitors designed in the studio, for the studio, with sonic performance rivaling much more expensive monitors. 4200 Series: the shape, and sound, of things to come. Available at your local authorized JBL Professional dealer.

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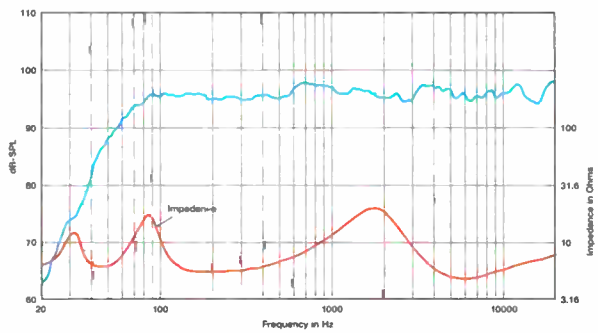
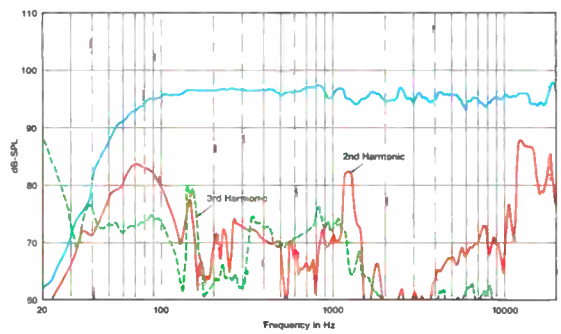


Frequency Response (Model 4206): 96 dB at 1 m, typical console listening levels



Distortion vs. Frequency (Model 4208) 96 dB at 1 m, typical console listening levels (distortion raised 20 dB)

JBL

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