

August 1991

Recording ■ Engineering ■ Production

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# REP

The Pro Audio Applications Magazine

# NATIONAL AUDIO

R-E-P's 1991

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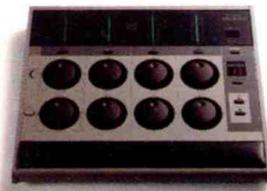
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# Contents

Volume 22, No. 8

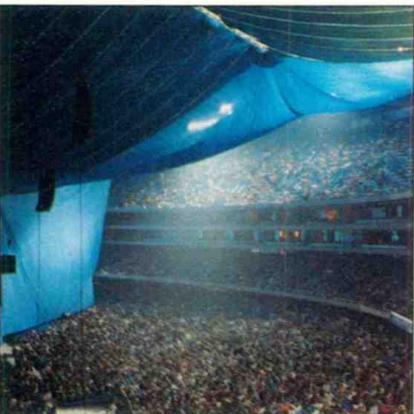
August 1991



12



27



48

## Audio Production

<b>Audio Education: Now and For the Future</b>	24
An overview on the art of providing an education, for entry-level students and working professionals both. <i>By: Garry Jones</i>	
<b>National Audio Test</b>	27
R•E•P's first audio exam allows you to evaluate your knowledge of the technical basics.	
<b>Is There More to Life Than Headroom?</b>	39
3M's new 996 analog tape formulation takes on Ampex 456 Grandmaster in a real-world showdown. <i>By: Les Brockmann</i>	
<b>Hands On: Tube-Tech CL 1A Compressor</b>	56
<i>By: Rick Schwartz</i>	

## Sound Reinforcement

<b>Live &amp; Direct</b>	46
Cutting Edge Consoles. <i>By: David Scheirman</i>	
<b>Working With Stadium Acoustics</b>	48
An acoustic designer's practical overview to survival inside those dreaded cavernous venues. <i>By: Richard Zwiebel</i>	
<b>All Access</b>	52
<i>By: Mark Herman</i>	
<b>Roadwork</b>	54
<i>By: Mark Herman</i>	

## Departments

From The Top	5
Letters	6
Random Access	8
Fresh Tracks	12
Sound Business	18
Digital Domain	22
First Look	61
Cutting Edge	62
Classified	65
Advertisers Index	72
NAT Answer Card	73
Rapid Facts Card	75
Subscriber Card	75

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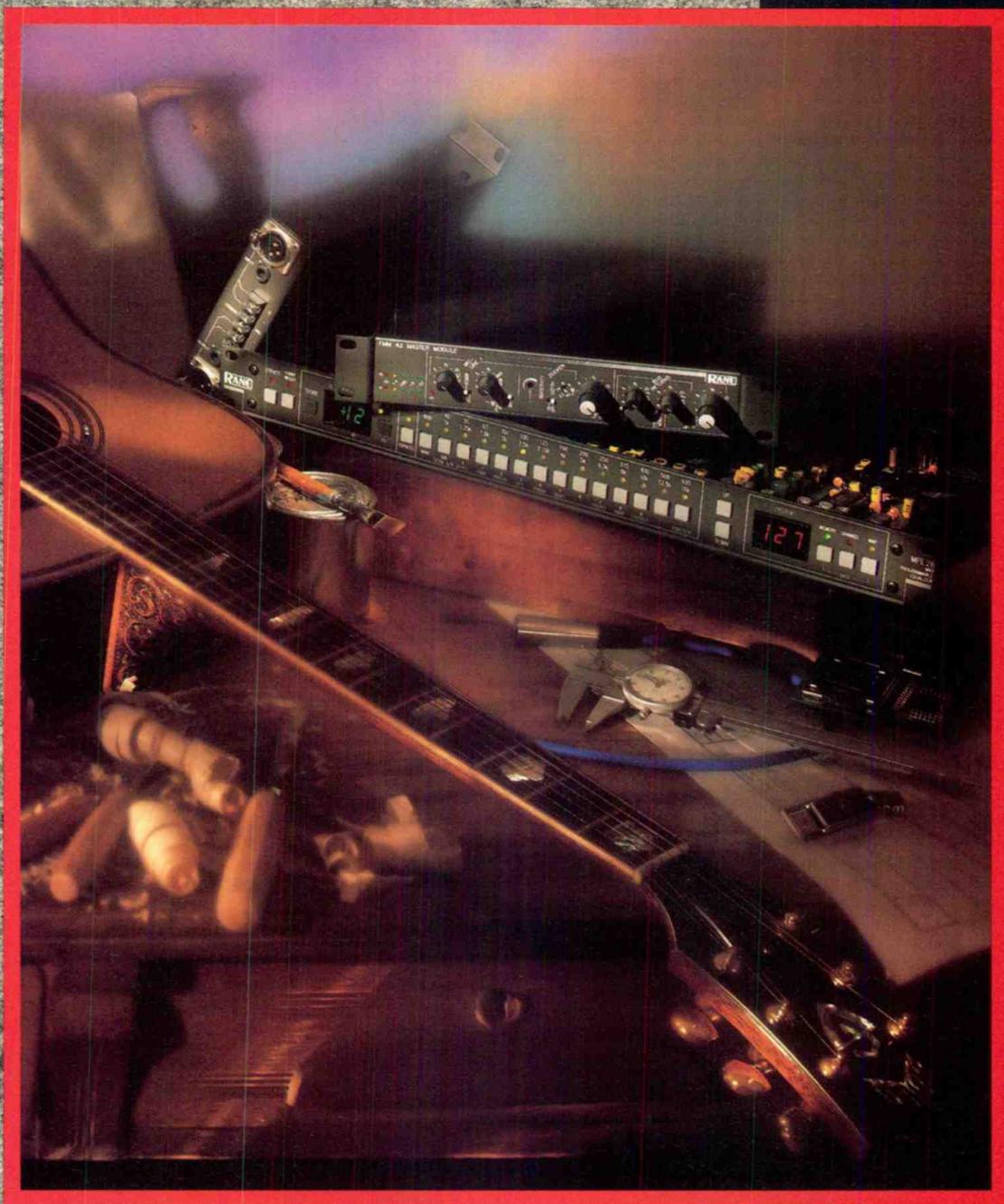
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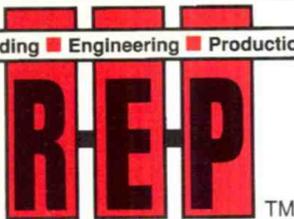
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# From the Top

## Tomorrow's Lesson

Think of education and you probably think of school, maybe K through 12, plus four years of campus life. Some might think of *vocationally*-related educational endeavors, from activity-specific institutions to OJT.

But most of us believe that education equals schooling: students plus teachers in rectangular rooms with lots of desks. Self-discovery or life-learned lessons hardly figure in to this traditional picture. Yet the latter is how most of us got to where we are today.

With few exceptions, the majority of us audio pros were driven by personal desire, emotion and curiosity to devour all we could on the given subject we absolutely adored — be it music or scoring or editing or mixing — until we could actually do it for a living.

Maybe we hung out in sessions, watching a friend or mentor over their shoulder. Or maybe we taught ourselves on gear bought with paper route money, or from an other-industry business we sold. Whatever we did, it worked. And it most likely happened outside of a classroom. As such, what we probably learned is what interested us, which made for holes in the patchwork of our total technical understanding. In my travels, it is common to meet someone who is an absolute definitive expert at one aspect of audio, and a babe in the woods in another area.

Imagine, for a moment, how audio pros might quantify their abilities if they had to. Any possible test, objective or otherwise, which creative and talented audio producers might take would only indicate where their particular backgrounds sourced from. How would you quantify or value these peoples' abilities? How tied to knowledge is it?

There was a time, harking back to early Abbey Road days with technicians in white lab coats, when all young upstarts passed through sanctified apprenticeships. Engineering hopefuls had to know the technology cold; producers had to know music or business, if not both. These were givens, hard demands of the job positions, as stipulated when hired. Programs were set up within companies to develop, train and nurture inside talent.

But that process pretty much died with the demise of the owned-and-operated studio system. Vocational recording and production schools took up where in-house

training left off, adding new twists and updating with the times. But after formal in-house studio training ceased, the majority of upcomers had to get their chops on the streets or via other non-traditional means.

Maybe not so ironically, this has gone hand-in-hand with the shifting technology. In many segments of the industry (but not all!), it is an audio production world where you virtually don't need to know anything technical to put together absolutely stellar, completely listenable product.

This doesn't negate the fact, of course, that audio is still a technical industry. As practitioners, we are far more valuable if we have knowledge, experience and perspective, no matter the specific nature of the projects that require our attention. It's still important for those of us active in the field to grasp, cold, the size and scope of what there is to know.

And, working on the hopefully not out-moded (yet) assumption that there are still things which a practitioner in the field of audio needs to understand — electronics, analog and digital signal processing, loudspeakers, mics and acoustics — we've put together a tasty little collection of basic but hardly shallow questions on subjects that many of us deal with daily. It's a test on audio techno stuff, but don't let it intimidate you. For some it will be old hat and boring. To others it will be Greek. Such is the nature of our industry today.

Score yourselves. The answers are in the back. Photocopy the blank answer sheet and pass it along to your friends, if you like. When you're done, fold up the score page and mail it back to us. We'll enroll you in a random drawing we've assembled exclusively for our readers. A number of manufacturers who believe in education as much as we do have donated some wonderful gear.

Don't worry, prize eligibility won't be tied to your test scores. Nobody is expected to know everything about all the applications of pro audio. We don't really want to know how well *you* did. We want to see where our readers stand *in general*, as a group. It helps us target the articles.

Grade yourselves. We'll trust you. And while you're on your way to the test pages, be sure to read Bruce Merley's excellent piece in this month's Sound Business column. It's a good insight into why we need to keep our learning chops up. ■

Mike Joseph  
Editor

## Where's The Zero?

From: Richard Parker, WHYY-FM, Philadelphia.

Thanks for the very informative article "Where's The Zero?" [June 1991], which addresses a very important issue — calibration levels for DAT recording. I must confess, though, that I found Bob Bushnell and Rick Schwartz a bit cranky in their approach to the problem, particularly their criticism of DAT manuals. There are a lot of units out on the market, some of them intended for the pro market, some not.

We have been using Panasonic SV-3700 DAT machines in all of our studios and remote music recording gigs for nearly a year. On page 26 of the SV-3700 manual, it states, "First supply +4dBu (reference level) analog signals and then adjust the recording level so that a peak level of -18dB is indicated ..." and right up front, on pages 4 and 10, it refers to the fact that "Standard I/O level of +4/-10 is shown at -18dB."

One of the misunderstandings with digital peak levels in general might simply lie in the area of seeing the relationship between VU and peak levels in the real world. In his remarkable tome, "Handbook for Sound Engineers" (Howard W. Sams & Co., 1987), Glenn Ballou tells us that "...on voice or music, the peak may be 10dB to 12dB above the VU reading ..." (in a discussion of VU meter ballistics and the associated "crest" factor).

In general, I think it is safe to assume that, with a -18 zero reference, we can let the DAT peak meters happily bounce around -3 or so and feel confident that the recording will play back through our console and bounce the VU meter needle around 0 to +3. I have no particular quarrel with Mr. Bushnell's and Schwartz's suggestion to set zero reference at -20, but I'm perfectly happy to defer to Panasonic's manual recommendation of -18. Because the SV-3700 has become a sort of de facto standard for judging the performance of DAT machines in general, why not run with it?

I know that many engineers think that they aren't doing their jobs if the meters aren't pegging whatever scale they are currently using (I suspect the same people insist on driving high-performance sports cars on 55mph highways) and doing this on digital equipment is just asking for problems. (If your console had a wide range peak meter that read up to

+24, would you really keep the needle there?) What it really comes down to is, calibration is calibration, and there is no substitute for proper documentation. So, when in doubt, lay down your tones, write down what you did for the next guy/gal, and if need be, go back and dig up that old audio text that explains the difference between peak and VU levels.

From: John Herman, Sunnyside, NY.

In reference to your article on digital calibration levels, I'd like to make the following comments:

First, while I agree that -20dB is a good nominal level for digital recording, I disagree with the recommendation of leaving five seconds between the end of the tones and the start of program.

Second, I disagree with your advice to start the DAT one second before rolling the 24-track. I would suggest leaving 30 seconds blank at the head of the DAT, then print 30 seconds of 1kHz, 10kHz and 100Hz tones. After this, you should leave one minute blank.

The reason for the 30 seconds before the tones is that it ensures that no one will put the DAT in, press play and hear 1k at some God-awful volume. The reason for leaving one minute after the tones is that this ensures that you are well away from the tones when you go to play the mix for the record executive or the singer's grandmother. This also isolates the tones from the program.

I also recommend leaving at least 20 seconds between takes. This prevents the possibility of going over the fade of the previous take. This is what we follow at Right Track Studio in New York.

In closing, I'd like to say that I thought the article was quite good and that I consider R•E•P to be an excellent magazine. ■

## Union Slam?

From: Chris Wood, San Francisco.

I can't figure out what the Spike and Mic cartoon in the May issue is trying to say. Sure, union workers make good money, but I think most people in the live sound game would admit that union crews get the job done faster and safer than non-union crews.

Discussion of pay is a common topic among union crews that I have been on, especially near the hour during a slow, late-night load-out, but I have never seen

a union crew deliberately slow down just to get a few extra dollars. Much more often, I have seen a lack of preparation by producers, sound companies or road crews sabotage local crew budgets.

It is no coincidence that most workers in this field aspire to become members of a union because they recognize that the best workers are there. Your cartoon does a disservice to all. ■

## Unbalanced Levels

From Stephen A. Cisler, Louisville, KY.

Attention, all mixers: Is there a national conspiracy concerning unbalancing levels of background to lyrics or speech in most of today's media?

As a listener to all forms of sound since 1925, I am convinced that modern mixing pays little attention to the clarity of any song or speech coming through with intelligence.

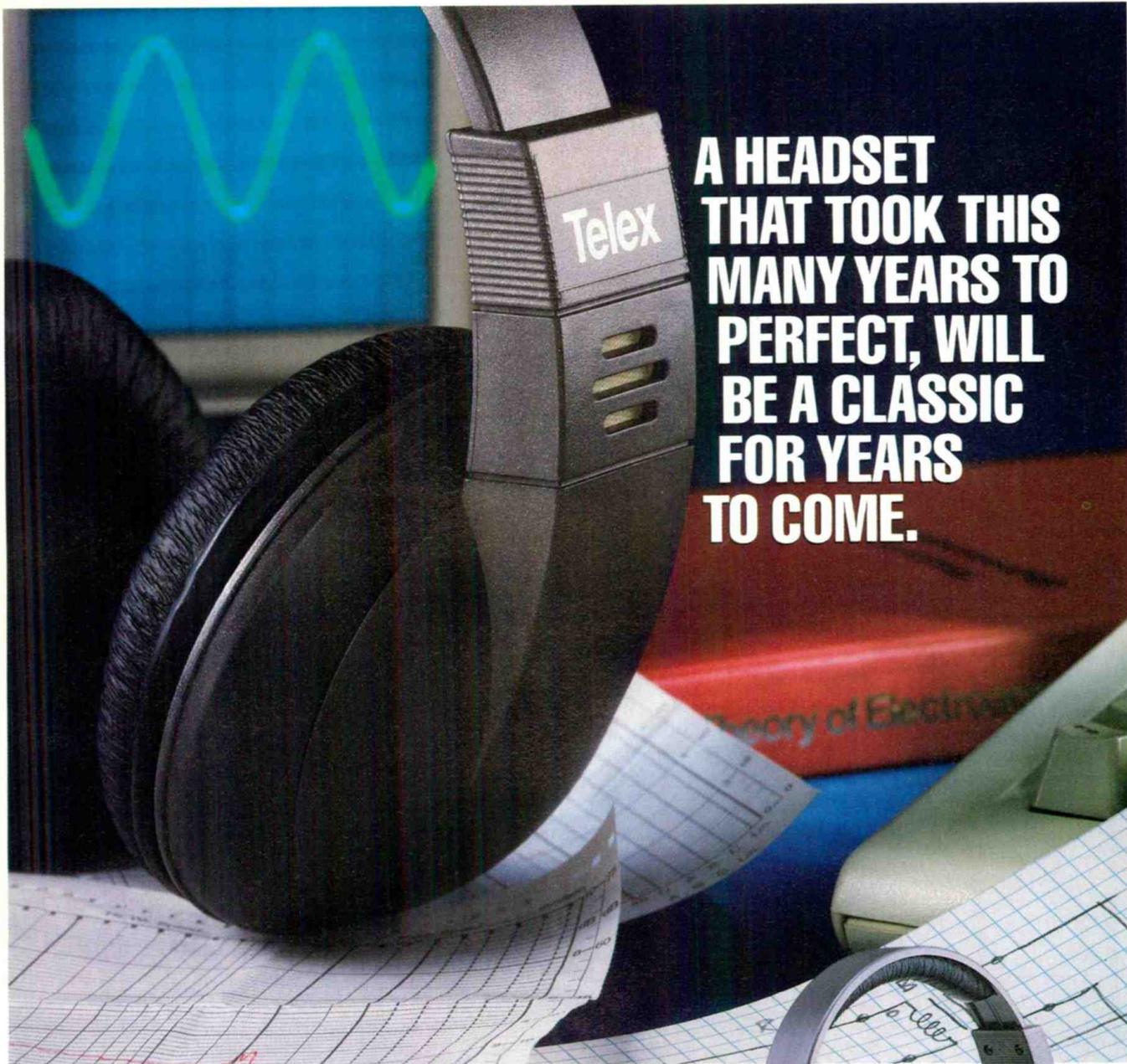
From the mumbling of TV morning talk shows to the sonic garbage of rap or rock music, we are losing the meaning of words. Screaming, caterwauling females and semi-males lose all impact of their lyrics with the cover-up levels of the band, plus crowd noise. Sloppy diction and grunts of movie characters leave us saying, "What did he say?"

Mixers should be required to listen to the final output on consumer sound and not the cloistered halls and super monitors of the recording studios. You are not getting through these days. Admittedly, we are not missing too much on some of this stuff, but even the superior works show up the defect. A song needs words. A speech needs clarity to convey the utmost.

Mixing experts, musicians and good listeners should be asked to compare present mixing with the simple results of the old.

I began as an engineer in 1925 building complete broadcast stations. I started with carbon mics and have gone through the condenser era. I have been a mixer and studio producer on big city live talent and big band pickups, in and out of studios. My ears have checked out as balanced for years, and no defects are known to me. My impression is arrived at over years of listening, and as of late, with the opinions of listeners, not engineers. ■

Send letters to R•E•P, Box 12901, Overland Park, KS 66212, fax 913-541-6697, or CompuServe mail 73477,2467. Letters must be signed and may be edited for length and clarity.



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# Random Access

**E**ducation. It's an ongoing thing. In the spirit of this issue's National Audio Test, we present thumbnails of some of the audio books published in the past couple of years.

We've noticed that writing an audio book can be tricky. It's a balancing act between presenting enough basic information without sacrificing a professional readership.

Only you can determine what your knowledge needs are; the focus of each of these books is slightly different.

• **"Audio Design: Sound Recording Techniques for Film and Video,"** by Tony Zaza, 1991, Prentice-Hall, Englewood Cliffs, NJ. This, the first of two recent books by Zaza, covers creative sound use in film, video, A/V and multimedia applications. Designed for beginning instruction or professional reference.

• **"Audio in Media,"** by Stanley R. Alten, 1991, Wadsworth Publishing Co., Belmont, CA. Designed as a text for college level courses, the scope of this book makes it applicable for professional reference. Covering audio technology and production in radio, TV, film and music recording, "Audio in Media" is in its third edition, and features new material to cover the recent changes in the industry.

• **"Audio Technology Fundamentals,"** by Alan A. Cohen, 1989, Howard W. Sams & Co., Indianapolis. As new-generation technology allows people to create great audio without the traditional recording backgrounds, knowledge gaps inevitably occur. This book assumes only a basic knowledge of math, electricity and other aspects of audio and offers an overview of audio systems, signals and circuits. Useful for pros needing information on basic audio tech.

• **"Mechanics of Sound Recording,"** by Tony Zaza, 1991, Prentice-Hall, Englewood Cliffs, NJ. The second of two recent books by the author, this volume covers audio recording pertaining to film and video. Also contains info on location audio and operating the Nagra, said to be the first book to do so.

• **"Music, Sound and Technology,"** by John M. Eargle, 1990, Van Nostrand Reinhold, New York. Grammy-winning engineer deals with recording from an acoustical perspective, which he says will help recordists utilize recording technology better, whether they're recording acoustic or electronic music.

• **"Modern Recording Techniques,"** by David Miles Huber and Robert A. Runstein, 1989, Howard W. Sams and Co., Indianapolis. Third edition of this best-seller might be considered too basic to some professionals, but could be useful for reference purposes. Includes updated information on digital technology and MIDI.

• **"Sound Recording Handbook,"** by John M. Woram, 1989, Howard W. Sams & Co. Another audio guru, the author of "The Recording Studio Handbook." His most recent tome covers all the bases. After starting with recording studio fundamentals, the author deals with the complete recording chain, without neglecting recent technical developments.

• **"Stereo Microphone Techniques,"** by Bruce Bartlett, 1991, Butterworth-Heinemann, Stoneham, MA. The author, a technical writer for Crown International, claims this to be the first text devoted to stereo miking. Designed to teach the often-complex subject to beginners and also be a reference to pros.

• In addition, don't overlook these older books: **"Handbook for Sound Engineers: The New Audio Cyclopedia,"** by Glenn Ballou; **"Sound System Engineering,"** by Don and Carolyn Davis; and **"Principles of Digital Audio,"** by Ken Pohlmann. For more emphasis on sound reinforcement, check out **"Successful Sound System Operation,"** by F. Alton Everest. Studio managers wanting business information should consider **"The Studio Business Book,"** by Jim Mandell.

• Finally, a comprehensive catalog of technical media on audio and related topics is available from Alan Gordon Enterprises, 1430 Cahuenga Blvd., Hollywood, CA 90028; 214-466-3651; fax 213-871-2193.

## PEOPLE

The 10th annual Lyra Awards honored the five audio teams nominated for the Academy Awards Achievement in Sound category. Sponsored by 3M, the Lyras honored the following professionals: For "Dances With Wolves," **Russell Williams II**, **Jeffrey Perkins** and **Greg H. Watkins**; for "Days of Thunder," **Charles Wilborn**, **Donald O. Mitchell**, **Richard C. Kline** and **Kevin O'Connell**; for "The Hunt for Red October," **Richard Bryce Goodman**, **Don Bassman**, **Richard J. Overton** and **Kevin F. Cleary**; for "Total Recall," **Nelson Stoll**, **Michael J. Kohut**, **Carlos DeLarios** and **Aaron Rochin**; for "Dick Tracy," **Thomas Causey**, **Chris Jenkins**, **David E. Campbell** and **D.M. Hemphill**. Original music scoring mixers also honored were **Shawn Murphy**, "Dances With Wolves"; **Jay Rifkin**, "Days of Thunder"; **Tim Boyle**, "The Hunt for Red October"; **Bruce Botnick**, "Total Recall"; and **Dennis Sands** and **Shawn Murphy**, "Dick Tracy" ... **Thomas M. Spain** has been appointed national sales manager of Studer's Revox division, for both consumer and professional products. At Studer Editech, **Matt Ward** has been named training and product manager ... **Michael Price** has been named vice president of engineering at E-mu Systems ... Opcode Systems has hired **Jim Montgomery** as director of research and development ... **Wil Sharpe** has left his position as Showco's sales representative to become a partner in a management company. **Robin Magruder**, Showco's senior vice president of sales and marketing, and **M.L. Procise**, who has been named senior sales executive, will now handle all sales and marketing ... **David H. Davies** has been named vice president of development engineering at Ampex Recording Media ... **Andy Wild** has joined Euphonia as vice president of sales and marketing ... Telex has named **James McFarland** as vice president of corporate development ... Technical Audio Devices has named **Hiro Takahori** manager of technical applications and development; **Leon Sievers** has been promoted to senior product planner ... **Steve Albanese** has been named media production supervisor of the Recording Workshop ... Avid Technology has promoted **Curt A. Rawley** to president and chief operating officer. ■

# TREND

w a t c h

**DCC:** The April 1992 launch of Digital Compact Cassette may be hampered by a lack of duplication facilities. *Billboard* reported that mass-production capabilities will not be on-line until late 1993.

**Record Labeling:** The Louisiana Senate has defeated a bill that would make it a misdemeanor to sell records with warning labels to minors. Previously, the bill had passed the state's House of Representatives.

**Copyright:** The lawyer representing a background singer suing Paula Abdul's record company claims that the singer has a claim in the recording copyright. Because singer Yvette Marine made substantial contributions to three tracks on "Forever Your Girl," she became a joint owner of the copyright. Question: When does copyright apply to a studio recording? According to the lawyer, Steven Ames Brown (quoted in *Entertainment Law & Finance*), "The copyright attaches to the work when it is fixed on tape, rather than when the tapes are mixed ... the mix is a derivative work."

**"When people go into a recording studio and make substantial contributions to a work, each automatically becomes a joint owner of the copyright. A smart producer or record company will have every person who makes a substantial contribution sign off on the copyright."**

— Lawyer Steven Ames Brown, representing background singer Yvette Marine in her suit against Virgin Records, as quoted in *Entertainment Law & Finance*.

# Random Access

## STUDIO UPDATE

Name/Location	Details
<b>NORTHEAST</b>	
Howard Schwartz Recording/New York	Audio sweetening engineer George Meyer has joined the staff.
Soundwave/Washington, D.C.	Composer Robert "Buck" Brown has joined the facility's original music division.
ZBS Productions/Fort Edward, NY	Recent awards include an Association for Independents in Radio Award for excellence and innovation, and a Corporation for Public Broadcasting Silver Award for outstanding technical achievement.
<b>MIDWEST</b>	
Technisonic Studios/St. Louis	Facility has donated three Ampex tape machines and two EMT reverb plates to Webster University's media communication department.
<b>SOUTHERN CALIFORNIA</b>	
The Arthur Company/Universal City	Tom Buel has been promoted to vice president of operations.
EFX Systems/Burbank	Automation capacity of the Harrison SeriesTen B console has been upgraded.
Pacific Ocean Post/Los Angeles	A \$2.5 million expansion has been completed; services now include telecine, graphics, off-line and on-line editing, and audio sweetening.
<b>NORTHERN CALIFORNIA</b>	
Audio Production Group/Sacramento	New facility featuring an AMS AudioFile, Neotek Elite, Studer A80, Panasonic SV-3500 and an Apple Macintosh SE with a variety of software. Ralph and Diane Stover are owners. Address: 3100 Fite Circle, Suite 105, Sacramento, CA 95827; 916-362-2540; fax 916-368-4133.
<b>DESIGNERS</b>	
Walters-Storyk Design Group/ New Paltz, NY	John Storyk has completed the renovation and expansion of Cove City Sound's Studio B.
<b>MANUFACTURERS</b>	
Adams-Smith	Recent sales: Howard Schwartz Recording, System 2600; Vidfilm Services (Glendale, CA), System 2600 E-A/V audio editor; Tele-Cine Group (London), System 2600 E-A/V audio-for-video editor; John Wood Sound (Manchester, England), System 2600 rack.
AKG Acoustics	Great American Radio has purchased five DSE 7000 production workstations.
Digital Audio Research	The BBC has purchased a DASS 100 digital audio interface.
DynaudioAcoustics	Euro Disney has purchased M3, M2 and M1 monitors for its 2-room facility.
Focusrite Audio Engineering	Ocean Way Studios (Hollywood) has purchased a 72-input console.
Neve	Console sales: CTS Studios (London), 60-channel VRP; Paul McCartney, 60-input VR72.
Otari	Masterfonics (Nashville) has purchased the first DTR-900-II 64-track recording system.

## NEWS NOTES

**Digital House** recently mastered and replicated a 99-track CD for the Minnesota Department of Education, said to be one of the first to fully use all of the available tracks in the format.

**Gand Music and Sound** has opened Gand Custom Installation. Hank Norton, formerly in Gand's pro audio department, has been promoted to lead the division.

**Solid State Logic** has received a special commendation from the British government for sales success in Japan, as part of a program encouraging export to Japan. More than 150 SSL consoles are installed in Japan; a survey of the Japanese audio community indicates that SSL is the market leader.

**Panasonic** has released the SV-3900 Software Developer's ToolKit, which contains custom-designed C and Pascal utilities that simplify the preparation of software programs for controlling the DAT machine. The system is available to software developers and manufacturers of workstations, automation controller and editing systems, for inclusion within their own applications.

**Sound Reinforcement Services** is a new company specializing in the design, manufacture and rental of high-end, horn-loaded sound systems. The company is located at 857 Newton Bridge Road, Athens, GA 30607; 404-549-6023; fax 404-549-0574.

## REP NEWS

**Gauss Loudspeakers** has appointed Taub Sales, Silver Spring, MD, as its exclusive representative in southern New Jersey, eastern Pennsylvania, Delaware, Maryland, Virginia and Washington, D.C.

**AudioControl Industrial** has appointed AVCOM as its representative in Ohio, West Virginia and western Pennsylvania.

**Walters-Storyk Design Group** has appointed Robert Margoueff & Associates as its West Coast representative.

## SALES NOTES

Sales of **New England Digital's** Synclavier and PostPro systems have reached 900 worldwide. ■

# If Bob Clearmountain didn't have so many good things to say about our digital multitracks, we might've had room for his picture.

It's not that Bob Clearmountain is camera-shy. It's just that when you consider he's one of the most respected names in the recording industry, his reasons for buying a Sony PCM-3348 DASH 48-track look even better.

He bought it for the transport. "The first time I ever used a 3348, the transport was so incredibly fast and responsive, I was addicted to it immediately."

He bought it for its reliability. "I've never had any real downtime because of a Sony digital multitrack. Either the 24- or the 48-

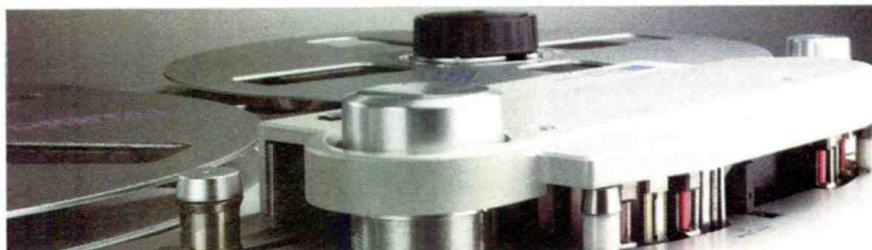
Since it's the music that matters, the on-board sampler, internal track "ping-pong" and advance digital output let you be more creative.

track. And believe me, there are other machines that have cost me weeks of my life."

He bought it for digital editing.

even better records."

He bought it for the sound. "The 3348 sounds fantastic. Everything I record sounds exactly the way it



The PCM-3348 has a truly unique transport mechanism. Its predictable response, consistent reliability, and incredible speed actually make the 3348 a lot of fun to use.

"Editing on the 3348 is unbelievably quick and easy. I can edit and re-edit without destroying an original take. And that leaves me an infinite number of options."

He bought it for creativity. "Sony's multitracks create an atmosphere where you can just let it all happen and have nothing get in the way. That really makes for better music and

went in, no matter how long I work with the tape."

And he bought it because he wouldn't consider buying anything else. "I don't think there's another machine that even comes close to the 3348."

To learn why you should buy our digital multitracks, call the Sony Professional Audio Group at 1-800-635-SONY ext. 902.

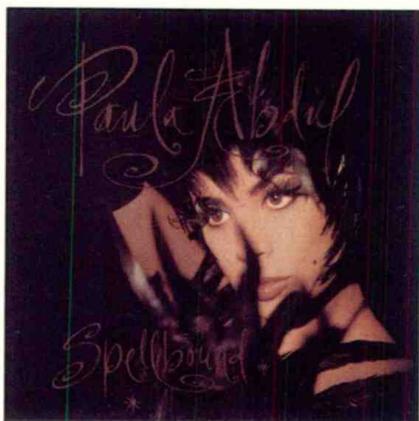


## SONY®

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# Fresh Tracks

## Paula Abdul: "Spellbound"



Label: Virgin/Captive  
Produced by: V. Jeffrey Smith, Peter Lord, Paisely Park, Jorge Corante, Colin England, Don Was  
Recorded at: Studio Masters, Sunset Sound, Larabee Sound, Mad Hatter Studios, Brooklyn Studio Masters, Hollywood Sound, Ocean Way Recording (Los Angeles); Green Street (New York); Paisely Park (Chanhassen, MN); Z Recording Studios (Brooklyn, NY)  
Engineered by: Greg Laney, Wolfgang Alchoz, Rod Hui, Michael Koppleman, Arne Frager, Don Feinberg, David Pensado, Ed Cherney  
Mixed by: Keith Cohen  
Mastered by: Dan Hirsch at Digiprep  
SPARS Code: N/A

**Comments:** With her previous album currently the subject of controversy, "Spellbound" should easily clear Abdul of any charges of performance fraud, one way or another.

**Of special interest:** After careful review, we've noticed a sparser production style in processing the lead vocals. Unfortunately, we must also report that while corrective measures seem to have been taken to clean up the tracks, they weren't enough; Abdul's sense of pitch leaves much to be desired. Here is an album replete with every technological trick in the bag, created by the top professionals in our field; unfortunately, the vocals pull down the entire project. ■

## Mozart String Quintets/Artis Quartett, Michael Schnitzler, Viola II

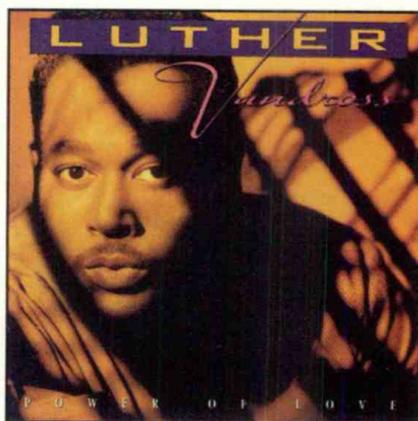
Label: Sony  
Produced by: David Mottley  
Engineered by: Sid McLauchlan  
Recorded at: The Mozartsaal, Konzerthaus Wien  
SPARS Code: DDD



**Comments:** The String Quintet in C Major, K.515 and the String Quintet in G Minor, K.516, written in April and May of 1787, are presented here. Excellent performance and production with excellent dynamic range. The musicians create a superb blend, well-captured on tape. The soft passages are clear and unobscured by hiss or dithering noise, and the louder passages are rich and powerful. Sony utilizes 20-bit technology for "high definition sound;" the result is a seemingly effective improvement over previous technology.

**Of special interest:** The Adagio ma non troppo in the String Quintet in G Minor is a particularly moving passage, one that is beautifully played. The recording of the cello, particularly on the Allegro opening the Quintet in C Major, has a nice amount of bow in the sound, adding a nice high midrange component to the rich low frequencies of the instrument. ■

## Luther Vandross: "Power Of Love"



Label: Epic  
Produced by: Luther Vandross and Marcus Miller  
Engineered and mixed by: Ray Bardani  
Recorded at: A&M Studios (Hollywood); Village Recorders (Los Angeles); Right Track Recording, Hit Factory (New York)  
Mixed at: A&M Studios  
Mastered by: Steve Hall at Future Disk  
SPARS Code: DDD

**Comments:** Here's a fully digital project without the digital "grind" artifacts. Every opportunity for anomalies could have, and should have, crept into this project, primarily because of its sequenced/workstationed nature. However, Vandross's vocal performance is couched beautifully by Marcus Miller's sensitivity to MIDI processing. As a result of his understanding the technology and the artistic integrity of the medium, Miller's musical chops serve this superb collection quite well.

**Of special interest:** Once again, QSound has made its way into the Fresh Tracks Listening Room; once again, we're not sure we get it. When the smoke machine arrives and the mirrors are installed behind our monitors, we'll let you know how it turns out. ■

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## DMT AND TRANSDUCER HOUSINGS —

All Cabinets used in the new Tannoy Monitor Series represent considerably more thought and design than the average 'chipboard cabinet of the correct volume'.

Cabinets are constructed from a high density space-frame with rounded corners and edges, supporting MDF/high pressure twin laminated walls

Rounded corners and edges greatly inhibit sound reflections and diffractions from cabinet boundaries. These can be major sources of irregularities in the reproduced sound, particularly in terms of the perceived placement of instruments within the sound stage. For the high frequency unit to make an effective job of launching all the detail that it can generate into the listening space, it must be held rigidly in the cabinet throughout its operational frequencies.

This is the key to the Tannoy cabinets. If a 'rigid' cabinet

is used, the redundant energy from the rear of the bass unit and frame cause endless resonance problems within the cabinet. Differential Material Technology provides the answers by using a variety of different adhesives between the rear of the drive unit and brace, the cabinet walls and the brace and within the layers of the MDF laminate.

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DMT provides an ideal cabinet solution for the complete frequency range, eliminating unwanted loudspeaker biases.

The overall result is a true representation of the mix, unequalled referencing capability, guaranteeing what you hear is what you get — *every time*.

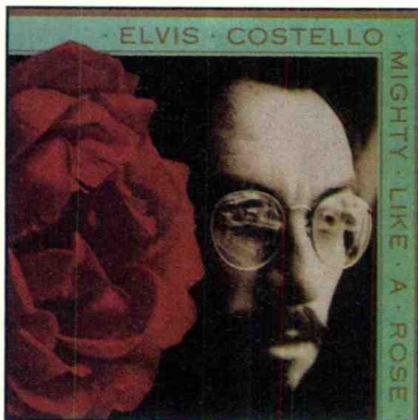
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## Elvis Costello: "Mighty Like A Rose"



Label: Warner Bros.  
Produced by: Mitchell Froom, Kevin Killen,  
D.P.A. MacManus (Elvis Costello)  
Engineered by: Kevin Killen  
Mixed by: Kevin Killen  
Recorded at: Ocean Way (Los Angeles);  
Westside Studios (London)

**Comments:** "Rose" covers a lot of musical ground, from the pop single "The Other Side of Summer" through the experimental piece "Hurry Down Doomsday (The Bugs Are Taking Over)" to the snide ballad "After The Fall." It is a complicated, dense album that may take some time to get into, but with repeated listenings it grows on the listener.

The songs are beautifully melodic, and Elvis continues to do what I like about him best: to masterfully mine little melodic nuggets from 1960s and 1970s singles and weave them artfully into his songs. Sometimes it's a snippet of a vocal line, sometimes a bass line or guitar hook. Costello clearly has it in him to write the kinds of songs that lounge singers would want to cover 20 years from now, classics like "Just The Way You Are" or "You Are The Sunshine of My Life," but he evidently has a strong desire to avoid Holiday Inn hell.

His lyrics are often too inscrutable, disturbing, subversive or punnishly clever to win him such mainstream accolades, but he does what he wants and stays true to himself; that's what I think the whole thing's about. ■

## FOCUS:

### MITCHELL FROOM, Producer, "Mighty Like A Rose"

**R•E•P:** There's a lot going on on this record; it's very dense.

**MF:** I agree, it's a dense record. Elvis has been listening to a lot of classical music the last few years, and I think his ears are getting adjusted to a more complex kind of sound. His general idea was that he wanted this to be his music album, he just wanted a lot of music on it. And he wanted each track to be real distinct and real bold. My feeling about it is that there's a lot of will on this record, it's a very willful album.

**R•E•P:** Where does the producer fit into all of this? Are you the guy who sort of choreographs all of his ideas?

**MF:** For one thing, it was a three-way production. In that respect, it was very liberating for me because the roles were much more distinct. My role in this was more on the musical end. Obviously, with Kevin Killen as the engineer, I didn't need to be responsible for that stuff. But as Elvis has said, the lines would blur. Sometimes Kevin would be involved with some musical suggestions, and so on.

**R•E•P:** What kind of musical suggestions did you make?

**MF:** Arrangements, mostly. We did a little pre-production together, just the two of us. He had made some demos and played them for me. I worked with him for a couple of weeks on the song structures, chord sequences, and so on. Most of my input was like, "What if we went to an instrumental here, what would we do?" and then Elvis would say, "Well how 'bout this?" It was very collaborative. In "Harpies Bizarre," the instrumental interlude was actually a whole different song he had written.

He has more musical and production ideas than anyone I've worked with — an overflow of ideas. Oftentimes on records I find I'm the person called upon to have the wild suggestions. If he wanted to be, he could be a really incredible producer, but I don't think he has any interest in doing it. But he's made some great records as a producer.

**R•E•P:** I don't imagine you can rehearse an album like this in the normal way...

**MF:** It's different. Usually when it's just a solo artist there's not much rehearsal involved because the musicians you're working with are used to recording and they can come upon what they need to more quickly than a band could. We just went into the studio and worked it out. We had real large tracking sessions because we'd have three keyboard players and two guitars going at once.

**R•E•P:** Did you have all the parts figured out ahead of time, how it was all going to come together?

**MF:** No, it all just evolved along the way. In a lot of the songs, there wasn't much added after the tracking. "Couldn't Call It Unexpected No. 4" is pretty much the way it sounded when we recorded it. Elvis was playing a keyboard — we had four guys playing different keyboards. For "After The Fall," what's on the record is the rough mix we did on the day we tracked the song; we liked it just the way it was.

*Continued on page 16*



“...performance that rivals digital,  
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If you're wrestling with the analog/digital question, these reports from Bill Koepnick, Emmy Award winning Sound Effects Designer, and Jim Hodson, Emmy Award winning Re-recording Mixer, both with *Advantage Audio* in Burbank, California, may help you with the answer.

Jim points out, “*Otari's MTR-100A gives me total flexibility in the audio post environment. From its auto alignment feature and responsive synchronization, to its sonic transparency and built-in Dolby\* noise reduction, the choice is very clear.*”

Bill says, “*We were looking for digital audio quality without the expense associated with going digital. The MTR-100A with its integral Dolby SR/A satisfied all of our criteria.*”

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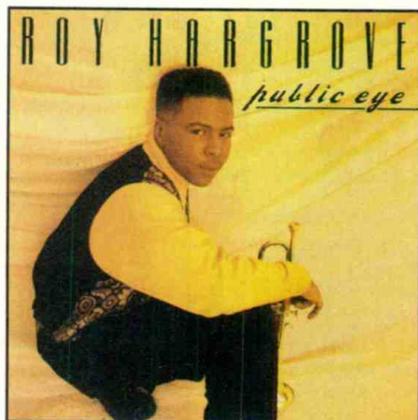
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## Roy Hargrove: "Public Eye"



Label: Novus/RCA  
Produced by: Larry Clothier  
Engineered by: Ed Rak  
Mixed by: Ed Rak and Larry Clothier  
Recorded at: Clinton Recording (New York)  
Mastered by: Ted Jensen and Ed Rak at Sterling Sound

**Comments:** 21-year-old Hargrove excels on his second release. Following in the traditions of Clifford Brown and Freddie Hubbard, Hargrove is part of the new generation of jazz traditionalists. He approaches these tunes with a freshness and skillfulness rarely found in jazz these days, be it traditional or modern. The quintet consists of a trio of bright young New York players, Antonio Hart, Stephen Scott and Christian McBride, plus veteran drummer Billy Higgins, best known for his work with Ornette Coleman, Sonny Rollins and Thelonious Monk.

**Of special interest:** Ed Rak preserves the feel of a late 1950s/early 1960s jazz record while adding tasteful, contemporary touches such as modern mic techniques and digital reverb to complement the performances. ■

*Continued from page 14*

**R•E•P:** What about "The Other Side of Summer?"

**MF:** There are more tracks recorded on that than any other record I've made in my life — more than 100 tracks. It was just in the nature of the song, it demanded all that. We spent a day just doing the submix to get it down to 48 tracks for mixing. We cut most of this album 16-track analog for basics, and then bounced it over to 32-track digital and did overdubs and brought the 16-track back in for mixing.

**R•E•P:** Most Mitchell Froom records have a sound in common, an engineering sound, that I would call open and spacious. I guess that's because you usually work with Tchad Blake. This record has a much more dense sound.

**MF:** You know, the funny thing is, it's really one of Tchad's favorite records; he really loves the way it sounds.

**R•E•P:** The records you make with Tchad have this open quality. You can mentally walk around the soundscape and hear all the instruments in their separate spaces. On this one everything is very tightly packaged and dense, with a wall of sound ...

**MF:** It's different, but I think if Tchad had engineered it he would have tried to do the same thing Kevin did. Because that was the idea of the record, to move a lot of air with the way people played. Some of it came about from talking to Larry Knechtel, who played keyboards on it. He told us about how he had played keyboards on some Beach Boys and Phil Spector recordings, and it was just appropriate to a song like "Other Side of Summer," with everybody pounding; the idea was to get that kind of blend, that wall, with people's playing and not with reverb or anything.

**R•E•P:** Where did all these weird keyboards come from?

**MF:** I own most of them. I have a portable organ, I've got about three Chamberlains and a couple of Mellotrons. There's a guy in Washington state, David Keane, who just bought up all the Mellotron stuff and I'm getting a Mellotron from him, a Mark II; it's the kind that John Lennon had. It has about 40 different sounds in it already; it's a big guy. I have a big Chamberlain that's like that, it has about forty sounds in it. It was actually Mr. Chamberlain's personal Chamberlain, the one he had at home. It's a beautiful thing.

**R•E•P:** Can David make new tapes for you?

**MF:** Yes, and he also bought up the entire Mellotron tape library.

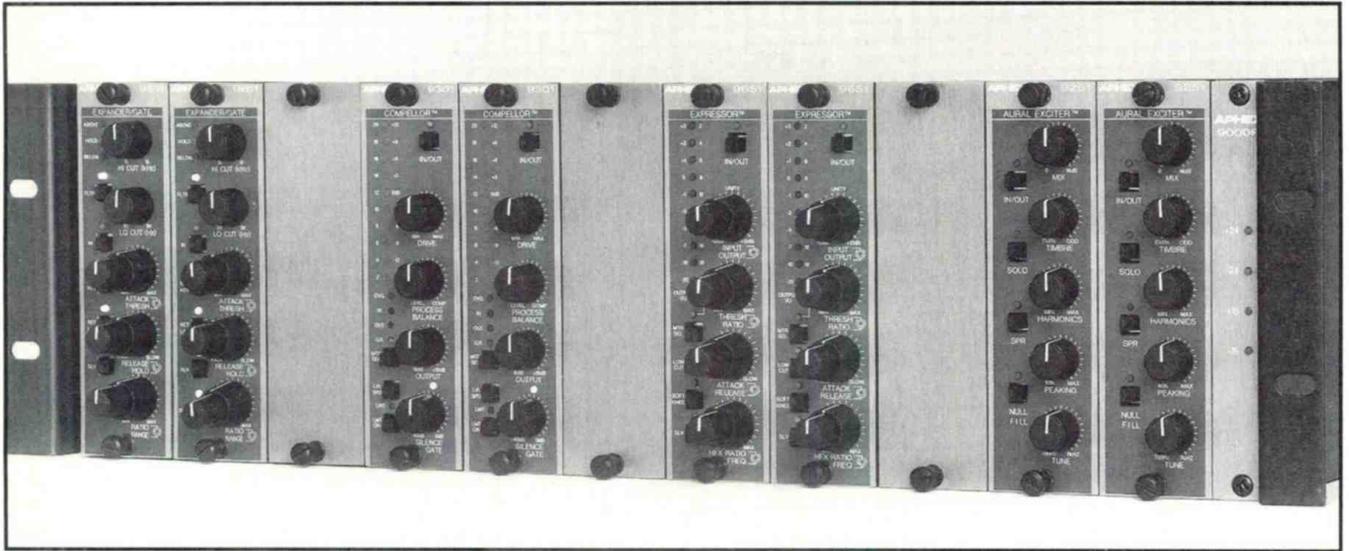
**R•E•P:** You used the Mellotron for the flute solo on "Candy," and it sounds really cool.

**MF:** If I had used the Chamberlain it wouldn't have had as much warble in it; the Mellotron's a cheaper instrument so it's a little more screwed up. Elvis really liked that sound. That whole solo was completely his melody. We talked about putting a solo in that section and he just sat down and sang the melody that you hear. It's a pretty complex melody, but that's just the sort of guy he is, it's pretty astounding. He knows instantly what he wants to hear. ■

*Interested readers can reach David Keane at 509-765-6451.*

Dan Levitin is a contributing editor to R•E•P and a producer based in Stanford, CA.

# Space Saver...



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## Keeping Abreast Of High Technology

By Bruce Merley

When I left home for engineering school, I left behind my collection of rebuilt Philco shortwave radios (with electro-magnet speakers) and took with me a "transistorized record player." I've always been a tinkerer; electronic toys still fascinate me.

Now, of course, I have the usual collection of remote controls for TV, VCR and stereo; I am writing this column on a PC with a modem and fax card; my car talks to me and its favorite gas pump talks directly to my bank; and my answering machine talks back to everybody. But can I program my VCR? Technology at work!

Even in our personal lives, the accelerating pace of technology development has made it difficult for us to keep up. In the professional world it's even tougher. Consider the case of the surgeon. Keeping up with technology is a basic necessity just to maintain a level of competency, much less excellence. As high technology developments bring new procedures and techniques literally every day, the doctor's life has become a non-stop continuing education laboratory.

But what about us? Nobody ever died from a mediocre mix — well, maybe. Nevertheless, there are important reasons why we must keep up with the technology developments in our industry. We owe it to ourselves as practicing professionals, to our clients and to our industry as a whole. After all, electronic technology is basic to what we do — it is the toolbox of our industry without which there would be no recording at all. And it ain't yet perfect!

Beyond that basic premise, what are the reasons for technology awareness? Business comes to mind immediately. Every time we purchase a new piece of gear, there are a set of expectations that come with the deal: Am I getting my money's worth? Will this be more efficient than the old machine? Can I sell this new service to my clients? Can I compete in a new market with this purchase?

Bruce Merley is president of Bryte Ideas, a New York-based consulting firm for the audio and video industries. He was formerly president and co-owner of Clinton Recording Studios and has served as president and chairman of the board of SPARS.

### STAY INFORMED

In order to successfully compete in business you must make wise, informed decisions about technology purchases and their applications. If you are just starting out or if you are diversifying in an area outside your personal experience, you need to know everything you possibly can learn about the technology if you expect to go head-to-head with the established leaders in that area.

Improving the quality of our products and services is an ever present issue in most businesses. We certainly are aware of the importance of quality in the audio business. Despite the notable and perhaps valid debates that always flourish among engineers, musicians and other audio nuts (i.e., the analog vs. digital debate), the fact

*The accelerating pace of technology development has made it difficult for us to keep up.*

is that the quality of recorded sound has steadily improved since Edison got us going, largely through the continuing development of electronic technology. Not only is this fundamental to our reason for being, it is also good business sense to pursue excellence. But in our "Search for Excellence," we must also be able to recognize it when we see it. That requires knowledge and awareness.

There are also times when technology spits up something wholly radical and offers the enlightened inquisitor astonishing opportunities. Synthesizers have allowed for an entirely new realm of electronic music and the concept of sound design, using sounds never before heard or imagined on the face of the Earth. Satellites allow two musicians thousands of miles apart to perform together as if they were in the same studio.

But how do you keep up? How do you stay informed? And informed of what? It would appear that there are two points to consider. First, there is the basic foundation of technology education required to be a working professional in this industry. That foundation may vary in nature de-

pending on the kind of job we are discussing: video technician, album mixer, studio chief technical engineer, etc. Let's assume that med school is already under our belt and we need to stay in the forefront of our profession.

The second issue is really one of continuing education but, even so, it must address two distinct groups. First, executives (owners, CEOs, etc.) must have some current level of technology awareness and literacy suitable to the requirements of their roles. Second, the engineers, technicians, etc. must have sufficient awareness to provide accurate, informed recommendations to the executive staff level and sufficient depth of knowledge to successfully implement, install, operate and maintain new high-tech systems in a facility.

Where do you begin? There are various, relatively simple means to cultivate a general awareness. In fact, if you are reading this column you are already working on keeping abreast. Trade magazines are required reading for anyone in this business. They are the front-line vehicles for manufacturers to inform their customers about their products. And the editors and writers of our trade press take seriously their responsibility to keep you informed.

### THE NEXT LEVEL

Next we must consider the role of professional societies and trade associations. AES and SMPTE publish technical papers and journals on an enormous range of technology and regularly hold seminars, meetings and conventions devoted to the examination of a variety of emerging, developing and mature technology. Trade associations such as SPARS, ITS and ITA hold regular meetings and special seminars on a variety of technology-oriented issues. The manufacturers of new technology, and often the developers and inventors themselves, are frequent guests and speakers at the meetings of these groups. Participation in any or all of the appropriate organizations should be considered a basic part of staying informed.

One of the benefits of membership in organizations such as those mentioned above is the exchange of information that happens among members. While attending the SPARS Digital Audio Workstation Seminar in Orlando, FL, I was struck by the multiple levels of information exchange that were evident:

- Manufacturers discussed and demonstrated their products.
- Question and answer sessions opened

*Continued on page 64*



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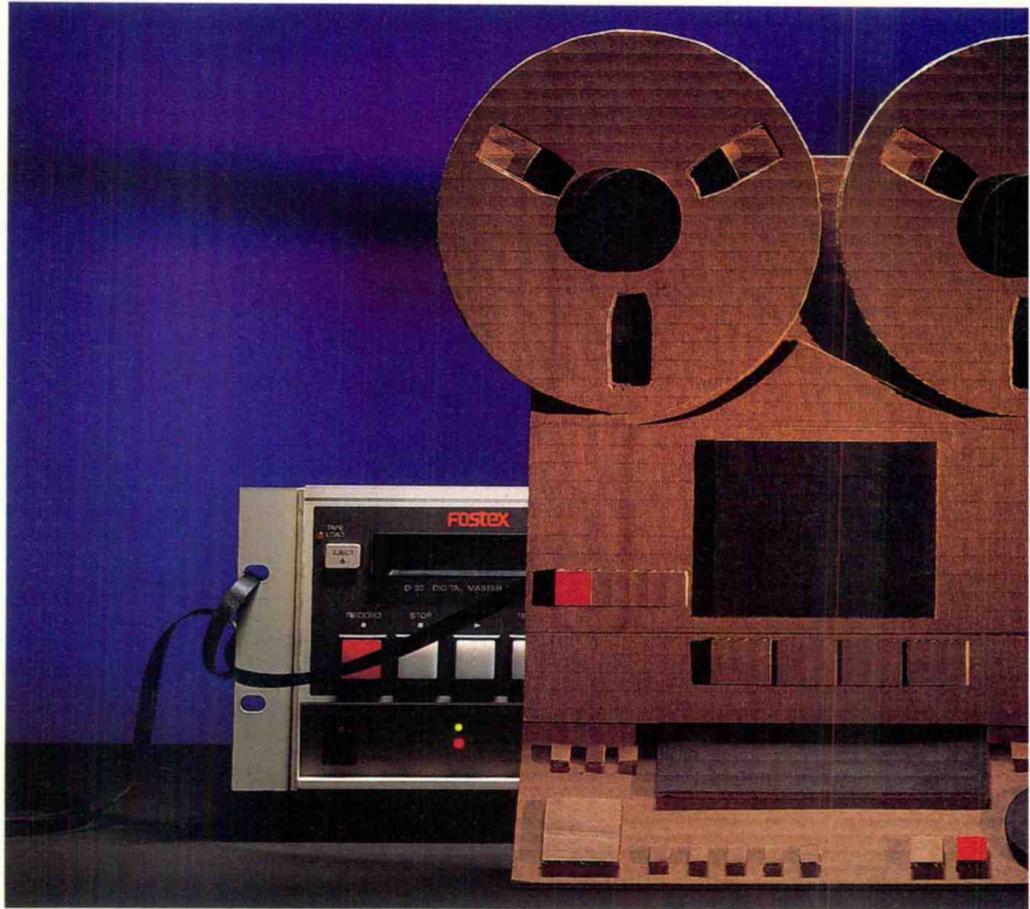
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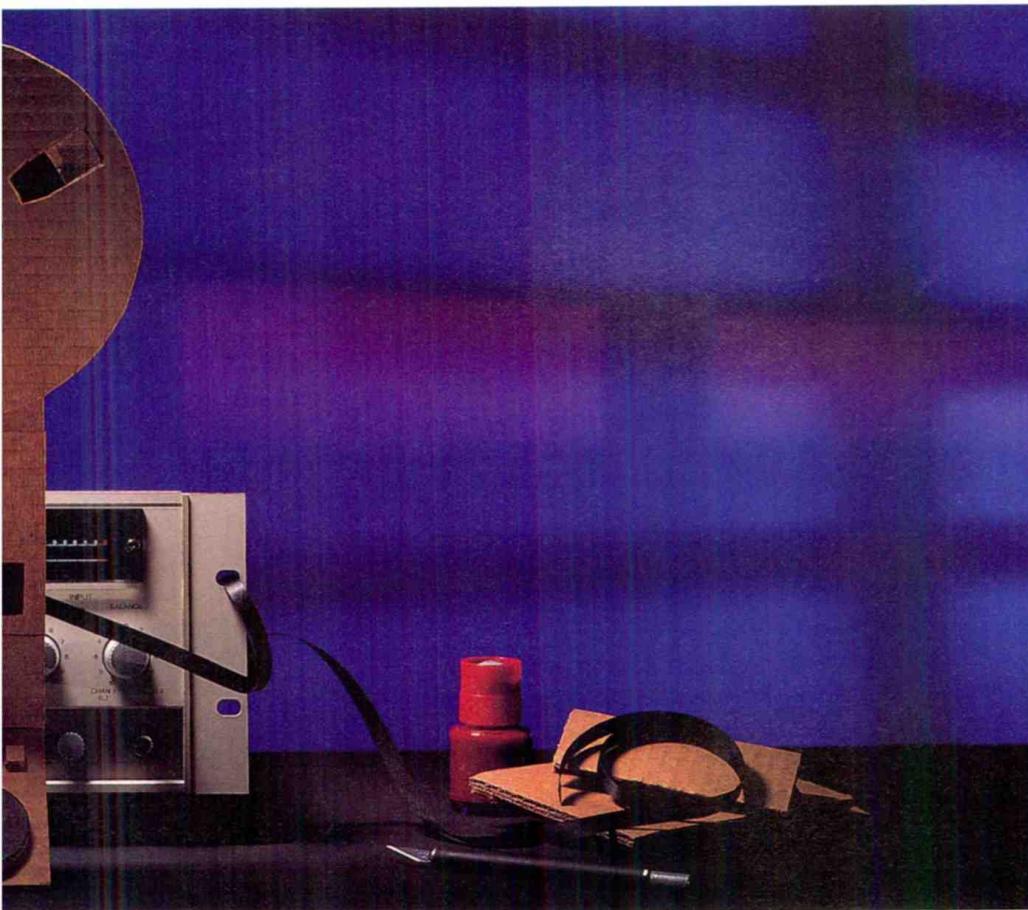


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*The optional 8320 Intelligent Controller adds complete remote control. Plus it can read, write and edit all ID formats and record up to 799 program numbers. Its LED display is switchable between SMPTE/EBU timecode and A-time.*

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## Lessons to Learn

By Rick Schwartz

**B**ack in June, Dolby Labs gave its first public demonstration of Dolby Stereo SR•D, its new process of digitally encoding sound on film. Although digital sound formats have been around for many years, most have been referred to as *dual-systems* because the audio was stored separate from the picture on multitrack tape, compact disc or laserdisk.

The first widespread use of a system with both digital sound and picture on a single piece of film was Cinema Digital Sound, a joint venture between Kodak and Optical Radiation Corporation. (CDS was featured in this column exactly one year ago this month.) Perhaps the single biggest difference between Dolby SR•D and CDS is *where* the digital information is recorded. Dolby records its bits optically in-between the sprockets on the film, while CDS uses the area where a normal optical soundtrack lies.

Beyond the obvious questions about the relative merits of each system, more important issues will affect the entire professional audio industry in the years to come. Additionally, there are a number of lessons to be learned from the evolution of digital film sound.

### LESSON NO. 1

You can't stop progress. The fact that Dolby Labs would even consider digital film sound is a strong statement in itself. Let us not forget that Dolby, the San Francisco-based audio giant, has thrived partly as a result of tape hiss. I'm sure the company doesn't want to see analog recording disappear anytime soon.

It's safe to say that its noise reduction technologies have added at least 10 years to the life span of analog recorders. The need for digital film sound appears obvious until you consider the fact that Dolby SR already has better noise performance than most 16-bit digital systems, not to mention the fact that optical Dolby Stereo SR already provides more dynamic range than many theaters can handle.

The reason for the move to digital systems is not simply a question of perform-

ance. The real reason is simple — most consumers want digital audio because they feel it sounds better. What the customer wants, the customer gets. Consumers are not the only ones. Directors like Tim Burton and Oliver Stone are willing to fight to use digital sound on their pictures because they know how much great sound can add to a film.

Dolby would rather not get into an analog vs. digital debate. It simply wants to give customers the best of both worlds on a single piece of film. Having both analog and digital tracks has a number of benefits, including the dependability of the optical analog track.

### LESSON NO. 2

Reliability is absolutely essential. How many times have you been turned away from a film because of technical problems? Probably never. Current film technology may not be flashy, but it's extremely reliable. Imagine how surprised ticket holders would be if they were turned away because of heat problems with the digital decoder. Projection rooms are hostile environments and differ greatly from a test lab. Manufacturers need to be sure to test their gear extensively in the field.

Even though Dolby is still tweaking its algorithms and getting feedback from the film industry, it has announced that the first SR•D screenings will not be heavily publicized. Smart move. The company expects test prints to be in some major markets by Christmas and in widespread usage by late 1992.

To prevent the possibility of dropouts, most digital systems use robust error-correction similar to the process used on compact discs. Although the company is still understandably reluctant to discuss technical details, Dolby has designed its error concealment algorithms so the system can survive a splice without a problem.

According to William Mead, Dolby's director of marketing, even if the data on one whole block are missing, the system will interpolate to restore the missing data. In the event of severe print damage, the Dolby system will automatically switch to the analog optical track until the digital track is usable again. The digital track is printed four frames ahead of the analog track and offset with a digital delay to accommodate transparent switching modes.

### LESSON NO. 3

The importance of media standardization. Film is one of the best examples of

interchangeable media. You can laugh about how little film technology has changed in the last 40 years, but a reel of 35mm film can be played almost anywhere in the world. Try to do that with any other format.

Because the sound is optical, there is no need to care whether tape equalization is AES or NAB. The frame rate of film is *always* 24 frames per second. There is no such thing as drop-frame, 29.97, PAL or SECAM. Film is film.

Hard disk manufacturers aren't the only ones that realize the value of removable media. Dolby plans to use removable optical media with a personal computer in the mastering process.

First, audio is converted to a digital PCM format. Next, DSP technology is used to convert the sound to an intermediate format that is then stored onto optical disk. All six channels of audio can be stored on a single 5<sup>1</sup>/<sub>4</sub>-inch optical cartridge using bit-reduction technology similar to Dolby AC-2. (See Digital Domain, March 1991.) In the mastering process sound data are stored on the disk in the compressed format. One advantage of removable media is sound can be previewed in a theater without actually making a film print.

### LESSON NO. 4

Make it affordable. Dolby seems to have addressed many, if not all, possible objections, providing the same multichannel capabilities of 70mm magnetic prints on an economical 35mm release format. Developing labs will be pleased to find there is no change to existing development practices or special film stock required.

Dolby would like to see every print of a given release be issued in SR•D so that any prints could be played in any theater. This way, distributors do not have to double inventory prints, and multiplex theaters can distribute the same print throughout all of its cinemas.

The company also hopes to make the technology available to most film labs, so that some day every film will have a digital stripe on it. This way theaters could convert to digital playback at any time. If they're already Dolby-ready, the conversion process is even easier because SR•D interfaces with their existing Dolby cinema processor, which lowers conversion costs. All the cinema needs to add is a digital reader and a digital decoder. Both readers sit on top of the film projector, although Dolby has plans to integrate it into the projector to further cut costs.

*Continued on page 64*

Rick Schwartz is a contributing editor to R•E•P and director of post-production at Music Animals, Los Angeles.

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An overview on the art of providing an education, for entry-level students and working professionals both.

# AUDIO EDUCATION: NOW AND FOR THE FUTURE

By Garry Jones

**T**he Media School of Tomorrow. In the future, there won't be anymore recording-specific schools per se, just media schools. They will offer specialized training, specific to technological advances, while teaching a general working knowledge of multiple, related fields. Labs will be held on state-of-the-art gear, equipment that is considered the best of its kind. The generalized training will encompass terminology and information about video production, post-production, studio maintenance, workstations, the entertainment business and more.

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*What about learning the small studio setup? A certified jet pilot can fly a Cessna 150, but the inverse isn't true.*

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The Media School of Tomorrow will satisfy two important needs, education-wise, in our industry: informational updating for working professionals already in the field, and basic training for college-aged students who choose to take the vocational approach.

If they are at the entry-level, they should be able, upon completion, to understand the basic issues of business negotiation — mechanicals, points, royalties, etc., in addition to equipment operation, maintenance

and application. Why business? Because the world belongs to intellectual, educated individuals who are quick on their mental feet and ready for anything.

## ENTRY-LEVEL

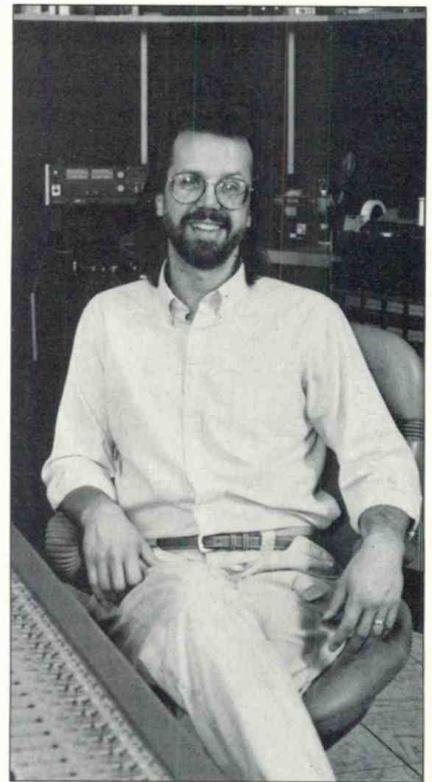
Any school preparing new students for work in tomorrow's entertainment industry must be founded and built upon three necessary principles.

1. The lab equipment students use must be current, upper-echelon gear, representative of cutting-edge technology found in the best studios. Training must occur on equipment that will be seen by the graduate in the workplace. What about learning the small studio setup? My analogy is that of an airplane pilot. A certified jet pilot can fly a Cessna 150, but the inverse isn't true. You have to be prepared for both.

2. Instructors must be experts in the field of study that they teach. Years of experience before entering the education profession should be mandatory. So, too, should be provisions by the school to allow for continued professional work by their instructors.

3. The school should be located in the heart of the industry in which it serves. This feat is accomplished by promoting and operating the studio facilities as professional media rooms with and for outside clients. The same gear that the students and instructors work with also produces professional end-product.

This provides a) verification that the studios meet professional standards; b) professional work for the instructors/engineers, allowing them to remain current at their craft; c) continuous exposure of the school and its students to professional clients who may well be future employers and/or industry contacts; d) studio clients who leave as ambassadors of good will for the students and the school; and e) industry experts as guest lecturers.



Author Garry Jones at one of Full Sail Center for the Recording Arts' studios.

The Media School of Tomorrow must serve an industry that is quickly evolving towards all-digital technology — most likely a single workstation handling pictures and sound — by training both new students and continuing audio pros to work with their eyes as well as their ears. In the past, hordes of graduates with bachelor's degrees in communications left campus searching for careers in audio production or television, only to discover their lack of experience in using a real multichannel console or current-technology camera.

In the future, working professionals and

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Garry Jones is senior vice president of Full Sail Center for the Recording Arts, Winter Park, FL.

new students both will be far more demanding of their education, asking specifically "How will this translate for me on the job?"

### CONTINUING EDUCATION

Separate from the entry-level student, but of equal priority in the educational arena, is the professional seeking an education update. Unfortunately, a large percentage of today's audio industry pros are too busy doing their daily tasks (while technology races past them) to further their education. Why?

1. The demands of the job allow no time for in-depth education.

2. There is a real fear of not being able to understand or utilize the new technology, a mindset that freezes motivation.

3. There is resistance to change, also known as "This is The Way I've Always Done It" syndrome, supported by the industry at-large.

4. Schools often fail to cater to the working professional's need for advanced, short-term programs that can be completed in the relatively brief time professionals have to attend.

5. Schools don't cover advanced enough material for those who already grasp and apply the basics.

6. The professional may not be in touch with who and where seminars or courses are presented.

The solution begins at the source — the school itself. Tomorrow's school must subscribe to the task of developing meaningful curricula for the active audio professional. Courses related to innovative changes or additions in technology should be designed to last from several days to two weeks. This would allow the employed individual an opportunity to attend on days off, during a brief sabbatical or on vacation days, and increases the likelihood of co-sponsorship by the employer.

Brief pre-course interviews with the school would determine an individual's initial skill/knowledge level, and from that, the base level of instruction could be arranged prior to the commencement of intermediate or advanced material. The pace of these programs would be faster and more in-depth than basic courses, and hands-on time would be an integral part of the program. Vital to the intermediate/advanced learner would be manufacturer support of the information presented, as well as factory information (manuals, spec sheets, etc.) to take back to the working environment.

Once the schools of tomorrow initiate

courses for the professional, it is up to the employed individuals to not only be cognizant of industry and technological changes, but to act upon and respond to them. Excuses as to why there's no time for continued education ultimately won't work, if the professional practitioner wishes to remain vital and active.

### THE FUTURE DEFINED

Tomorrow's school will accomplish many things: It will acquaint new students with technology as they learn from current professionals. It will serve as a perennial watering hole for professionals who seek educational updates. Importantly, it will motivate and give both of these groups the personal tools to succeed.

Finally, the modern educational environment must empower everyone it touches to be successful in a demanding, highly competitive *changing* marketplace by teaching how to think, inductively and deductively, how to cope with the increasing stress and pressures of our modern production environment (with its evermore complex and numerous list of technological goodies), and how to maintain a forward-leaning positive attitude toward maintaining currency with the ever-rushing technology. ■

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	8 $\Omega$ both chs. driven	: 400W
	4 $\Omega$ both chs. driven	: 600W

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# Small Wonder

**Incomparable** *Performance*

**Unmatched** *Versatility*

**Incredible** *Value*

**No other small speaker in the world can match the new Electro-Voice S-40 compact monitor.**

**In fact, no one comes close.**

We like to say that the S-40 "breathes freely." Unlike our competitors, we gave it independent woofer and tweeter protection, which activates only when the speaker is overdriven, never before. EV's exclusive PRO™ circuit protection guarantees 160 watts of long-term power capacity.

And to further prevent failure, the tweeter is ferro-fluid cooled and uses flexible tinsel lead wires. Smooth and accurate throughout the entire frequency range, the S-40 features high-quality components with an optimized crossover. The rugged polystyrene cabinet is optimally vented for extended low-frequency response ( - 3 dB at 85 Hz).

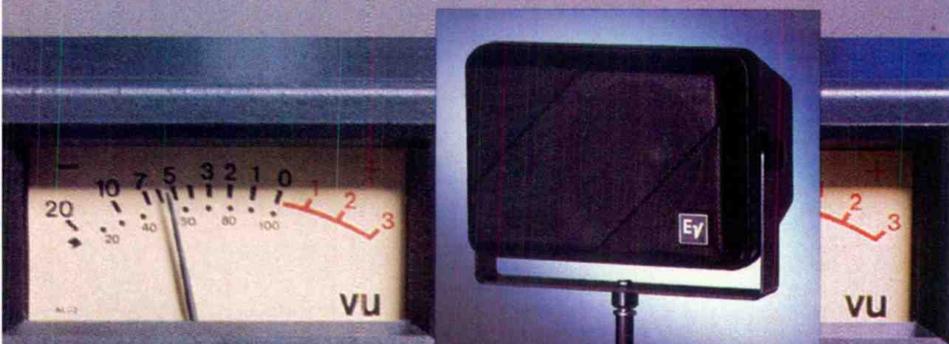
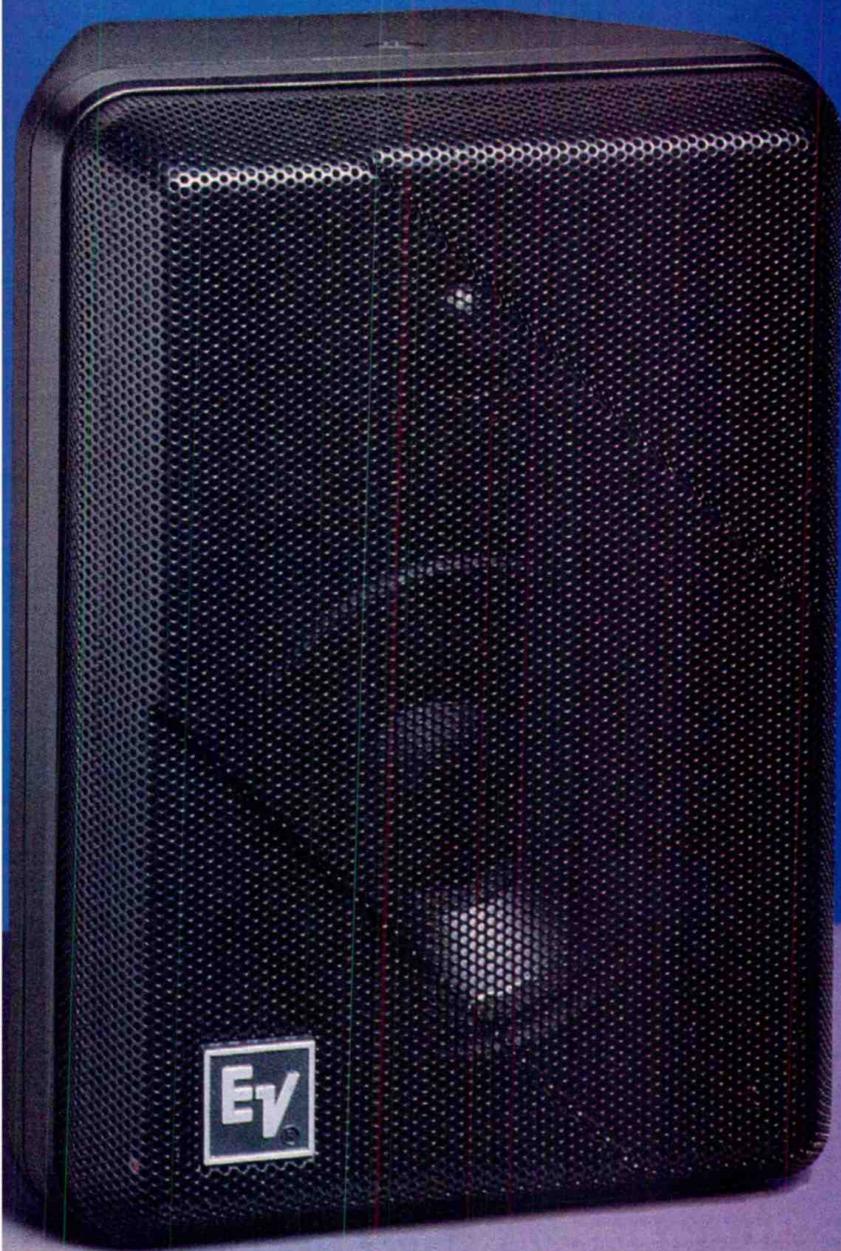
Low-flux-leakage magnetic design means the speaker can be placed close to video monitors without interference. Optional enclosure mounting points are conveniently spaced so that a wide range of hardware can be used for stand or wall mounting. A special mounting bracket is also available.

Available in black and white, the S-40's sharp styling will enhance the look of your studio, and offers numerous options for a live set.

The Electro-Voice S-40 — a small wonder. Proof that good things **sometimes** do come in small packages.



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**1991 R•E•P NATIONAL AUDIO TEST**

Welcome to the first R•E•P National Audio Test. We strongly believe in knowledge and education, and as such, are proud to present this audio technology exam for those of you brave enough to find out how much you really know about the technical basics.

Admittedly, an exam of this short length can barely be expected to scratch the surface of all there is to know in audio. For every question you see here, five were discarded. But those that made the cut cover a wide-ranging sampling of the types of things that we, as professional practitioners, should definitely be up on.

Nobody should expect to be current in all the areas covered, so a 100% on the test score might be considered unusual, if not exceptional. However, in your chosen area of experience, the questions pertain to material you might reasonably be expected to know. More important than any other consideration, this exam is for your education. At the least, we hope that it points out your areas of strengths and weaknesses, providing incentive to stay current.

The test itself contains 100 multiple choice questions, divided into five groups of 20, covering the following categories: acoustics theory and practice; transducers, meaning speakers and microphones; digital technology; physics and electronics; and audio production. The desire to keep the exam down to a manageable length precluded in-depth coverage of audio-for-video post or film environments, questions on field acquisition, concert touring specifics, or any one of a number of other specialized areas, no matter how truly important they might be.

In framing the questions, we have made every effort to be clear and concise. The instructions are simple: choose the best or most technically correct answer. Most questions are self-explanatory. Read them carefully — some have wording which expose their true nature. Tear out the answer card on page 73 and record your responses. After you finish the exam, you may want to check your answers on page 60. Although no explanations are given for the correct answer in this issue, if enough people write in, we will be happy to print an in-depth, technical explanation in a future issue. Space is also supplied on the answer sheet to request explanations for specific questions.

Finally, you may want to photocopy the blank answer sheet to let your friends and associates have a shot at the exam. We would like to invite you all to submit the entire answer page as your entry form into the multi-prize, audio equipment random drawing. This give away is open to all subscribers except manufacturers and audio magazine employees.

However, if you're not a current subscriber, please fill out the free subscription form in the back of this issue. Send it along with your test results and we'll put you in the random drawing to be held at the AES show in October. Take a look at the prizes offered. Incentive enough to take the test?

Mike Joseph  
Editor

**NAT AWARDS**



1st Prize: (one) Eventide H-3000-KS Ultra Harmonizer, fully loaded, with sampler board (retail value \$4,590).



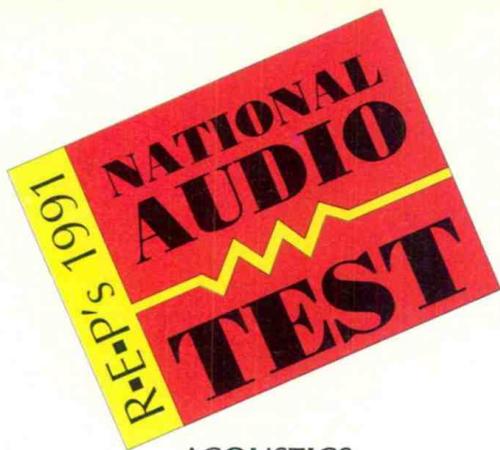
2nd Prize: (one pair) Genelec 1031A self-powered control room monitors (retail value \$2,998).



3rd Prize: (one) Shure FP42 mixer (retail value \$1,020).



4th Prizes: (four) Electro-Voice N/D 857 microphones (retail value \$472 each); one item per winner only.



## ACOUSTICS

1. In LEDE design, which area is considered "live"?
  - A) The front of the room
  - B) The ceiling and floor
  - C) The back of the room
  - D) The console area
2. What is the main advantage of LEDE?
  - A) The room is large and develops low frequencies
  - B) The walls and ceiling are resonant to specific frequencies
  - C) The sweet spot is larger
  - D) Reflections are controlled and reinforce the direct sound
3. The Haas Effect stipulates that:
  - A) Imaging in stereo is determined only by each channel's SPL
  - B) Imaging is determined more by path length differences (delay)
  - C) Imaging is determined by the frequency content of the signal
  - D) The Haas Effect doesn't deal with imaging
4. Approximately how long (or deep) would a room have to be in order to develop a complete 40Hz wavelength, assuming average temperature and humidity conditions?
 

A) 40 feet	C) 20 feet
B) 30 feet	D) 15 feet
5. Meter bridge-mounted monitor speakers are effective primarily because they:
  - A) Widen the sweet spot
  - B) Eliminate reflection off the console top
  - C) Increase the ratio of the direct to indirect (reflected) room sound
  - D) Exactly match what the consumer will be hearing at home
6. If a sound absorber has a random incidence absorption coefficient of 0.8 at 125Hz, what percentage of the incident sound at that frequency is reflected?
 

A) 20%	C) 60%
B) 40%	D) 80%
7. If a square reflecting panel specularly reflects frequencies for which its length is four times the wavelength, approximately how long a panel is needed to reflect a 50Hz signal?
 

A) 90 feet	C) 60 feet
B) 75 feet	D) 45 feet
8. If a room's average ceiling height is eight feet, what is the approximate frequency of the primary floor-to-ceiling standing wave that occurs?
 

A) 35Hz	C) 70Hz
B) 52Hz	D) 88Hz
9. The Inverse Square Law determines:
  - A) How rapidly high frequencies are absorbed in air
  - B) Low frequency propagation
  - C) How multiple sound sources combine in level
  - D) Sound attenuation with distance
10. Theoretically, a low frequency point source, located against an infinite boundary plane in half-space, has how much higher a power output than the same source in full-space?
 

A) 10dB	C) 3dB
B) 6dB	D) 0dB
11. A directional high frequency source, such as a horn tweeter, mounted in half-space has how much higher a power output than the same source in full-space?
 

A) 10dB	C) 3dB
B) 6dB	D) 0dB
12. Power Alley is:
  - A) A club complex in Dallas
  - B) The first few front rows of a concert
  - C) Down the center of the main seating area
  - D) Directly behind the main speaker stacks
13. One can control the reverberation in a large acoustic space by:
  - A) Increasing the volume of the sound system
  - B) Reversing the polarity of the mics relative to the speakers
  - C) Delaying the entire mix by the distance between the speakers and the sound source
  - D) Tightly controlling the system's splay
14. Critical Distance is:
  - A) The distance from loudspeakers where all the components blend or focus
  - B) The point where one is too far away from the speakers to hear with any intelligibility
  - C) The point where the direct sound field is equal to the reverberant field
  - D) None of the above



# Command Performance

The 3200. Your wish was our command. Introducing an analog console that dramatically refines performance while radically improving operational control and flexibility. Its design centers around the classic split configuration and successfully brings Soundcraft to a new milestone in console design.

The 3200, with full status illumination, offers up to 100 fader-controlled inputs and 20 auxiliary sends. With fully balanced 32 buss routing, global multitrack A/B switching and a noise gate on every channel, it delivers remarkable creative control. And, thanks to innovative electronics and advanced circuit design, the finest in sonic performance as well.

The 3200. It awaits your command.

## Soundcraft



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H A Harman International Company

15. A loud sound excites the standing waves in a rectangular room with rigid walls. The resulting sound pressure level will be minimum at:
- The center of the long walls
  - The geometric center of the room
  - A quarter distance out from the short walls, at the 90° wavelength points
  - In the corners of the room
16. Extremely low frequencies (30Hz) are leaking from one studio to the other. The best fix is to:
- Treat the walls with 6-inch absorptive material
  - Treat the ceiling with 4-inch absorptive material
  - Build an active bass trap
  - Decouple the source to eliminate vibration
17. Three identical loudspeakers are symmetrically spaced apart with their coverage patterns overlapping and are driven in phase with identical signals. Their combined polar pattern will exhibit:
- Peaks around their common axes
  - Nulls around their common axes
  - Both of the above
  - None of the above
18. Minimal lobing at a given frequency of multiple horns occurs when:
- The 3dB down-points of the patterns just meet
  - The 6dB down-points of the patterns just meet
  - The horns are angled 15° apart
  - The horns are angled 30° apart
19. Inside an enclosure, the best place to locate sound absorbent material is:
- On the back, opposite the speaker
  - In the very center
  - Along two sides only
  - On all four walls
20. If an equal amplitude, equal time-delayed signal is fed to two speakers so as to create a phantom center image, and one side is reduced by 10% in level, the sound will appear to:
- Not shift at all
  - Shift to one side slightly
  - Shift to one side strongly
  - None of the above

Questions continue on next page

## THE FIRST CHOICE OF RECORDING STUDIOS IS THEIR SECOND CHOICE, TOO.

There's been an interesting phenomenon developing since the release of the ATR 60/16.

Seems when it comes time to expand, major studios already owning a 60/16 always buy a second.

100% of the time.

The studios sometimes look at other models. But what they discover, is that feature for feature, dollar for dollar, no other 16 can compete.

That's because of, among other things, the 60/16's superior head technology. It's so accurate that final EQing decisions can be made right in the sync mode, without rewind or repro verification.

And our special circuitry provides transparent punch-ins for gapless edits.

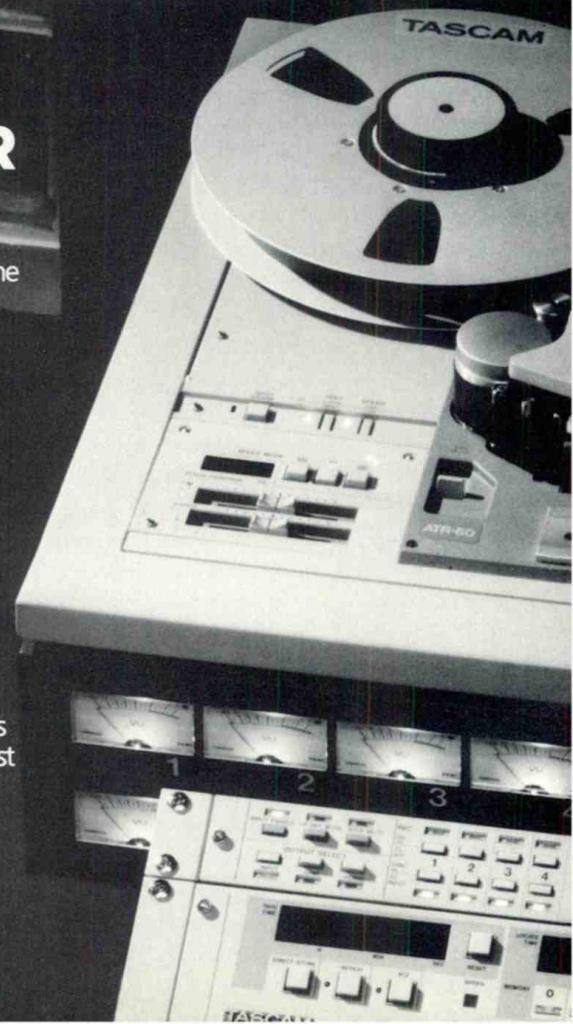
There's also incredibly fast lock-ups, at speeds limited only by the quality of your other equipment.

So, get into your Tascam dealer and see the machine that has them coming back for seconds. The ATR 60/16. It's the industry's first and second choice, because it's second to none.

# TASCAM®

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28. Theoretically, in anechoic conditions, when the signal from two identical, well-spaced microphones is summed together, and the source is equal distance from both, the result will be:
- A comb filter response due to wavelength dimensions
  - Full cancellation
  - Partial cancellation determined by mic separation
  - An increase in output over just one mic
29. All other things being equal, the microphone with the flattest inherent frequency response is:
- An omnidirectional
  - A cardioid
  - A figure-eight
  - A shotgun
30. To lower the box-tuning frequency of a vented woofer enclosure, one would:
- Decrease the area of the ports
  - Increase the lengths of the ports
  - Increase the internal volume of the box
  - All of the above
31. A  $60^\circ \times 40^\circ$  horn will increase the midband efficiency of a compression driver how many decibels compared to a  $90^\circ \times 40^\circ$  horn?
- 0dB
  - 3dB
  - 6dB
  - 9dB
32. The optimal splay angle for a trapezoid loudspeaker system is:
- $15^\circ$
  - $30^\circ$
  - When the sides of the boxes are parallel and almost touching
  - None of the above
33. The "Q" of a loudspeaker is a measure of its:
- Polar pattern frequency
  - Efficiency
  - Frequency response rolloff slope
  - Directivity Index
34. Assuming the same drivers under the same power, a  $60^\circ \times 40^\circ$  CD horn will "throw" sound a lesser or greater distance than a  $90^\circ \times 40^\circ$  CD horn?
- Lesser
  - Greater
  - The same
  - None of the above
35. A JBL 2445, fed with 100W, mounted on a good  $90^\circ \times 40^\circ$  exponential horn, will "throw" sound how many feet?
- 75
  - 150
  - 250
  - None of the above
36. For the same acoustic power output, a 15-inch woofer must have an excursion of how much more than an 18-inch woofer?
- About the same
  - 1.2 times greater
  - 1.5 times greater
  - 2 times greater
37. To produce 10 acoustic watts at 60Hz, a direct radiating 18-inch woofer (with an effective piston diameter of 16.5 inches) would have an approximate peak excursion of:
- 1 inch
  - 0.4 inches
  - 0.2 inches
  - 0.1 inch
38. In the U.S., the de facto polarity standard for a cone loudspeaker is:
- A positive voltage to the + terminal moves the speaker outward
  - A positive voltage to the + terminal moves the speaker inward
  - There is no standard
  - Both have been standards at different times
39. An  $8\Omega$  speaker offers what advantages over a  $16\Omega$  loudspeaker:
- It plays louder
  - It has inherently better frequency response
  - It draws more current from the amplifier
  - All of the above
40. A diaphragm which is said to be "doubling" is really:
- Acting as if it had the output of two devices
  - Generating even harmonics
  - Generating odd harmonics
  - None of the above

## DIGITAL TECHNOLOGY

41. Ten minutes of 16-bit stereo program, sampled at 44.1kHz, will take up about how much space on a hard disk?
- 96Mbytes
  - 100Mbytes
  - 105Mbytes
  - 210Mbytes
42. Digital audio frequency response is most affected by:
- Sampling rate
  - Number of bits per sample
  - Word or byte size
  - All of the above
43. Digital audio dynamic range is most affected by:
- Sampling rate
  - Number of bits per sample
  - RAM size
  - All of the above

# The AES 91st Convention

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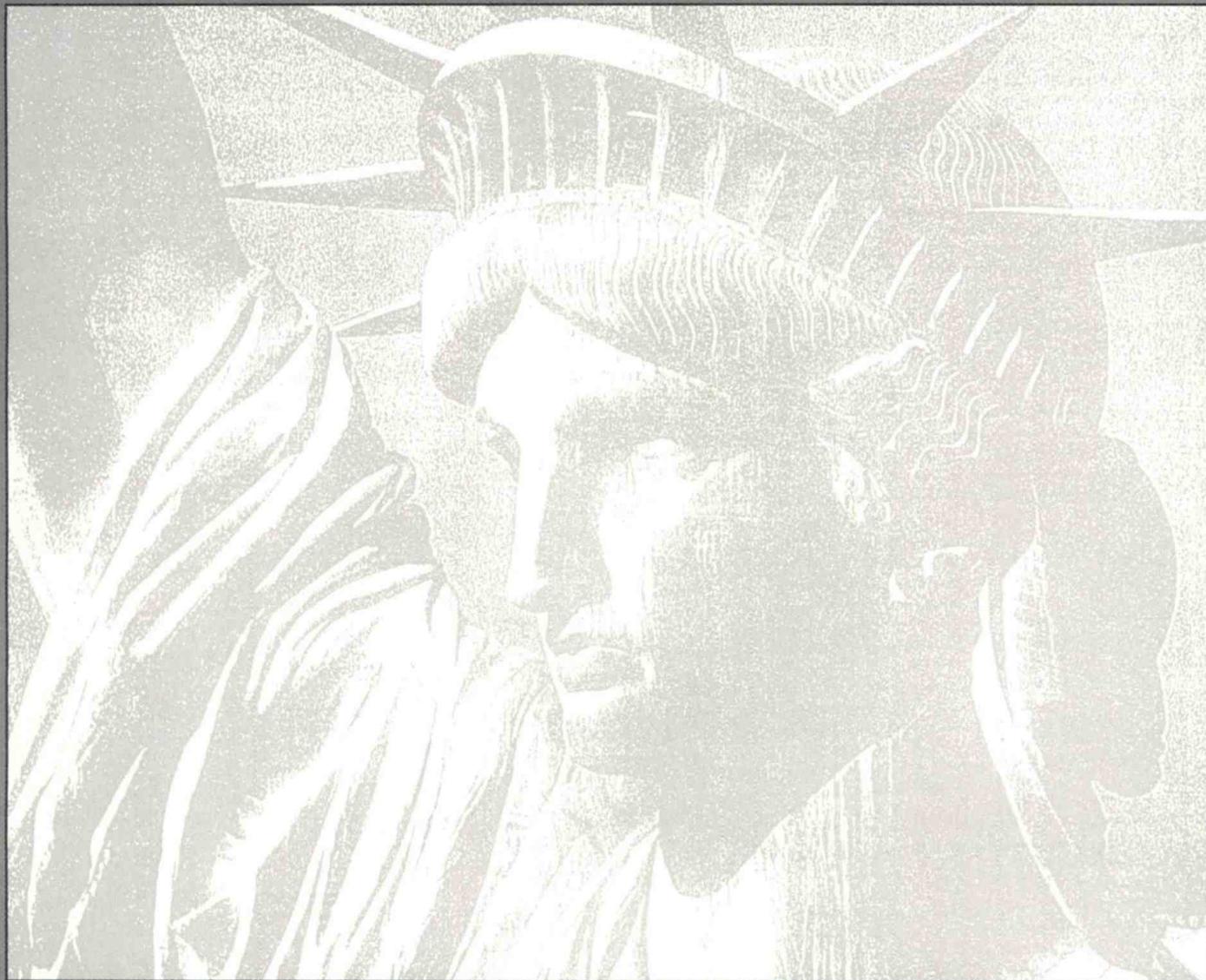


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44. *Interleaving refers to:*
- A) The way tracks are laid out on a disk
  - B) The way two channels are combined on a workstation
  - C) The way digital audio bits are ordered in the S/PDIF protocol
  - D) All of the above
45. *SCMS will mostly affect:*
- A) Consumers who copy CDs
  - B) Anyone who records on a DAT machine
  - C) Home and pro machines that have been modified
  - D) Copied source material that has been encoded at pressing
46. *Rotating 4-head digital tape recorders work by:*
- A) Laying down a discrete track per head
  - B) Modulating RF signal with digital information
  - C) Breaking up the digital signal into different frequency bands
  - D) None of the above
47. *The theoretical dynamic range of a 16-bit system is:*
- A) 84dB
  - B) 92dB
  - C) 96dB
  - D) 102dB
48. *SDIF2 is a digital I/O format that:*
- A) Interleaves left, right and clock information
  - B) Uses two cables, one for clock, one for L/R
  - C) Was proprietarily developed for the Sony PCM 1610
  - D) Was the first to have a published design spec
49. *MADI will have the following I/O format features:*
- A) It will carry up to 56 channels on a single cable
  - B) It will have a high (100MHz) data bandwidth
  - C) It will be a universal professional standard
  - D) All of the above
50. *S/PDIF varies from the AES/EBU format in that:*
- A) It uses an unbalanced coax interconnect
  - B) It carries fewer channels per cable
  - C) It is bi-phase encoded
  - D) Its channel information is encoded sequentially
51. *One of the drawbacks in using the AES/EBU digital format when copying program between DAT machines is:*
- A) The machines must be close together
  - B) All indexing and directory information is lost
  - C) Speed variations between the clocks will cause errors
  - D) All of the above
52. *The AES/EBU I/O format uses digital words that are how many bits long per channel?*
- A) 16
  - B) 20
  - C) 24
  - D) 32
53. *Dithering is a process whereby:*
- A) Internal clock speed is altered to match incoming sync
  - B) High frequencies are filtered to avoid aliasing
  - C) Low level random noise is introduced to the analog signal
  - D) None of the above
54. *Dithering is done because:*
- A) It randomizes sampling irregularities
  - B) It masks quantization noise
  - C) It allows interpolation of signal below LSB
  - D) All of the above
55. *Low-pass filtering is done on an audio signal before it is converted to digital because:*
- A) Broadcast transmission systems have problems with high frequency signals
  - B) Samples become inaccurate with less than two samples/wavelength, causing aliasing
  - C) We can't hear above 20kHz
  - D) It smooths the roughness of the digital sound, called the Nyquist factor
56. *In digital (binary) code, the number 12 is represented as:*
- A) 1001
  - B) 1010
  - C) 0110
  - D) None of the above
57. *Which of the following digital systems has the best dynamic range but smallest bandwidth?*
- A) 16-bit/44.1kHz
  - B) 16-bit/48kHz
  - C) 20-bit/44.1kHz
  - D) 20-bit/48kHz
58. *A 16-bit word allows approximately how many increments or quantizing steps:*
- A) 65,500
  - B) 64,000
  - C) 48,000
  - D) None of the above
59. *Which format suffers the least quantizing error?*
- A) 16-bit
  - B) 18-bit
  - C) 20-bit
  - D) Quantizing error is a function of sample rate, not word size

*Questions continue on next page*

60. One place where a low-pass filter in a digital audio chain can be located is:
- A) At the output of the ADC
  - B) At the input to the DAC
  - C) At the output of the DAC
  - D) None of the above

## PHYSICS AND ELECTRONICS

61. There really is an XLR hot pin standard! It is:

- A) Pin 2
- B) Pin 3
- C) It varies by country convention
- D) That's a lie!

62. A "telescoped ground" signal cable is:

- A) A very long unbalanced signal cable
- B) A balanced cable where one of the signal's hot leads and the ground lead are switched
- C) A two conductor (balanced) cable with the shield cut or floated at one end
- D) A center conductor (unbalanced) cable with the shield cut or floated at one end

63. Which of the following is NOT an effective grounding noise solution:

- A) Grounding all equipment separately to an ac service ground
- B) Floating the service and using a separate single ground rod
- C) Installing a center-tapped iso transformer for service
- D) Telescoping the shields on all balanced signal lines

64. Which of the following analog line level interconnection schemes is currently considered optimum:

- A) Lo Z to Hi Z bridging
- B) Lo Z terminating
- C) Hi Z terminating
- D) None of the above

65. How much signal loss is there in a 100-foot run of 12-gauge speaker cable, assuming a 4Ω load?

- A) 0.4dB
- B) 0.8dB
- C) 1.2dB
- D) 1.8dB

66. What single amount of phase shift does a polarity reversal cause?

- A) 90°
- B) 180°
- C) 360°
- D) None of the above

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67. Which of the following analog circuits has the least amount of phase shift?
- A 1-pole filter
  - A 2-pole filter
  - An 18dB-per-octave filter
  - A "brick wall" filter
68. A +4dBu device has a gain stage with a dynamic range of 97dB. It's headroom is 18dB. Where is its noise floor?
- 83dBu
  - 79dBu
  - 75dBu
  - None of the above
69. Assuming the same measuring standard, one console, operating at a nominal -10 level, clips at +20dBu output. Another console, operating at +4dBu, clips at +24dBu output. The difference in their headrooms is:
- 4dB
  - 8dB
  - 10dB
  - 14dB
70. Both of the above consoles have a 95dB signal-to-noise ratio. The approximate difference in their noise floors is:
- 4dB
  - 8dB
  - 10dB
  - 14dB
71. If both of the above consoles had a 105dB dynamic range, the difference between their noise floors would be:
- 4dB
  - 8dB
  - 10dB
  - 14dB
72. Most gain trim controls in the mic pre-amp stage are accomplished via a pot or switch selected resistor matrix:
- Before the gain device
  - In the negative feedback loop
  - After the gain device
  - As an active voltage divider driving the VCA
73. A -10 nominal operating level on consumer or semi-pro unbalanced equipment usually refers to a signal 10dB below:
- 5V
  - 1.228V
  - 1.0V
  - 0.775V
74. The proper value for the -10 signal above is stated in:
- dBm
  - dBu
  - dBV
  - dBa
75. A +4 nominal operating level on balanced professional equipment usually refers to a signal level 4dB above:
- 5V
  - 1.228V
  - 1.0V
  - 0.775V
76. The actual level difference between a Hi-Z, semi-pro unbalanced device that reads 0 VU at -10 and a Lo-Z professional balanced device that reads 0 VU at +4, once impedance matching is taken into consideration, is:
- 14dB
  - 12.3dB
  - 11.8dB
  - 10.2dB
77. A device's slew rate is related to:
- Bandwidth
  - Frequency response
  - Voltage swing rate
  - All of the above
78. Bias is:
- A dc offset in electronic circuits
  - A high frequency current applied to analog tape
  - A speaker's deviation from its center resting point
  - All of the above
79. IM is measured by:
- Reading the overtones added to a simple sine wave
  - Reading the overtones caused by a square wave
  - Reading the sidetones caused by two primary tones interacting
  - All of the above
80. A low-pass filter with a knee at 80Hz, a -6dB point at 60Hz, and a -18dB point at 15Hz is said to:
- Be a 3-pole filter
  - Have a slope of 6dB/octave
  - Have a slope of 12dB/Octave
  - Have a Q of 4

## AUDIO PRODUCTION

81. If a mix is completed on a monitor speaker system that has a prominent or "forward" midrange, the resulting tape will sound:
- Bass prominent
  - Treble prominent
  - Midrange prominent
  - None of the above
82. In a studio, a mult is typically used to:
- Split a signal
  - Combine a signal
  - Provide multiple or different levels to different sources
  - A and B

Questions continue on next page

83. *You just laid down a channel on the analog multitrack. The red light was on during recording, but the track won't play back now. The LAST thing you'd do is:*
- Swap record cards and try it again.
  - Go to a blank spot on the tape and try recording something there.
  - Swap play cards.
  - Check the sync head versus the repro head for signal on tape
84. *The proper level to record time code on a single analog multitrack channel is:*
- 5dB to 10dB hotter than the audio so the synchronizer gets a good lock
  - At the same level as the audio
  - 5dB to 10dB below the audio
  - 25dB down, to minimize bleed.
85. *Drop-frame time code can be at which of the following rates?*
- 29.97 fps only
  - 30 fps only
  - Both of the above
  - Neither of the above
86. *An analog de-esser works by:*
- Inverting the high frequency component of the signal and mixing it back with the original
  - Inserting a high pass filter into a limiter sidechain
  - Using an analog "smart circuit" to analyze and filter signal content
  - None of the above
87. *VITC and LTC differ in that:*
- Only one can be read with the tape stopped
  - Only one can be restriped without affecting program
  - The word lengths are different
  - All of the above
88. *A modern 28-input in-line console with four stereo aux returns typically provides how many available inputs during mixdown?*
- 32
  - 36
  - 60
  - 64
89. *A modern 28-input, 24-monitor "split" console with four stereo aux returns typically provides how many available inputs during mixdown?*
- 32
  - 36
  - 56
  - 60
90. *In microphony, the Three-To-One Rule stipulates that:*
- When multiple mics pick up the same sound, they have to be three times as far away for equal level
  - Three mics, when used in one close acoustic environment, should be replaced by one, so as to avoid phase anomalies
  - To avoid interaction, multiple mics should be three times greater a distance from each other than to the sound source
  - None of the above
91. *Blumlein miking technique differs from X-Y in that:*
- X-Y technique uses a shallower angle, typically less than 90°
  - Blumlein uses only figure-eight mics at 90°
  - X-Y uses only dynamic or condenser microphones
  - Blumlein requires very specific spacing between the diaphragms in both the horizontal and vertical axes
92. *Which of the following analog tape situations is the quietest?*
- Factory fresh new tape
  - Tape which has been "biased" (erased on the machine, with no audio signal present)
  - Tape that has been bulk erased
  - It depends on the circumstances
93. *If an acoustic piano and a violin are in tune at middle C, two octaves higher the violin is:*
- Sharper
  - Flatter
  - Still in tune with the piano
  - Off by a tempered amount
94. *The brand and type of analog tape which requires the highest bias level to operate at spec is:*
- 3M 226
  - 3M 250
  - Ampex 456
  - Agfa 468
95. *A microphone which normally sounds fine develops a nasal quality when placed eight inches above a table to record a voice. Why?*
- Path length differences
  - The table creates a half-space surface, which alters the sound's wavelength
  - The absorptive value of the table top material colors the sound
  - None of the above
96. *Pressure Zone Microphones might sound "thin" because:*
- Their element diaphragms are so small
  - The small space between the element and the plate limits the wavelength
  - They are designed to accentuate the highs
  - They aren't being applied properly

Questions continue on next page

97. A fix for the hum of a Fender guitar plugged into a Fender amp is:

- A) Flip the ground switch
- B) Reorient the guitarist in space
- C) Use an iso transformer on the amp's ac line
- D) All of the above

98. Why might a unidirectional microphone sound different off-axis vs. on-axis at a distance?

- A) Sensitivity to lows is more than to highs, but decreases off-axis
- B) The mic's grill causes major coloration off-axis
- C) Path length differences exist between the front and back of the diaphragm
- D) All of the above

99. Generally speaking, the following has the most extended low frequency response:

- A) A 15ips analog tape
- B) A 30ips analog tape
- C) They are the same
- D) It depends on the machine

100. At 15ips, and using Ampex 456, the best A-weighted dynamic range one could expect from an analog 2-track 1/4-inch tape deck without NR is approximately:

- A) 95dB
- B) 85dB
- C) 75dB
- D) 65dB

—THE END—

(Answers appear on page 60)

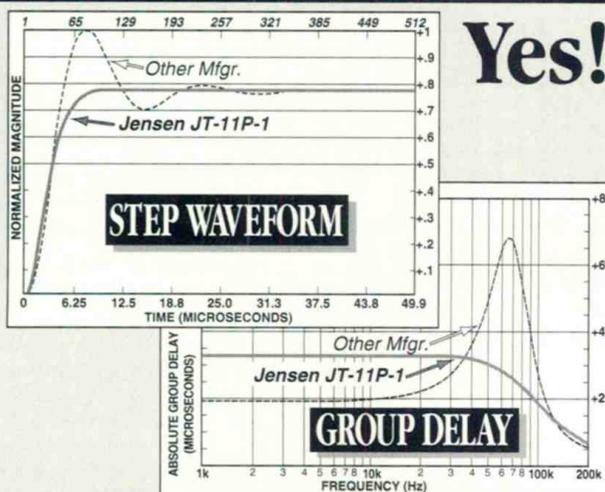
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David Moulton  
Skip Pizzi

Rick Schwartz  
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By Les Brockmann

# IS THERE MORE TO LIFE THAN HEADROOM?



Participants in the Great Analog Showdown: from left, Peter Kelsey, Stewart Levin and Les Brockmann. (Photo by Sam Urdank.)

## 3M's new 996 analog tape formulation takes on Ampex 456 Grandmaster in a real-world showdown.

**W**ith the improving transmission of audio to the home listener through CDs and stereo television, audio professionals continue to seek better-sounding ways to record.

Digital recorders are becoming more common as manufacturers strive to keep up with the demand. But makers of pro analog equipment haven't been content to let the analog medium become stagnant or die. Indeed, analog tape recording remains a viable media for many producers of music and other recorded product, for reasons of economy, tried-and-true flexibility for many kinds of production tasks

and especially because analog recording continues to offer sound quality that many find to be excellent.

There are a couple of new products on the market that claim to offer an improvement in analog tape recording: Dolby SR noise reduction and 3M 996 tape. Dolby SR has enjoyed wide acceptance in the recording industry because of its capability to give analog recording an extremely wide dynamic range while maintaining good fidelity. A lot of people seem to think of Dolby SR as a "miracle circuit," offering noiseless recording with no signal loss or degradation. At the 1990 AES convention, 3M introduced a new tape formulation, 996, with increased maximum signal level capabilities. "Set up your machine for a hotter operating level and the noise floor

will be so low that you won't need noise reduction," is the implication in 3M's promotion.

Recently, three of us set out to find out whether these claims are true. Stewart Levin is a composer of music for network TV shows. His credits include scores for ABC's "thirtysomething," as well as Fox's "Get A Life." Peter Kelsey is an independent recording engineer. In addition to his work with Stewart Levin, he's worked with others in TV and records, including an upcoming release by Jean-Luc Ponty. (His chosen format on the Ponty project was an interesting hybrid: basic tracks cut on analog Ampex 456 +3 at 15ips with Dolby SR, transferred to Sony digital for overdubs and then the two locked together for the mix.) I am an independent engineer

Les Brockmann is a Los Angeles-based independent engineer.

who works with Stewart and others on music for TV, motion pictures and albums.

Our "house standard" setup for Stewart Levin's work has been Ampex 456 on the 24-track 2-inch machine, at 30ips, aligned for a +6 reference level equaling 0VU (320nW/m). Recently he became interested in finding out whether adding Dolby SR for the multitrack or switching to 3M 996 tape would give better performance, especially lower background noise. So, we planned a "Lab Day," which turned into two days of recording, realigning and a lot of careful listening.

It should be emphasized that our tests were quite subjective in nature. We did not approach our evaluation as a technician might — no distortion analyzers or other test equipment was used. Instead, we recorded and listened to music — several acoustic and electronic instruments, multitracked in a couple of short compositions. Our intent was to get a user's point of view: What does it sound like?

### EQUIPMENT AND PROCEDURE

We used a Neve 8108 console, with a Sony JH-24 24-track recorder. Dolby's XP set of 24 SR channels was provided by Audio Affects Rentals of Burbank, CA. We monitored with Yamaha NS-10 speakers.

Musical instrument sources were a Kurzweil 250 playing piano and bass, a Roland R8 drum machine, a Yamaha DX-7, and guitarist John Wheelock playing several of his classic acoustic and electric guitars. Stewart prepared two simple pieces of music, both similar to what he writes for TV scoring: a quiet type of cue featuring piano, two tracks of acoustic guitar and a background synthesizer pad; and an up-tempo rock 'n' roll piece, with drums, bass, piano, electric piano and electric guitar.

These were the setups tested:

1. Ampex 456, 30ips, +6, Dolby SR (tracks 1-8).
2. Ampex 456, 30ips, +6, no NR (tracks 17-24).
3. Ampex 456, 15ips, +6, Dolby SR (tracks 1-8).
4. Ampex 456, 15ips, +3, Dolby SR (tracks 9-16).
5. Ampex 456, 15ips, +6, no NR (tracks 17-24).
6. 3M 996, 15ips, +6, Dolby SR (tracks 1-8).
7. 3M 996, 15ips, +9, no NR (tracks 9-16).
8. 3M 996, 15ips, +6, no NR (tracks 17-24).
9. 3M 996, 30ips, +6, Dolby SR (tracks 1-8).
10. 3M 996, 30ips, +9, no NR (tracks 9-16).
11. 3M 996, 30ips, +6, no NR (tracks 17-24).

We started each tape speed/brand setup by carefully aligning the machine. After setting repro levels and high-frequency response using an MRL tones tape, we biased the tape to be tested according to its factory-recommended or common-practice spec: feeding a 10kHz tone, set-

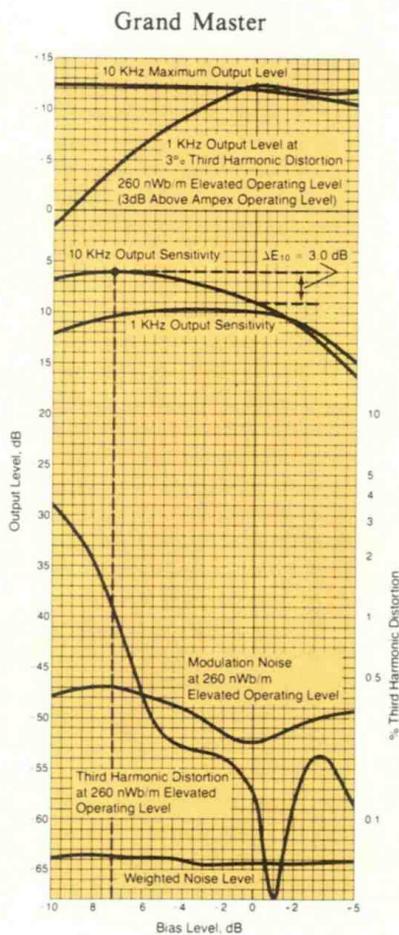


Figure 1. Performance characteristics of Ampex 456 Grand Master.

ting bias for Ampex 456 at 30ips to 1.5dB response drop beyond the peak on the VU meter; 456 at 15ips, +3dB beyond the peak; 3M 996 at 30ips +2dB; and 996 at 15ips, +4dB. Level, and high- and low-frequency settings were adjusted for flat response. After each alignment, a 1kHz tone was printed for 60 seconds, to be used for later playback level alignment and matching.

The console and the tape channels were divided into three groups of eight, and for each of the four speed/tape brand setups, we recorded the music once, busing each instrument to three tracks.

### RECORDING SEQUENCE

The recording was in several segments, as follows:

1. Blank unmodulated tape — to test for tape self-noise — 30 seconds.
2. Slow quiet music piece approximately two minutes.
3. Up-tempo rock music sequence: Kick, snare, hi-hat, stereo percussion group (including gogo-bells, congas, and cymbals), piano, bass, electric guitar; repeating loop including 2-bar rest (to listen for print-

- through), approximately two minutes.
4. Drums only: Fade up from silent to full modulation over 30 seconds; print additional minute, increasing source level to 3dB higher than standard level to test for compression, saturation and headroom; fade down to silent over 30 seconds.
5. Erasure test: Record drum loop again, full modulation, 30 seconds, then erase it.

### LEVELS

Each instrument was recorded with a maximum modulation level of approximately 0VU, with the exception of the drums. The kick and snare were set for about -3 on the Neve's VUs, to allow for transient peaks; hi-hat was somewhat lower, roughly -6. Small amounts of EQ were used as we saw fit. Drums and keyboards were patched direct, acoustic guitar was miked with an AKG C451 and the electric guitar amp was miked with a Sennheiser 421. Gentle peak limiting was inserted on the acoustic guitar with a dbx 160X, as we often do.

Then it was time for our playback tests. With each speed/brand setup, the printed 1kHz tone was used to reset repro level on all of the 24-track channels, and the Dolby SR channels were set either "in" or "bypassed." One group of eight channels was balanced in a reasonable mix (no reverb or additional EQ was used). The 1kHz tone was then played again, with one channel at a time switched on at the console, to carefully match the level and panning of each of the three kick drum tracks, each piano track, and so forth. The Neve's peak-reading metering was used as well, with the music track playing, to

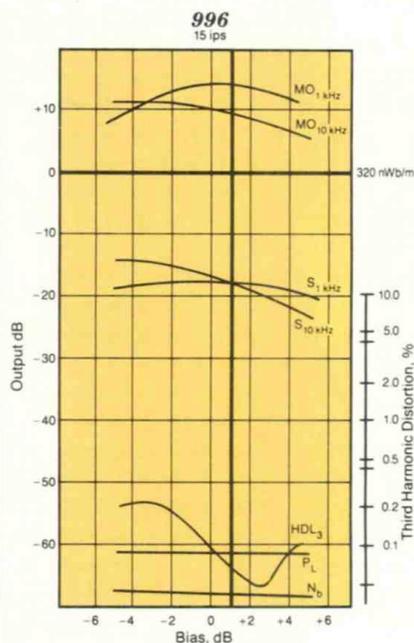


Figure 2. Performance characteristics of 3M 996.

match levels on the drums. (Anytime a listening comparison is made, it's important that the choices are played at equivalent volumes, otherwise the louder choice might sound better — it's easy to fool the ear.) The listening volume was set for a comfortably loud level and then the pot was carefully marked with tape and pen; the fader levels were marked as well.

**Our intent was to get  
a user's point of view:  
what does it sound  
like?**

I prepared a several-page worksheet on which to make notes about what each of us heard. The criteria were: blank — noise; silent modulated — noise; music: noise/hiss; color — top, bottom; transients/size/impact; compression; distortion; print-through; crosstalk between channels; erasure of modulated tape. I also included a section for us to make other notes.

As we listened, each of us in turn sat in the "sweet spot" and played each segment several times, sometimes muting or soloing various tracks. We archived each segment to DAT, on a Panasonic 3700, for future reference and ease of comparison. (However, we found that the differences in sound were most evident in listening first-generation to the multitrack; the DAT masked the differences quite a bit.) The following results and comments are taken from the comment sheets and from subsequent discussion.

**EVALUATION**

First, the mechanical stuff:

**Tape handling and recorder headroom:** The 3M 996 was a new, unknown product to us, and we wondered whether it would be compatible with our tape machine. There were two aspects of compatibility that we were initially curious about. First, as you handle the tape, it seems somewhat stiffer than normal. We consulted with Charlie Bolois of Vertigo Recording Services, a well-respected independent maintenance technician. He said to watch for indications of tape-to-head-contact problems, such as the tape skewing or riding high or low on the heads.

Upon careful observation we noticed no such problems on the JH-24. While recording and monitoring a 10kHz tone during alignment, I did notice that edge tracks, 1 and 24, and to a lesser extent 2 and 23, showed somewhat more wavering of the reproduced tone than did inner tracks, about 1dB to 1½dB up and down on the VUs, for slightly less than one second. Inner tracks wavered about ½dB at 10k. The 1kHz was stable on all tracks. (In my experience, it is somewhat common for some of these Sony/MCI machines to show a bit of waver on the 10k tone.)

Charlie said that this is a symptom of spacing loss. There can be less than perfect contact of the tape with the surface of the heads, especially if the contour of the head is slightly irregular in any dimension. The tape can slightly lift away from its contact with the head, leaving an air gap. This can be especially prevalent with 996 due to its increased stiffness — it's less likely to wrap smoothly and tightly around the head's curves.

The Ampex 456 was more consistent in its response across all tracks. In our music recording tests, we confined the edge tracks to instruments that were less demanding on high frequencies (kick drum and bass), but noticed no audible problems

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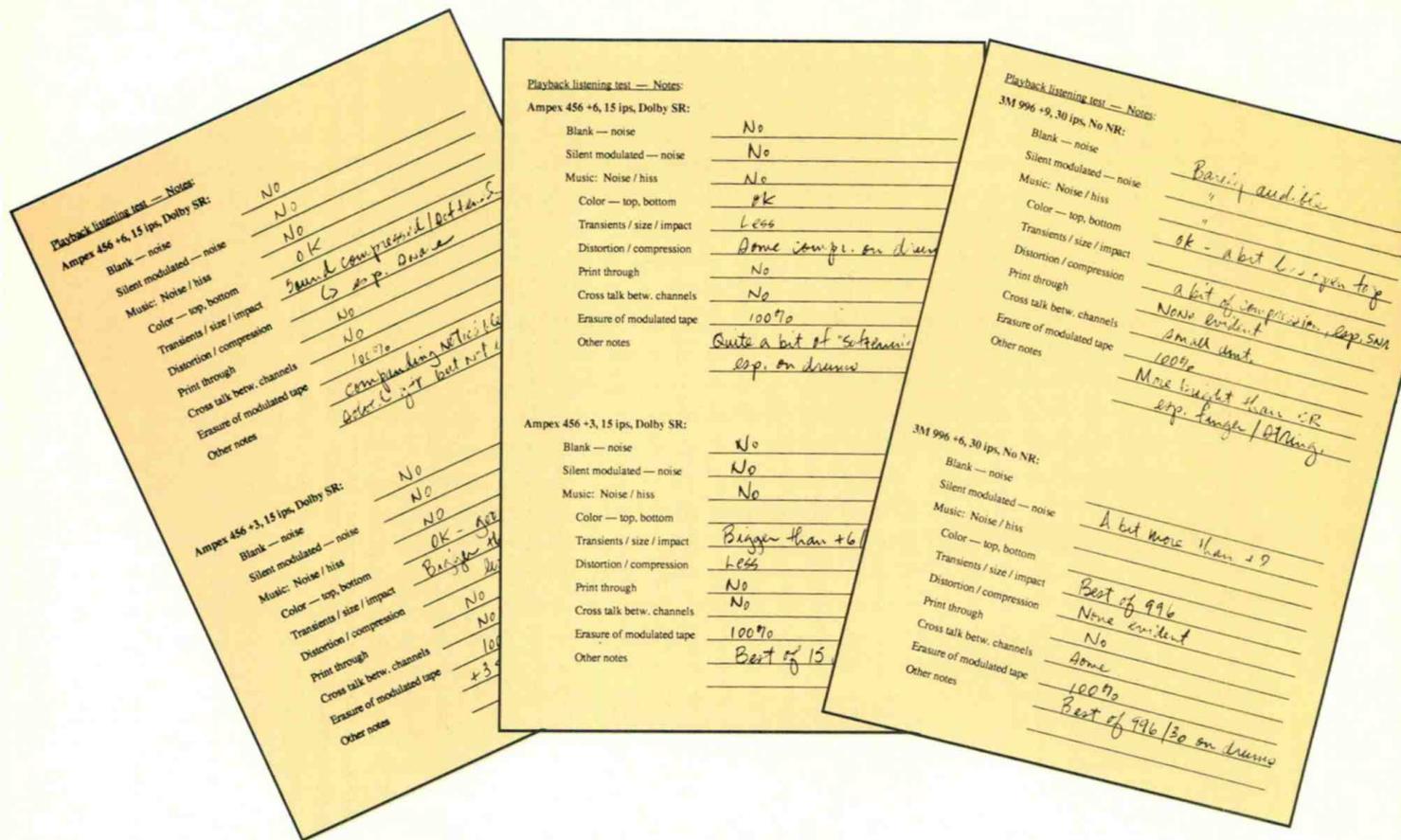
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Circle (20) on Rapid Facts Card



Examples of listener response worksheets filled out by Les Brockmann, Peter Kelsey and Stewart Levin.

or changes that we attributed to this. We also tried recording SMPTE time code on track 24 of the 996, and it reproduced cleanly enough to be read accurately by several synchronizers and readers. We've also recently used 996 on a project that took us to outside studios with a Studer A800 and a Sony APR-24, and noticed no problems.

I also wondered whether a +9 setup could be handled with plenty of clean headroom by the record electronics of the recorder. We noticed no problems with this. Charlie Bolois says that in his experience one machine, the Otari MTR-12, requires a simple modification in the record cards to cleanly do +9.

**Tape self-noise:** In no case did we find any unexpected noise on blank unmodulated tape. In the past I've occasionally found virgin tape with noise, especially low-frequency "bumps" (possibly picked up in shipping or storage). Both the 3M and Ampex reels were factory-fresh and close to completely silent. On the setups without noise reduction, a low-level hiss was evident.

**Silent modulated — noise:** Each tape erased cleanly, with no "bias rocks" or other spurious noise. Setups without noise reduction had the typical even hiss. The quietest of these was the 3M 996 at 30ips, +9. The setups with Dolby SR were dead

silent on blank tape, either erased or virgin. Without noise reduction, modulated (erased) tape had a somewhat louder hiss than virgin tape in every case.

**Erasure:** One of the tests was to record the drum-machine pattern at full modulation and then erase it. After one pass of erasing (machine in record with all signal sources silent and muted), every setup showed complete erasure, with no evidence of the drum part.

**There were no big-time winners or losers.**

**Print-through:** We were somewhat surprised to observe little or no evidence of print-through with any of the setups, either with or without noise reduction. There was a tiny bit of "shadowing" with the Ampex 456, 30ips, +6 with no NR. Two weeks after our initial recording, I checked again and still found no print-through.

**Crosstalk:** With each setup without noise reduction, there was some evidence of crosstalk — for example, with the kick

drum soloed, the snare on the adjacent track could be heard at a low level. This did not seem to change appreciably between levels, speeds or tape brands. However, when Dolby SR was used, this crosstalk was almost entirely eliminated.

**SOUND**

At last, the nitty-gritty! I hate to disappoint you, but there were no big-time winners or losers, with the exception that all of us determined that none of the 15ips setups without noise reduction were quiet enough for our professional work.

After our listening tests, we took some time to discuss our evaluation of the various options. We began with a few comments on the Dolby SR.

**Peter Kelsey:** "My basic conclusion on listening back was that the sound was more 'open' without the Dolby SR."

**Les Brockmann:** "Yes, I agree, it was a bit veiled [with it]. I noticed that especially in comparing the drums and also the quiet acoustic guitar. There was a little more sense of 'listening' to the sound [with the SR] vs. 'feeling' it as well [without]. On some of my favorite-sounding setups, such as the 456 +6 at 30 ips, no NR, the acoustic guitar almost seemed to project out in front of the speakers, with an excellent sense of presence. On the same tape setup, the SR-encoded tracks of the same in-

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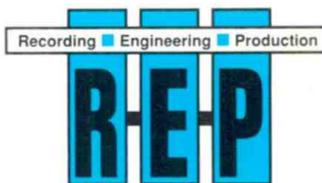
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The Pro Audio Applications  
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strument showed less of this presence. The drums seemed punchier without the noise reduction."

With the SR, on some soloed tracks you could sometimes hear some evidence of the Dolby's compression and expansion.

**Peter Kelsey:** "The guitarist was adding his own reverb through the amp, and as you listened to the reverb decay, there was a point where it seemed to sort of cut off or be gated rather than fading all the way to room tone." I noticed this as well on some of the acoustic guitar notes.

Peter also pointed out a bit of coloration introduced on some instruments by the SR. He said that there seemed to be a change in the low mid area, especially on piano and guitar. "I don't want to call it a boost, though; it just sounded different." Interestingly, he felt this coloration was a bit more evident with the 996 tape than with the 456. He, and the rest of us as well, felt that neither the coloration nor the "gating" effect were noticeable when all the instruments were heard together in a mix.

Regarding the tape brands, there was general agreement that the 456 had a bit more open sound in the high frequencies, especially at 30ips.

**LB:** "I noticed more of the high harmon-

ics of the acoustic guitar, as well as a sense of the fingers on the strings."

**PK:** "Listening back on the DAT, I liked the midrange area of the 996 more than the 456. Listening to the acoustic guitar, I really liked the way the attack came through."

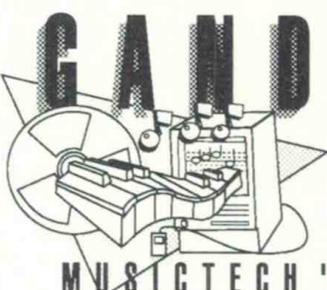
In considering the effects of the various setup levels, the differences that became most evident were, as you might expect, in transient response, compression and distortion. 3M suggests that 996 be set up for +9, the implication being that the tape offers a full 3dB increase in maximum level.

In our experience, we concluded that this might not be entirely the case. The drums, especially kick and snare, recorded on the 996, 30ips, +9, no NR, seemed to be more compressed than on the 456, 30ips, +6, no NR. The snare drum sample had a nice sharp transient "crack" that was evident on the playback of the 456 at +6. On the 996 at +9, the transient was less evident, the sound more saturated. Peter felt that he could use this compression to very positive results — he liked the effect for rock 'n' roll drums. On the quiet acoustic music, none of us noticed any effect of compression on any instruments, even at the +9 setup.

On the tracks with Dolby SR, our conclusion was that the lower-level setups, such as +3, offered the best sound because the SR eliminated the noise consideration for low-level signals, and the greater headroom eliminated any compression effects at normal levels (though you could reach for it if you wanted it).

What about the differences in tape speeds? As I mentioned earlier, at 15ips the Dolby SR is pretty much required, and with it the format sounds quite good, with either tape. (If I had to record at 15ips without noise reduction, I guess I would chose 996 at +9. The noise floor was almost bearable, on the rock tracks at least, although there was considerable compression, especially of the drums.)

One difference that is often discussed between 15ips and 30ips is the matter of low frequency response. Due to the physics of how analog heads work, 15ips offers a -3dB low-frequency rolloff point that's lower in frequency than does 30ips. The resulting sound is described by many as "warm" or "fat." In the music we recorded and listened to, differences in bass response were not greatly evident to me. Of course this becomes one more element in the often-contradictory soup of elements that are to be considered in choosing a for-



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mat. With regard to the highs, I felt the 30ips formats were a bit more open in the top end; Peter did not find a difference sufficient to comment on.

#### CONCLUSIONS

**PK:** "What I liked was the 456, +3, 15ips, with SR, and the 996, +9, 30ips, with no NR. I felt that the 15ips sounded fat, and I really loved the way the snare sounded [at 15ips] — it was the best to me. In fact, though, I could cheerfully work with nearly anything we tried. There was nothing really bad about anything that we tried; it was just subtle differences. Except 15ips without NR."

**LB:** "Just in terms of musical fidelity, size, and impact, the 456, +6, 30ips, with no NR. Although I think I would choose differently with different jobs to do. Both types of music we recorded here, and often do for Stewart's scores, are relatively even in dynamic level — they either start fairly quiet or loud, and stay that way, and so with careful recording and mixing the noise problems are minimized. The masking effect of a continuous strong sound effectively hides the noise."

**PK:** "Yes, I know that Dolby takes advantage of masking — in the presence of a strong signal, close to 0VU, the Dolby units do little or no processing."

**LB:** "However, the next time I have an orchestra to record, for instance, I would love to have SR, for lots of reasons more than just the ultimate fidelity. An orchestral score typically has music with very wide differences in dynamics, and an orchestral scoring session is usually a high-speed, high-tension affair, due to the huge budgets involved."

"You don't always have time to slowly and carefully set the perfect level for each instrument in each musical cue. If the conductor says, 'Beautiful take!' to the orchestra, the mixer can't say, 'Excuse me, I needed more level on the percussion and the French horns in the end pinned the meters.' The SR makes it so much easier, and it really does sound very good."

Stewart pointed out that as a music producer whose job it is to deliver finished music to his clients, the various aspects of "good sound" have to be weighed, and noise is definitely an important one. "After you guys are done mixing it, I take it to my bosses, the producers on the dub stage, and play it," he says. "When it's noisy in the quiet spots, they definitely notice. They (or the monitoring circumstances) may not be sophisticated enough to notice all the transparency and harmonic content, but they certainly notice something like noise."

"Even though the Dolby may color the sound in subtle ways, there has to be something positive said for listening to a

track that's really dead quiet. It makes the recording technology more 'invisible' — it's a great, kind of magical effect."

As you can see, the three of us went through the same testing and listening together, and came up with three somewhat different points of view. I think this puts all of the products evaluated in good light. This was a unique and excellent opportunity to compare two tape products, one a standard and the other brand new, and not base future choices on rumor, hype or

what was used on someone else's million-selling album. ■

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# Live & Direct

## Cutting Edge Consoles

By David Scheirman

**M**ixing consoles for sound reinforcement are like the flagship in a naval fleet: because all eyes are on the hardware, you like to load your biggest guns and fly your brightest flags from the mast. A touring sound system is often judged by its mixing consoles, perhaps rightly so, because the soundmixers responsible for operating the system have to sit at that desk every day.

Evolutionary change in mixing consoles is understandably slow. The basic console architecture cannot be changed too much or too quickly without surpassing the general learning curve of most of the industry. The most successful (and therefore the best-funded) touring projects can afford to specify something newer or better. However, few soundmixers will bet their reputation on a radical, unproven new product introduction without first making certain that they can get good results from leading-edge (and often unfamiliar) equipment.

Traditional large-frame analog consoles from only five or six manufacturers still dominate the industry. A look at the 10 highest-grossing concert acts, as reported in a recent issue of *Amusement Business*, shows which touring groups in the country were on top for the moment (moving into summer of 1991, it was New Kids on the Block, ZZ Top, Paul Simon, Sting, INXS, Gloria Estefan, etc.). A knowledge of the sound companies and their systems serving these artists would let us know just what's "in" for mixing consoles this season.

From commercial manufacturers, the Soundcraft Series 4, Yamaha PM-3000, Gamble EX-56, Midas Pro 40, Ramsa WR-S852 (S840 for monitors) and the Harrison HM-5 (SM-5 for monitors) still dominate the scene. An occasional TAC SR-9000 is in use. ATI's massive Paragon is starting to creep onto the scene, though it rarely makes the charts, as so few units are actually in the field yet. This list gives a price spread ranging from about U.S. \$40,000 to \$90,000 for a single console, offering 32 to 56 input modules.

David Scheirman is R•E•P's live sound consulting editor and president of Concert Sound Consultants, Julian, CA.

So, where are things headed? What's really new? While the industry waits for accurate news on the hush-hush Yamaha PM-4000, while TAC hustles out the mid-priced SR-6000, and while the brand-new Midas XL-3 attempts to get some market penetration, many sound company owners and other console purchasers are taking a careful look at all available options.

The generally accepted standard mixing console format for concert use includes 4-band parametric EQ, eight to 16 auxiliary sends, some mute groups, and perhaps eight VCA group controls. An output matrix section is nice, as is the occasional onboard mini patchbay for sophisticated signal processing. Newer offerings have improved audio signal paths, beefier power supplies, better grounding schemes, and a gimmick or two.

To actually get a feel for the future in mixing console technology for sound reinforcement, we would do well to take a close look at what is going on right now in the theater production field. With Broadway shows often staged for a multi-year run, and with many sophisticated performing arts centers actively working to upgrade their audio facilities, the budgets are available in some quarters to support the type of R&D needed to break two very important barriers: those of digital audio and computer control.

### A FULLY DIGITAL MIXING CONSOLE

While Yamaha's compact DMP-7 is a digital mixer often used to control MIDI linked special effects devices in a concert sound system, it is a small-scale device (eight inputs) that would require dramatic changes to find acceptance as the primary mixing console on a major tour. While it's a pleasant little fellow to use, it doesn't quite seem to point the way to the future of digital console design.

However, a fully digital, large-format mixing console for sound reinforcement does exist. After an intensive R&D phase in Japan, this million-dollar flagship product has actually been in continual use successfully since September 1990. The console is the TOA ix-9000, and the lucky new owner is the Vienna State Opera House in Austria. A second console system has been ordered for Vienna's nearby Burgtheater.

The ix-9000 processes all audio signals in the digital domain, yet the console looks and feels like an analog console. The system comprises a 64/48 matrix mixing unit that features a 256-channel fully dig-

ital input/output patching system. Operating parameters can be changed by software revisions, so that modifications to the futuristic console frame (which includes two interactive touch-screen monitor) are not needed.

The console uses a DSP unit that has a sampling rate of 48kHz, and it features 18-bit linear pulse code modulation. For operator convenience, the ix-9000 offers 48 group-out and 16 auxiliary sends in any of three different formats: pre-EQ, pre-fader or post-fader. An internal high speed drive circuit powers the fully automatic motorized faders. Gain control ranges from -64dB to +4dB, with 0.1dB resolution in the normal operating range.

The unit handles five different operas per week, never the same two nights in a row ... and there are 150 different works in the State Opera Company's repertoire. Each must be set up on the day-of-show. Many involve 50-voice choirs, backstage horn ensembles, etc.

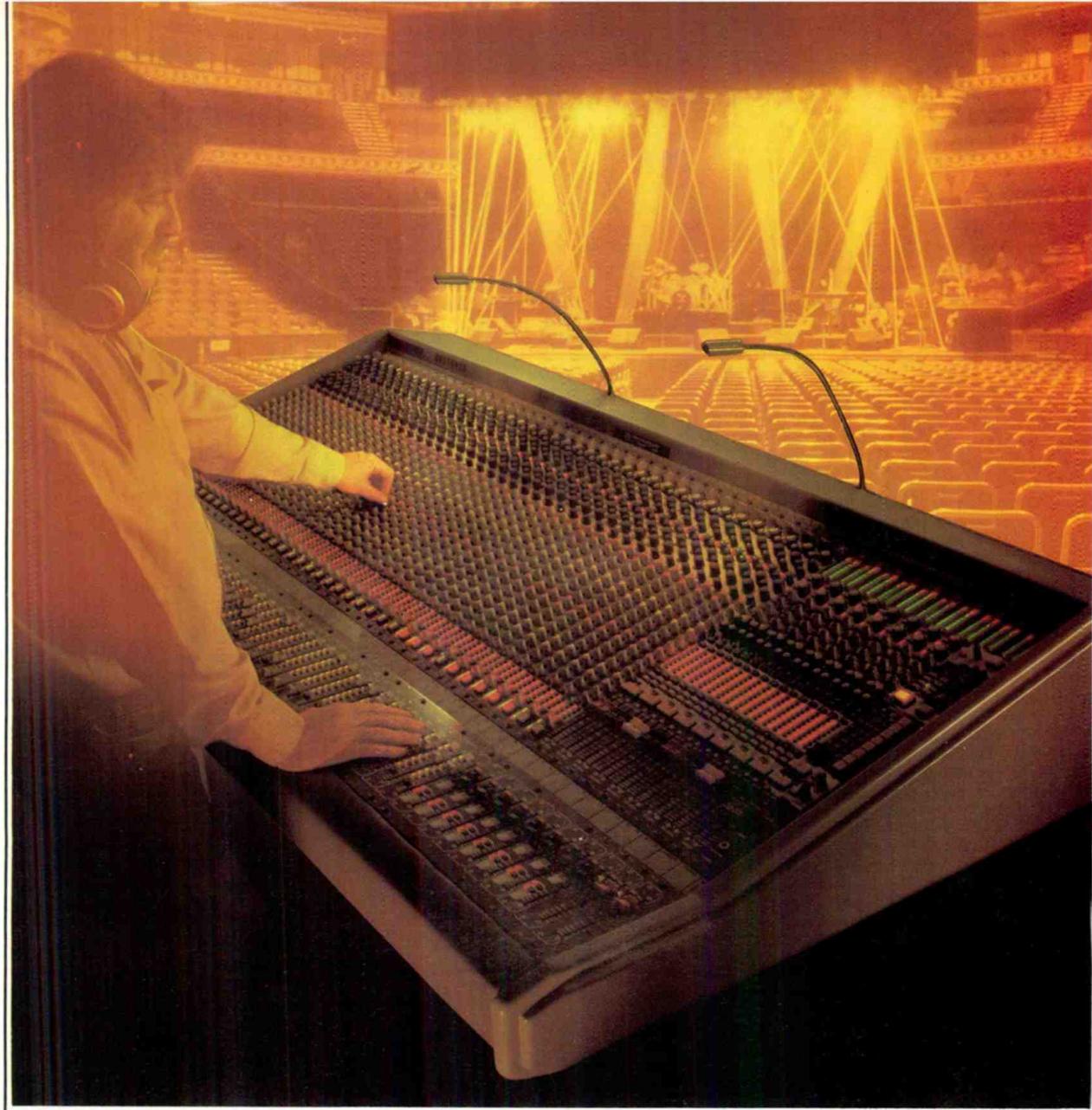
### COMPUTER CONTROL FOR STAGE SHOWS

Not all productions can afford a million-dollar pricetag for a fully digital large-frame console. Fortunately, while waiting for the price to drop, other options exist.

In April, "Miss Saigon" opened on Broadway. Sound design for the show by Andrew Bruce includes a 70-input E-type Cadac theater console with a 12x12 matrix output section. ProMix of New Rochelle, NY, supplied a split-frame Cadac (25+45) for the production, which opened at the Broadway Theatre. A pair of IBM 386 PCs enable the console operator to control signal routing, MIDI switching and VCA masters.

The rock industry's major touring productions are headed in the same direction, like it or not. For example, recent tours by Janet Jackson, Madonna, George Michael and INXS have featured many dance-oriented production numbers that call for a high degree of coordination between choreography, sound, lights and special visual effects. All benefit from computerization of cues to insure repeatability.

Outboard systems, such as the Real World switching matrix and the Richmond Sound Designs computer control system, are but two examples of the linkage that is starting to take place between the personal computer and the console. As software and hardware interface packages become more accessible to the soundmixer and system engineer, a greater shift in this direction seems inevitable. ■



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By Richard Zwiebel

# WORKING WITH STADIUM ACOUSTICS

An acoustic designer's practical overview to survival inside those dreaded cavernous venues.

**M**ost touring sound professionals would agree that stadiums, domes and arenas can present a difficult acoustical environment for permanent sound system installations and touring systems. Some of these buildings are better than others. What is it that makes the acoustics of one building superior to another?

This article will explore the methods employed to improve the acoustical performance of these facilities. A domed stadium can have a volume as large as 8 million cubic feet; an 8-second reverberation time is not uncommon. This results in an acoustically difficult environment. Large reflective surfaces, creating disturbing reflections, amplify this problem.

As acoustical consultants, it is our job at the Joiner-Rose Group to improve the acoustics of a facility while paying attention to the budgetary restrictions of the project. Many of these large facilities are designed primarily for sports activities. Until recent years, little attention has been paid to the requirements of touring sound companies.

An acoustically "live" room is often preferred for sporting events, as this amplifies the effect of crowd noise and cheering. This added level increases the excitement of the audience during a game. A permanent sound system is normally provided in these facilities to provide sound reinforcement for sporting events. Intelligibility of these systems is im-



Richard Zwiebel is an associate with the Joiner-Rose Group, Dallas.

*Stadiums are an acoustically difficult environment at best; some can have a volume of 8 million cubic feet and an 8-second reverberation time.*

proved by attempting to reduce the reverberance of the room. Therefore, it is the job of the acoustical consultant to provide a balance between these opposing requirements.

Due to the large volumes involved, these rooms are naturally live and reverberant. Most of the acoustical design effort is spent on reducing the reverberance of the room and controlling specular reflections. For almost all stadiums, several surfaces present a challenge for the acoustical designer.

One of the major offending surfaces is the ceiling. In arenas and some larger indoor stadiums, this is typically a reflective metal roof deck. In many arenas, this surface is flat and parallel to the floor. To reduce the reflection from the ceiling, an "acoustical" roof deck is often recommended.

Acoustical roof decks typically have a corrugated profile in which perforations have been punched. Sound-absorbing batts may be located behind these perforations. The corrugated shape of the deck, in conjunction with the sound-absorbing materials, acts to break up sound waves, increasing the capability of the ceiling to absorb sound. The decision to utilize an acoustical roof deck must be made before construction.

Once a facility has been built, acoustical banners may be added to provide additional absorption, reducing the amount of sound energy reflected from the roof. Acoustical banners are available in numerous finishes, including sail cloth, perforated vinyl, and open weave fabrics, which encase glass fiber batting. Acoustical banners typically have mid-frequency NRC ratings between 0.60 and 0.85.

### THE SEATING AREA

Another area critical to the acoustical performance of the facility is the seating area. When the house is filled with patrons, bodies add absorption to the room. However, when the seats are empty, the plastic or metal surfaces offer little absorption, thus increasing the reverberant sound of the room. Upholstered seats, in addition to offering more comfort to the patrons, increase absorption. Typically, the facility management prefers to use these seats in the more expensive "deluxe" seating areas.

Although an upholstered seat offers a degree of improvement, this is limited when the seat is unoccupied, as the seat bottom will "stand up," exposing the reflective underside of the seat. To address this situation, the seat bottom can be perforated. This allows the seat cushion absorption to be effective in either position. Another option is to use an underseat sound absorber. This is an absorptive panel covered with a perforated protective cover, which may be in-

stalled on the underside of the seat.

The next area of concern is the drumwall, the wall behind the top row of seats. While it is desirable to make this wall absorptive, its proximity to the audience requires that it be resistant to vandalism. Here, perforated decking material covering fiberglass batts can be applied successfully.

Another possible treatment for the drumwall is to use diffusive surfaces, rather than absorptive ones. Diffusion acts to reduce the "slap" or specular reflection of sound off this wall, while spreading the reflected sound energy over a larger angle. This application can be beneficial for sporting events or concerts where crowd noise, and the sense of excitement it creates, are desirable. Diffusive surfaces can be constructed in the form of quadratic residue diffusors formed from concrete block. A new product offered by RPG Diffusor Systems that provides diffusion is called Diffusorbox. Diffusorbox are a solid precast lightweight concrete block, with a preformed sound diffusing surface.

Most modern stadiums and arenas have one or two rows of private suites around the circumference of the facility. These suites typically have glass sliding doors which present a large reflective surface. If you listen for it, it is often quite easy to hear the reflections off these doors during a concert. While hanging heavy drapes in front of these glass doors would

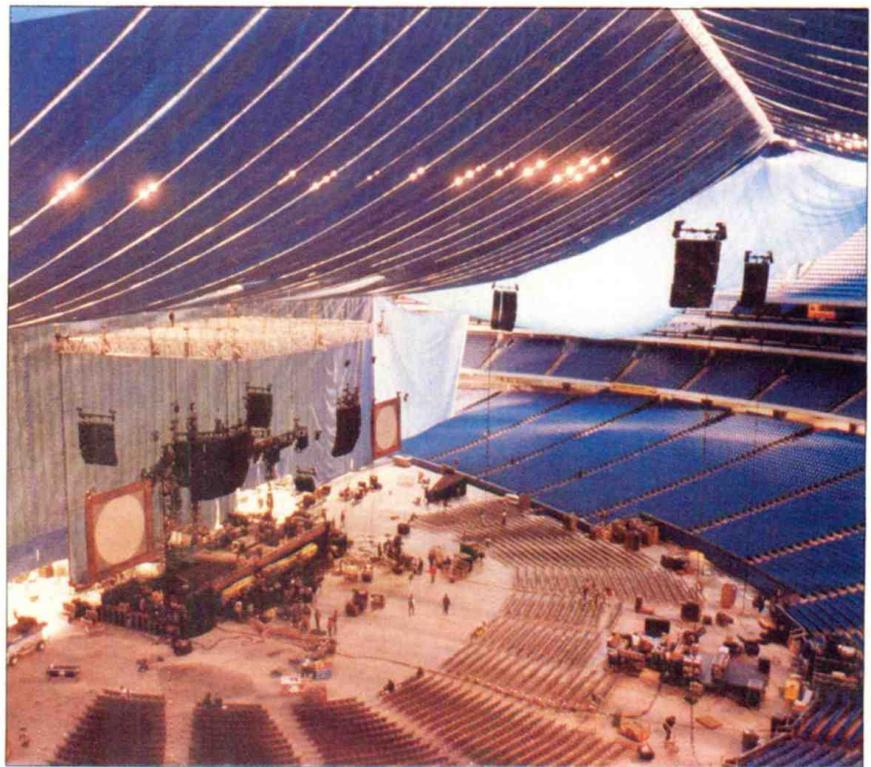
reduce these reflections, this solution becomes impractical due to the required maintenance and the increased possibility of vandalism. The best solution is to open these doors during a concert. This reduces the quantity of reflective surface by at least 50% in most cases. However, this presents its own set of security problems, as these suites are usually leased to clients and are considered "private."

Another problem area that causes unwanted reflections is the bulkhead or balcony front, at the front of each seating level. Although these areas are typically only three to five feet high, they are often the source of disturbing reflections. To reduce these reflections, balcony fronts may be designed in a rounded, rather than flat shape or may have absorptive panels attached to them.

### THE CANADIAN APPROACH

Some newer venues have been designed with acoustics in mind. One of these facilities is the Toronto SkyDome. The roof of this 60,000-seat dome can be opened up during nice weather or closed during inclement weather. This movable roof was constructed of acoustical roof deck, which greatly improves the acoustics of the space. There is a surprisingly small difference in sound quality with the roof opened or closed.

The acoustics of this facility perform quite well for sporting events. One reason



*The Toronto SkyDome's SkyTent is a huge enclosure that provides a controlled acoustical environment inside the venue.*

that this room sounds good is that the installed permanent sound system is a high-quality distributed type, including numerous speaker clusters located throughout the facility. By locating the speakers close to the audience, rather than utilizing long throw central clusters, most patrons are seated within 100 feet of the nearest speaker cluster. It is not feasible for touring sound companies to locate speakers in this manner. Therefore, room acoustics can have a significant effect on their sound quality.

The management of the SkyDome is dedicated to providing a high quality venue for all types of activities and has responded to unfavorable initial reviews of touring concert events. To improve the acoustics of the room, several steps were taken, including opening the sliding glass doors to the two levels of private suites, and the addition of acoustical panels to the bulkhead and drumwall.

Additionally, the "SkyTent" was built, consisting of a huge tent suspended over the stage, floor, and seating area at one end of the dome. The seating capacity within the SkyTent itself is approximately 20,000. The tent is constructed of a rip-stop nylon sailcloth with 1.5 pound density fiberglass insulation quilted inside. This material provides a typical absorption coefficient of 0.6 to 0.7 from 250Hz to 4kHz. The reduced reverberation time at these frequencies provides a more intimate sound and feel to a concert. The Sky-Tent has made a noticeable improvement

in the quality of the sound. By making a commitment to improving the acoustics of the room, the management has provided a much improved facility for concerts.

#### NEW DESIGNS

An arena currently under design at the Joiner-Rose Group is the Chung Hua Arena located in downtown Taipei, Taiwan. This facility will seat about 11,000 and will be Taiwan's first state-of-the-art concert facility. Additionally, it will be used for sporting events, public gatherings and as a giant first-run movie theater. The owner of this facility, realizing the importance of acoustics to the overall success of a concert venue, has instructed the Joiner-Rose Group to design the facility with the best possible acoustics for concerts.

The roof of the new arena will be entirely covered using fiberglass insulation with an airgap behind it. This treatment should provide significant absorption down to 100Hz. The drumwall will utilize selectively applied diffusive, absorptive and reflective surfaces in areas determined through computer modeling. The seats will be upholstered and will be perforated on the underside. The stagehouse area will be treated with fiberglass insulation held in place by expanded metal to reduce early reflections. The walls adjacent to the stagehouse will be treated with absorption as well.

Utilizing software developed by Sam Berkow of SIA Acoustics, we are able to predict the acoustical characteristics of the

arena prior to construction. Using this design information, we may actually listen to a computer simulation of the room from any given seat. This ability to simulate the sound field within the room allows us to test the design for disturbing echoes and excess reverberance prior to construction.

As more facility managers become aware of the influence acoustics have on the selection of facilities made by touring acts, we expect to see more facilities upgrading their acoustics and new facilities paying greater attention to this subject.

#### VISITORS' OPTIONS

What can a touring sound company do acoustically to improve its sound for arena or stadium shows?

One method is to use delay clusters, located so that they provide sound as close to the audience as possible, thus increasing the direct-to-reverberant energy ratio at the audience. Another method would be to request the facility management to open the suite doors. However, this may result in added security requirements for the facility management.

A third method that may be used to improve acoustics is to utilize drapery. Some large venues, such as domes, have large quantities of drapery available and may be able to divide the building by hanging these curtains in a manner that provides a smaller, more intimate space. Most venues, however, have access to only a limited quantity of drapery, and most promoters have a limited amount of funds to rent it. By selectively hanging drapery, it is possible to make a significant improvement with a minimal amount of material.

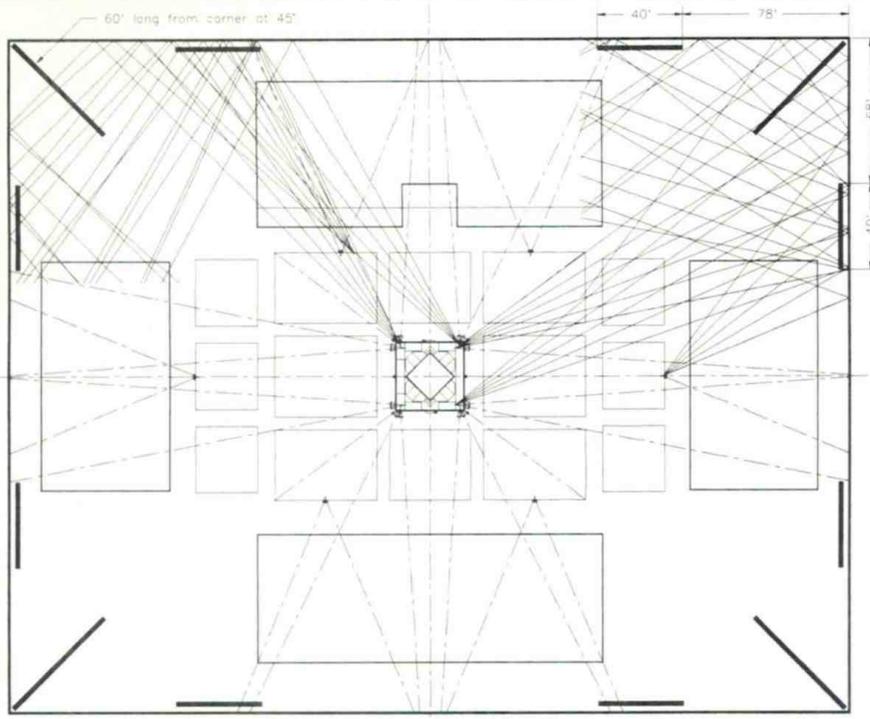
If available, a heavy, backed velour drapery is preferred. To use drapery properly, first inspect the room and carefully listen to it. By making this inspection it should be possible to determine the offending surfaces. To get the most benefit, drapery should be hung in a location that blocks the path from the speaker to the reflective surface. This method can improve the sound quality within the room without covering the entire offending surface.

Alexander "Thorny" Yuill-Thornton II of Solstice Co. is a live sound designer who specializes in classical sound. He has been utilizing drapery quite successfully. One method he uses involves hanging what he calls an "eyebrow" in front of and above the speaker clusters. The height is trimmed so that the top row of the audience can just see the horns. The "eyebrow" blocks the path from the speaker to the roof and area above the top row of the audience. This reduces the energy reflecting back from these areas. By using a small amount of drapery, a large area of "offending surfaces" is thus improved.

Thorny also utilizes computer modeling to determine where drapery can be hung



An unusual scene: semi-trucks parked just outside of the SkyTent, well within the confines of the SkyDome.



NOTES:  
 1. If corner drapes not possible, extend wall drapes toward corners as far as possible.  
 2. Drapes are the same in each corner.  
 3. Hang drapes away from wall 2 to 6 inches if possible.  
 4. Use as heavy a material as possible.  
 5. Drapes should hang down at least 1/2 distance to floor.

FOYER  
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Figure 1. By utilizing ray tracing, areas with the greatest density of reflected sound can be corrected with a minimum of treatment.

to provide the biggest improvement. Sound reflects in much the same manner as light. Figure 1 shows the setup used at Bill and Gloria Gaither's Praise Gathering held in Exhibit Halls A, B and C at the Indiana Convention Center and Hoosier Dome in Indianapolis. The lines from the speakers indicate the path that the sound travelled.

By utilizing ray tracing, the reflective paths were determined and shown. By carefully determining which areas had the greatest density of reflected sound and hanging drapes at these locations, it became possible to greatly improve the sound quality of the room with only a minimal amount of treatment.

By taking the time to inspect the room to determine which surfaces will be the big "offenders," and carefully planning the most efficient method of blocking the path from the speakers to these areas, it is possible to make significant improvements to the sound quality of a concert while remaining within the bounds of the limited amount of funds available from the promoter for this purpose. This can result in a more enjoyable concert experience for the audience, the act and the sound mixer.

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# All Access

By Mark Herman and Louis Adamo

## SOUND IMAGE

Headline Act:  
**Jimmy Buffett**

**Support Act:** Fingers Taylor  
and the Ladyfingers Revue  
**Dates:** June 14-Aug. 19  
**Region:** North America

## PERSONNEL

**House Mixer:** Dave Reynolds  
**Monitor Mixer:** Ross Ritto  
**Support House Mixer:** Dave Reynolds  
**Support Monitor Mixer:** P.K. McCain  
**Technicians:** Rob Stokes, Steve Folsom  
**Rigger:** Buster VanWerry

## CONSOLES

**House:** (2) Yamaha PM3000  
**Monitor:** Ramsa WR-S840  
**Support House:** PM3000s: (Headline Act)  
**Support Monitor:** Yamaha MC2408M

## AMPLIFIERS

**Main FOH:** QSC 3350, 3800  
**Lows/Subs:** QSC 3800  
**Monitors:** QSC 3350, MX2000  
**Sidefills:** QSC 3350, 3800  
**Center Cluster:** QSC 1600  
**Distribution Amp:** Aphex Model 120

## FOH MAIN CABINETS

**Model/Manufacturer:** (20) Sound Image  
PhaseLoc Series 5

## CENTER CLUSTER CABINETS

**Model/Manufacturer:** (6) Sound Image  
PhaseLoc CF

## LOW END CABINET/SUBWOOFER

**Model/Manufacturer:** (12) Sound Image  
PhaseLoc Series 5

## ONSTAGE MONITOR WEDGES

**Model/Manufacturer:** (16) Sound Image  
PhaseLoc Biamp Floor Wedges

Mark Herman is a contributing editor to R•E•P. He and Louis Adamo are co-owners of Hi-Tech Audio, a sound reinforcement equipment rental company based in South San Francisco.

## ONSTAGE SIDEFILLS

**Model/Manufacturer:** (4) Sound Image  
PhaseLoc Series 2 3-way Sidefills

## HOUSE SIGNAL PROCESSING

**Equalizers:** Klark-Teknik DN360 (mains),  
Audio Logic SC31 (center cluster)  
**Crossover:** BSS FDS-360 (mains), TDM  
24CX-2 (center cluster)  
**Reverb:** Yamaha REV-5, (2) Yamaha SPX-  
900, Yamaha SPX-90II  
**Delay:** Roland SDE3000  
**Other Effects:** Eventide H3000S, Aphex  
Aural Exciter Type III  
**Gates:** (2) Klark-Teknik DN514  
**Compressor/Limiters:** JBL 7110, (3)  
Klark-Teknik DN504, Symetrix 528  
**DAT Machine:** Panasonic SV3500, Pana-  
sonic SV3700

**Cassette Machine:** Technics HX Pro

**CD Player:** Kenwood DP-M6630

**Headphones:** Koss Pro 4AA

**Intercom System:** HME

**Monitors:** (2) JBL Control 1 Plus, QSC Mod-  
el 1100 Amp, (2) DeltaLab ADM310 Delays  
**Analyzer:** Goldline RTA

## ONSTAGE SIGNAL PROCESSING

**Equalizers:** Klark-Teknik DN360, Klark-  
Teknik DN410  
**Crossovers:** TDM 24CX-4  
**Analyzer:** Goldline RTA

## MICROPHONES

**Main Vocals:** Beyerdynamic M88  
**Kick:** Beyerdynamic M88  
**Rack Toms:** Ramsa WM-S5  
**Floor Toms:** Ramsa WM-S5  
**Overheads:** AKG C-460B  
**Snare Top:** Shure SM57  
**High Hat:** AKG C-460B  
**Guitars:** Sennheiser MD421  
**Keyboards:** Whirlwind Director Direct  
Box  
**Bass:** Whirlwind Director Direct Box  
**Steel Drums:** Dean Markley Contact  
Pick-ups  
**Leslie Keyboards:** Shure SM53  
**Sax:** Samson Broadcast Series Wireless Sys-  
tems with Ramsa WM-S10  
**Percussion:** AKG C-460B

## CABLING

**House snake:** (2) 56-channel  
**Multi-pair connectors:** Elco  
**Stageboxes:** Whirlwind Medusa with Ben-  
dix Multipin Connectors  
**Splitter:** 2-way passive

## SCHUBERT SYSTEMS GROUP

Headline Act:  
**The Doobie Bros.**

**Support Act:** The Fabulous  
Thunderbirds  
**Dates:** May 31-Oct. 6  
**Region:** North America

## PERSONNEL

**House Mixer:** Pete Carlson/Gary  
Whitelock  
**Monitor Mixer:** Mike Kelly/Alan "Loon"  
Bonomo  
**Support House Mixer:** Larry Hampton  
**Support Monitor Mixer:** Alan "Loon"  
Bonomo/Mark Drale  
**Head System Engineer:** Alan "Loon"  
Bonomo  
**Technicians:** John Gabrielli, Tim Holland,  
Wes Leathers  
**Rigger:** Chris Schmidt

## CONSOLES

**House:** Gamble EX-56  
**Monitor:** Crest/Gamble EX-48 Monitor  
**Support House:** Soundcraft Venue 36  
channel  
**Support Monitor:** EX-48: (Headline Act)

## AMPLIFIERS

**Main FOH:** Crest 7001, 8001  
**Lows/Subs:** Crest 8001  
**Monitors:** Crest 7001  
**Hi-Power Monitors:** Crest 4801, 8001

## FOH MAIN CABINETS

**Model:** (48) Schubert Systems Group  
Steradian

## LOW END CABINET/SUBWOOFER

**Model:** (16) Schubert Systems Group 2x18  
(JBL 2241)

## ONSTAGE MONITOR WEDGES

**Model:** (8) SSG 112 (JBL 2206, JBL 2450)  
**Model:** (8) SSG 212 (JBL 2206, JBL 2450)  
**Model:** (1) SSG Keyboard Processor (JBL  
2118, JBL 2405)  
**Model:** (1) SSG Headphone Monitor (modi-

fied Sony MDR-V6/Shure SM10)  
**Model:** (1) SSG Wireless Headphone Monitor (modified Sony MDR-V6/Ramsa WMS-15)

#### HOUSE SIGNAL PROCESSING

**Equalizers:** Klark Teknik DN-300  
**Crossover:** SSG 4-way time-aligned  
**Reverb:** Yamaha REV-5, (2) Yamaha SPX-900, Yamaha SPX-1000, Ursa Major Stargate 626  
**Delay:** TC Electronic 2290, Lexicon PCM-70, Roland SDE-3000  
**Other Effects:** Eventide H3000, (2) BBE Sonic Maximizer 822A  
**Gates:** (5) Aphex 612, Klark Teknik DN514  
**Compressor/Limiters:** (8) dbx 160XT, (2) dbx 165  
**DAT Machine:** Awei  
**Cassette Machine:** Technics  
**CD Player:** Technics  
**Headphones:** JVC HA-D700  
**Monitors:** (2) JBL Control Monitors

#### ONSTAGE SIGNAL PROCESSING

**Equalizers:** On Board Crest/Gamble EX-48 Console  
**Crossover:** SSG Biamp Crossover  
**Effects:** Yamaha SPX-90  
**Gates:** Klark Teknik DN514  
**Compressor/Limiters:** (3) dbx 166  
**Headphones:** Sony MDR-V6  
**Analyzer:** Ivie Electronics IE-30A

#### MICROPHONES

**Vocals:** Sennheiser 430-2, Ramsa WM-S15, Shure Beta 58, Shure SM10  
**Kick (two drum kits used; double all drum mic assignments):** Sennheiser MD 421  
**Rack Toms:** Sennheiser MD 421  
**Floor Toms:** Sennheiser MD 421  
**Overheads:** Shure SM81  
**Snare:** Shure SM57  
**High Hat:** Shure SM94  
**Guitar No. 1:** Sennheiser MD 409  
**Guitar No. 2:** Sennheiser MD 421

**Keyboards:** Countryman DI  
**Leslie Keys:** Shure SM-57 (high), E-V PL-10 (low)  
**Bass:** Trace Elliot Balanced Output  
**Congas:** Shure SM-57  
**Timbales:** Shure SM-57  
**Gong:** Shure Beta 57

#### MISCELLANEOUS

**ac Power Conditioning:** Technipower 1582-A Automatic Voltage Regulator  
**Multi-pair connectors:** Amp QL, Amp G-2  
**Stageboxes:** SSG Amp G-2 Stageboxes ■

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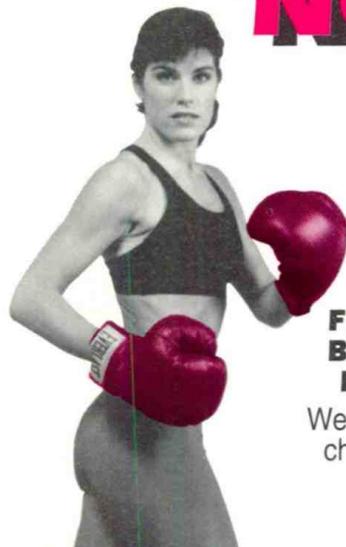
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# Roadwork

By Mark Herman

**Crunch Time:** The recession-influenced, industry-wide slowdown all but evaporated in early June. Everyone is reporting booming hire business and a shortage of available equipment. Bid prices have risen with the influx of bookings, and it looks as though the strong summer season might last just a bit longer than usual. This is great news for an industry that was on the ropes earlier this year.

**DB Sound** (Des Plaines, IL) is quickly becoming one of the industry's leading players through hard work, an aggressive touring policy and an ever-expanding equipment inventory. DB has remained busy since spring. Shows include Nelson's September U.S. tour leg, with plans to go to Europe and back to the U.S. with a 40-box HD3/HD4 system. Crew includes **Toby Francis** at FOH, **Mike McNeil** on monitors, **Linden Sargent** and crew chief **Bruce "Slim" Judd** ... DB handled the challenging Budweiser Superfest, which featured a variety of acts, including Keith Sweat, Pebbles, Babyface and Bell Biv DeVoe ... AC/DC remained out on their own until early July, when they joined this year's Monsters of Rock extravaganza. Of special interest are the two new Midas XL3 universal 40-channel mixing consoles. Look for more coverage on the Monsters in next month's issue ... This summer's Milwaukee Summerfest festival (June and July) saw DB Sound running five concert stages ... Rapper M.C. Hammer worked dates in July ... The Allman Brothers tour started this month with a 40-box HD system ... Live radio DJ Johnny Brandmeier's "On The Loose" live TV show needed DB's help ... Baseball fanatic George Thorogood began in mid-July and is scheduled through mid-September with a 32-cabinet MT-4 system. **Robert "Fuzzy" Frazer** mixed on a Gamble SC32 monitor console. Thorogood will take a short break for the playoffs and World Series before returning to the road for another eight weeks ... Recent equipment purchases were 100 Crest 8001 power amplifiers for the Monsters of Rock.

**Get the Scoop Here.** The word is that **T.C. Electronic** is releasing its M5000 digital multi-effects signal processor at the upcoming AES show. The versatile M5000 should be attractive for those seeking high-quality multi-effects at a relatively af-

fordable price point. Designed for sound reinforcement, recording studios, installations and broadcast applications, it is a multi-platform digital processing system with plenty of on-board horsepower, similar to the Lexicon 480L. T.C. has designed a dedicated audio co-processor IC that makes the system so powerful. The 2-rack space modular system is capable of accepting four individual modules at a time. Some of the module options available include a complete FOH digital drive rack, time-alignment digital compression, multiple stereo reverb, capstan servo module for time squeeze, chorus flanger, sampling, a complete DSP system analog I/O module and a pitch changer. The device has room to expand and will feature upgradable I/O performance when 20-bit and 24-bit become obtainable. The M5000 has these ports on it: AES/EBU, S/PDIF, optical, 2.5Mbyte-per-second LAN, SMPTE, Korg memory card option, SCSI and a floppy disk option — all on one unit. This may be one of the hottest things to see at the AES show.

T.C. Electronic's U.S. distributor **Virtual Designs** reported sales of its innovative 6032 remote control programmable TC1128 equalizer system to the following companies: Clair Bros. Audio (Lititz, PA), 54 additional TC1128s for its numerous 6032 systems, bringing its total to more than 200 1128s and 32 controllers; Midwest Audio (Louisville, KY), a 12-mix 6032 system; Audio Analysts (Plattsburgh, NY), a 6032 system; Electrotec Productions (Canoga Park, CA), nine 1128s for a recent installation in Hawaii; and RAT Sound (Sun Valley, CA), more 1128s to its EQ inventory.

**Mixing Console Update:** **Ramsa** exhibited its new retrofittable mute group option for the Ramsa WR-S852 house console and the WR-S840F monitor console. Available sometime this month, it features 10 mute groups with a non-volatile memory, a MIDI interface and an approximate kit list price of \$3,500. The installation can be done by a qualified technician, or **Windt Audio** (Culver City, CA) will install it for about \$1,000 ... The **Soundcraft Europa** FOH console made its debut at NSCA and will be fully unveiled at AES. Available in 24-, 32-, and 40-channel versions, the Europa sports a host of features such as a noise gate and 4-band fully parametric EQ on every channel, 12 globally switchable pre/post aux sends, eight mute groups, eight VCA groups and a complete inte-

grated linking system. The 40-channel list price is \$59,950 ... **Klark-Teknik** has announced that the new XL3 40-channel universal console is finding happy homes in North America. Delicate Productions (Camarillo, CA) will use the Midas for the summer Lollapalooza 9-band tour, following short-term rentals with MacPherson Sound (Lansing, MI) and Rodewald Sound (Peoria, IL). Midas has sold nearly 30 XL3 desks worldwide ... **Amek/TAC** introduced the SR6000 at NSCA, featuring a 24-, 32- or 40-channel format with 4-band semi-parametric channel EQ, eight subgroups, eight VCA/mute groups, four stereo effects returns and a unique split auxiliary bus system. Each channel has eight aux sends, but the split aux masters allow any or all of the aux buses to be divided in half between the left and right sides of the console, creating up to 16 different aux buses. Now available, the SR6000 has a 40-channel list price of \$59,500 ... Also at NSCA: the **Soundtracs** Megas Stage series. These consoles feature 4-band channel EQ with two sweepable mid-bands, plus a high-pass filter, six aux buses, eight subgroups, eight effects returns and six mute groups. Available in 24-, 32-, 40-, and 48-channel frame sizes, the Megas is very affordable, with a \$17,199 list for the 40-channel model ... Although previewed to a select few behind closed doors, **Yamaha** will show the prototype of the long-awaited successor to the popular PM3000 console at AES. Rumor has it labeled the PM4000.

**Sound Image** (San Marcos, CA) and its QSC-powered PhaseLoc systems are running at full capacity and enjoying a good summer season. Barbara Mandrell continues as usual (January-December) with a **Mike Wisniewski**-engineered main system featuring 24 boxes and a Yamaha PM3000. **Tony DiSteffano** is mixing monitors ... Indigo Girls hit the shed circuit (February-July) with Ramsa 852 and 840 consoles, mixing engineers **Rob Mailman** (FOH) and **Les Banks** (monitors), and 24 PhaseLoc cabinets ... Harry Belafonte is keeping 16 cabinets busy March through December ... And, of course, the ever-popular and entertaining Jimmy Buffett is out (see this month's All Access) until mid-August ... Robert Cray, with **Dave Shadoan** mixing monitors, finishes at the end of this month.

With all the hype over the America's Cup, it is only fitting that a San Diego-area company such as Sound Image be respon-

Mark Herman is a contributing editor to R•E•P and president of Hi-Tech Audio, South San Francisco.

# HOLDS UP ON THE ROAD

sible for all the audio events that involve the prestigious quest for yachting excellence. The company will provide systems for big shows, meetings, concerts, sound reinforcement for actual races and worldwide media interaction through 1992.

**Riverview Systems** (San Jose, CA) has been busy with large and medium corporate/industrial events throughout the country, as well as plenty of symphony, civic, theatrical equipment rentals, A/V and lighting work. Non-corporate events included the city of San Jose, 16-date Music in the Park series featuring local and national acts, the second annual San Jose jazz festival, the U.K.'s Hampshire Youth Symphony and the San Jose symphony. Riverview primary main speaker system consists of 16 MacPherson M1 cabinets powered by Crown MA2400 and 1200 amps. MacPherson LPM and PAS 15 wedges are driven by Carver 1.5 amplifiers and EQ'ed with White 4001s. Recent new purchases include a Ramsa WR-S852, four Intersonics Bass Tech 7 servo subwoofers, dbx 166 compressors, Yamaha SPX-900 reverbs, 24 Telex FMR2 and Shure LS24 wireless microphones with with Beta 58 heads.

**Crest Audio** reported strong amplifier and **Gamble EX Series** console sales around the world. A large quantity of amplifiers (more than 50) was sold to Electrotec Productions. A new Crest system was first used on tour with Elvis Costello and is currently powering Damn Yankees. Electrotec also recently bought a Gamble EX56 FOH and a EX48 stage console. Console sales in the Orient were to Japanese pro audio distributor Bestec (Tokyo) and Singapore's Music Plaza. Maryland Sound purchased its fourth Gamble Series EX56 console and Bernard Brown (Dallas, TX) just got their first EX56. Ultra Sound recently obtained yet another Gamble EX56 for the Grateful Dead's FOH engineer Dan Healy. Two EXs will be connected with the special Crest interlink system. The Opryland theme park acquired an EX for its amphitheater/shed facility. Florida's Disney World procured a Series EX56 console for its Convention Entertainment Division, which provides sound reinforcement for all shows brought onto the Disney property. The Gamble will be teamed up with an all Meyer speaker system powered by new Crest amps. ■



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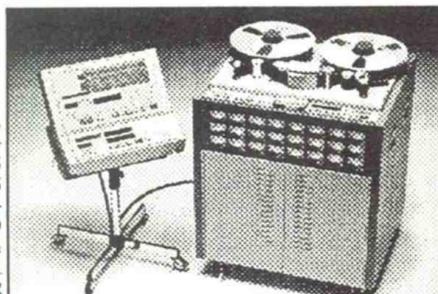
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# HANDS ON:

## TUBE-TECH CL 1A COMPRESSOR

By Rick Schwartz

**T**ube gear is hotter than ever. Just look at the compressor market. It's almost impossible to discuss tube compression without mentioning the Universal Audio 175 peak-limiter, which later became the Teletronix LA-2A. Those so-called "audio antiques" frequently command prices many times higher than the gear cost new.

The heart of any compressor is its gain-reduction element (GRE). One of the things that makes the LA-2A so popular is the smooth-sounding characteristic of its optical-sensing GRE circuit, which consists of a photo-luminescent emitter panel and a photocell sensor. In basic operation, as more level is fed to the panel, more light is emitted, which enters the photocell and varies its resistance. The relatively slow response time of this circuit softens the sound. Unfortunately, photocells tend to be a little noisy and their performance deteriorates with age.

Instead of copying old circuitry to capture tube compression's positive characteristics, a small company from Denmark named Lydkraft is reinventing it, by creating a device with a "classic sound" and some impressive specs. The Tube-Tech CL 1A is a mono compressor that uses a modern optical gain-reduction element housed in a light-tight epoxy block. The GRE itself is an opto-coupler made up of an LED and an LDR, or light-dependent resistor.

Lydkraft's GRE offers low harmonic distortion and none of the non-linearity problems of the old elements, or even semiconductors. The element in the CL 1A is positioned immediately after the input



transformer and is controlled by side-chain amplifiers. Following the GRE is an all-tube push-pull amplifier with a wide gain range.

At first, we were surprised by the number of semiconductors inside the device, in light of the company's claim that the signal doesn't pass through any silicon. According to Lydkraft, the side chain is the only part of the compressor that contains semiconductors. The signal controlling the gain-reduction element is handled by two quad op-amps and a couple of transistors, chosen for their high slew-rates as well as their compact size.

The CL 1A is not an LA-2A clone. Look

inside and you'll see major differences. The LA-2A uses five tubes; the CL 1A has only two. A pair of 12AX7A triode pre-amplifiers buffers the inputs and outputs on the LA-2A. The Tube-Tech uses a lower noise version of the same tube called an ECC-83. The CL 1A also uses an ECC-82, which is a European equivalent to the 12AU7.

### A CLOSER LOOK

Lydkraft products are made in Denmark and distributed by AudioTechniques, New York. A hand-written specification sheet is proof that these devices are not cranked

Rick Schwartz is a contributing editor to R•E•P and director of post-production at Music Animals, Los Angeles.

out on some large assembly line — the device uses high-quality parts throughout. On the inside, the CL 1A is better laid out and more cleanly designed than most other tube designs. All front panel controls use oversized, high-quality sealed pots. Bus selector and bypass switches are also ruggedly designed.

The CL 1A has front panel controls for compression ratio, input threshold and gain. The gain control makes up for signal lost in the compression process. Because the gain control affects the output levels, we thought it would have been more logical if it were on the right and the input threshold control was on the left. After power was applied, the circuitry warmed up almost immediately. During operation the power can be switched on or off without any loud thumps.

Using a compressor may not require a Ph.D., but we thought the 5-page manual that came with the device was marginal for something costing this much money. Although the device is not difficult to use, not all of its functions are intuitive — especially the use of complex release times and linking multiple units. Although the CL 1A is a mono compressor, up to 10 compressors can be linked together by using the sidechain jack on the rear panel and a front panel bus select switch. According to the manual, with multiple devices the unit performing the most compression controls all others. It's important to note that the ratio and gain controls on all of the slaves need to be set the same to maintain a proper stereo image.

Some believe a compressor should be judged by its inaudibility; others look to compressors as an effect. The Tube-Tech CL 1A is capable of both, depending on how you set it. Lydkraft includes recommended settings for overall compression, guitar, bass, drums and vocals. As mentioned, the CL 1A has both fixed and variable attack and release times. This feature makes it possible to use both of the time control circuits separately or combine their functions. By combining both settings, it is possible to obtain a complex release-time response. The manual recommends the use of the fixed/manual mode when compressing a mix. This mode creates an automatic release function with a constant (fast) attack-time and a variable release-time based on the duration of the signal peaks.

Still, we preferred the use of manual settings when compressing mixed program material. For inaudible compression, you might stick with medium to slow attack settings and relatively fast release times. Although the CL 1A always sounded good, the use of very fast attack times and long release times can result in audible pumping. By using a 10:1 ratio and fast attack

settings, it's possible to almost freeze the meters in place. By the way, the manual recommends that the user keep the meters in the gain-reduction mode during use to keep distortion low.

#### ON THE BENCH

Despite its great sound, tube gear doesn't always measure well. To the contrary, the Tube-Tech boasts some very respectable noise and distortion specs. Instead of just confirming their published specs, we wanted to compare the device to other compressors on the market. How would the CL 1A measure-up to the "industry-standard" (all-tube) LA-2A or Neve's smooth-sounding (solid-state) stereo compressor?

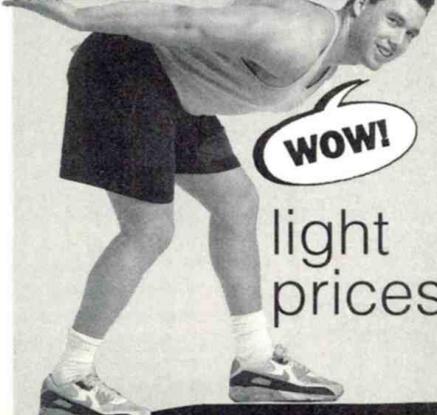
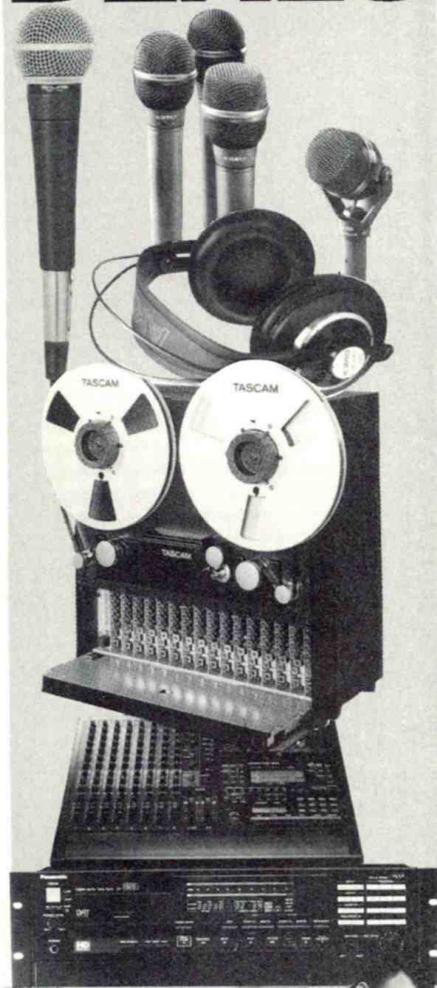
Using a special gain linearity program designed by Jim Williams of Audio Upgrades in Los Angeles for the Audio Precision analyzer, we set out to compare the three devices. Gain linearity is a useful test because it shows how each compressor reacts to different input levels, indicating when a compressor "kicks-in" and what kind of a curve or "knee" it has. Does it have a hard-knee or a less audible soft-knee? How does it track gain changes? The AP analyzer tells all and prints it out.

A straight 45° line on a typical input-to-output graph indicates unity gain or zero compression. With the front panel control on the CL 1A set to the maximum compression ratio of 10:1, the device measured more like 5:1. Figure 1 shows that no matter what the ratio, the CL 1A has a very soft knee, which is no doubt one of the reasons it sounds so smooth under listening tests.

For comparison, we tested the LA-2A and Neve solid state stereo compressor. It was difficult to set the former device for unity gain, because even with gain reduction set to off, the device still acted like a limiter at high input levels. At normal operating levels, the knee on the LA-2A was surprisingly hard compared to the Tube-Tech. On the other hand, the LA-2A was capable of more gain-reduction than the Tube-Tech, with compression ratios higher than 20:1. The Neve stereo compressor had a knee that was more pronounced than the Tube-Tech, but less pronounced than the LA-2A.

Next we tested the frequency response of each device. The CL 1A actually measured a little better than spec. The low end response of the CL 1A was excellent (+0.15 at 10Hz). On the other end of the spectrum, the device exhibited a 0.75dB peak at 16kHz, before rolling off sharply. Although the device was only 3dB down at 30kHz, at 200kHz the CL 1A was down 36dB, with a roll-off very steep after that. Figure 2 shows a high-frequency overshoot we believe traceable to the input trans-

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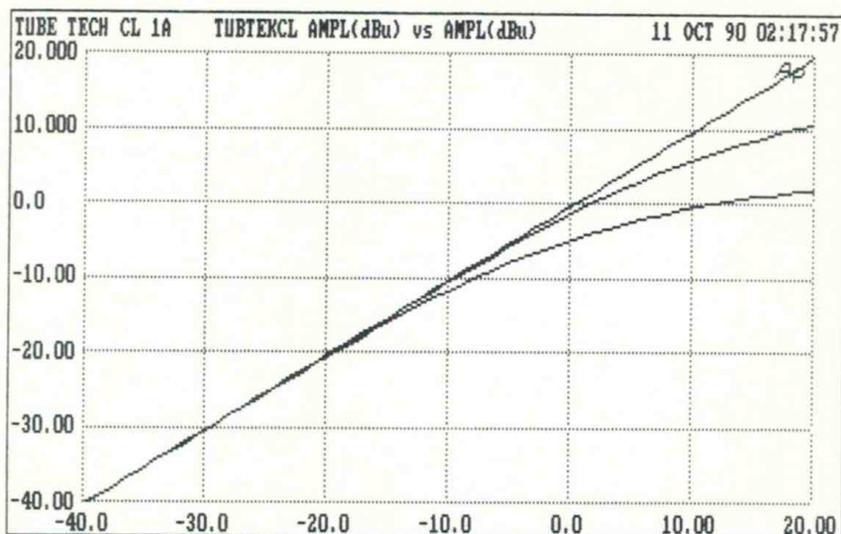


Figure 1. Gain linearity of the CL 1A.

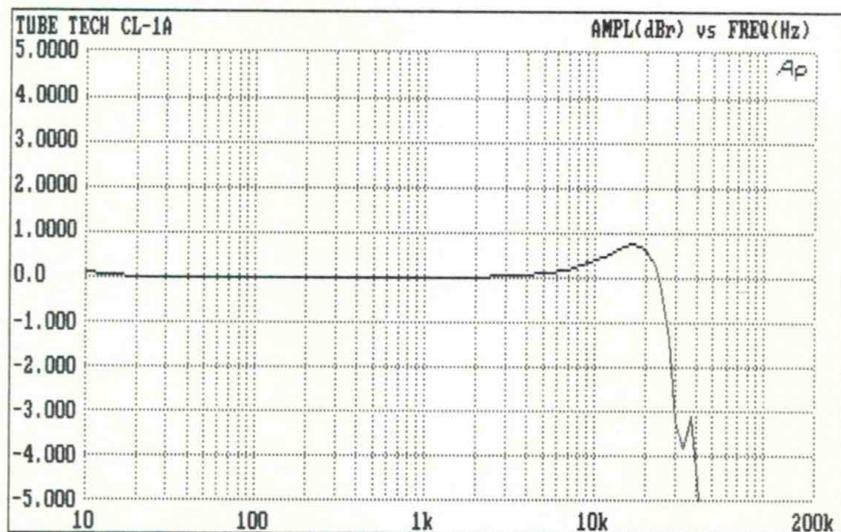


Figure 2. Amplitude vs. frequency.

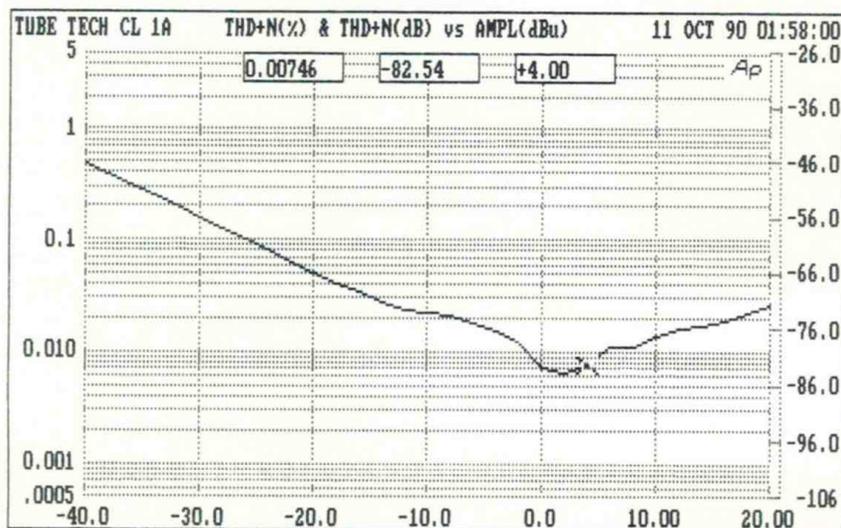


Figure 3. Total harmonic distortion plus noise vs. amplitude.

former. If you ran a square wave through the device, the ringing would be measurable. Because of its similar quality transformer, the frequency response on the Neve doesn't look much different than the Tube-Tech, with a slight low-frequency bump and some high-frequency overshoot. The conclusion to be made here is that quality transformers are worth their weight in golden performance, and skimping always hurts.

#### DISTORTION MEASUREMENTS

The reason that distortion measures somewhat higher at lower signal levels is the fact that noise tends to wash-out the actual distortion readings. Only when the signal starts pushing zero is the distortion measurement representative of actual operating situations. Total harmonic distortion on the CL 1A measured only 0.00746% (without compression), which is surprisingly low (See Figure 3).

The Tube-Tech handled very high input levels incredibly well when connected to a higher impedance load of 100k. In this situation, the worst case distortion readings were only slightly higher than 0.01%. However, with a 600Ω load, the THD vs. frequency test was another story (See Figure 4), with the CL 1A measuring 0.1% distortion at 20kHz.

It is noteworthy to point out that many manufacturers spec distortion measurements at a single frequency, typically 1kHz, where distortion is almost always at its lowest. Lydcraft uses 40Hz, where it feels any output stage, transformer or gain reduction device distortion will be unveiled.

Low-frequency distortion is mainly caused by the transformer, but the high-end distortion is often circuit design distortion, due to factors such as capacitive effects, active components chosen and negative feedback. A well-designed circuit will normally maintain a fairly flat distortion curve to 20kHz. Use of excessive negative feedback could be the cause in this particular case of the rising distortion on the THD graph. As you drive the device harder, more of the signal is returned through the feedback loop. If this signal doesn't match what's coming out of the circuit, distortion starts to climb.

Still, the worst-case distortion on the CL 1A reached only slightly higher than 0.02%, which is not bad at all. The LA-2A didn't do as well on the distortion plots, with almost 5% distortion at 20 cycles. That's probably why some people like to use them on a kick drum — put 20 cycles in and get 40 cycles of harmonic out. THD measurements on the Neve compressor were more well-behaved and did not rise at higher frequencies like the Tube-Tech did, but its distortion took off like a rocket at higher signal levels.

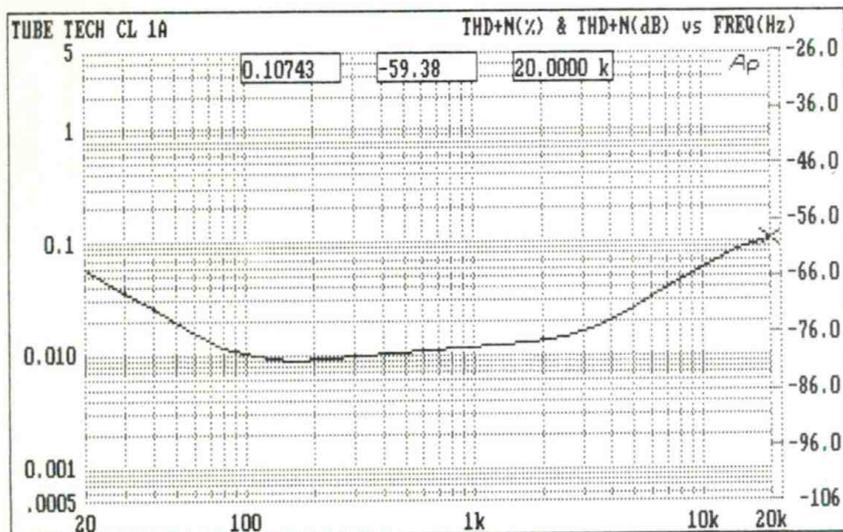


Figure 4. Total harmonic distortion plus noise vs. frequency.

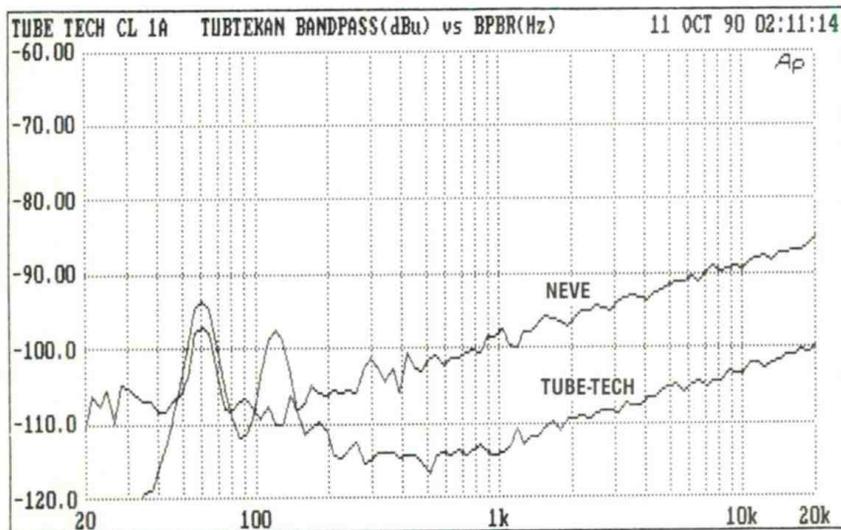


Figure 5. Comparison of spectral distribution of residual noise of Neve and Tube Tech compressors.

Residual noise performance on the Tube-Tech compressor was excellent, with only a 60Hz peak and its harmonic caused by the power supply (See Figure 5). Unweighted signal-to-noise measured 89dBm, which was also slightly better than spec. Residual noise at high frequencies was outstanding. At 20kHz, the CL 1A was down 100dB. It gets better: at 1kHz, noise was down almost 115dB. That's much quieter than the theoretical limit of 16-bit digital. Well-designed tube circuitry like the CL 1A is capable of being extremely quiet. With a remote power supply or an extremely well-filtered design, the noise response would improve at lower frequencies. Still, at 60Hz the noise was down 93dB, which is not too shabby.

The LA-2A did not perform near as well,

with residual noise down only about -54dB at 60Hz. Although the Tube-Tech compressor had less hiss, the Neve had better noise performance at low frequencies, because of its well-designed power supply. Figure 5 shows the Neve's lack of the predominant 120Hz harmonic.

#### LISTENING TESTS

If you've never heard a high quality tube compressor on bass guitar, vocals or a snare drum, you're in for a real treat. Many tube compressors seem to dampen the top-end. With the CL 1A we noticed no high-frequency loss, even with moderate compression settings. In fact, the compressed signal often seemed brighter than the original sound. We found this slight perceived high-frequency bump to be ac-

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ceptable and pleasing.

Listening tests confirmed the gain-linearity measurements of the three different compressors. The LA-2A sounded good, but was more audible than the CL 1A. The Neve was very smooth, but not as flattering as a tube compressor. Our ears confirmed the fact that distortion was more audible on the CL 1A at lower input levels than normal levels. Also, we noticed more distortion with faster attack times, but this is not unusual for the genre.

The CL 1A has a classic tube sound without the noise and dirt you have come to expect from audio designs of yesteryear. A lot has happened in the electronics world since the 1960s — some good and some bad. Just because a piece of gear is old, has tubes and big fat knobs, does not make it “good sounding” — even if people are willing to pay ridiculous amounts of money for it. With a U.S. list price of \$1,785, we found the Tube-Tech CL 1A to be superior in many ways to other so-

called “classic designs.” It’s easy to use, and as a rich-sounding tube device, will flatter almost any signal. Give it a listen. ■

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*Editor’s note:* After the review of the CL 1A was completed, Lydkraft announced that the unit’s model number had been changed to the CL 1B. However, the unit’s internal workings had not been changed.

## ANSWERS



- 100. C
- 99. A
- 98. C
- 97. D
- 96. D
- 95. A
- 94. B
- 93. C
- 92. A
- 91. B
- 90. C
- 89. D
- 88. D
- 87. D
- 86. B
- 85. C
- 84. C
- 83. A
- 82. A
- 81. D

## AUDIO PRODUCTION

- 80. B
- 79. C
- 78. D
- 77. D
- 76. C
- 75. D
- 74. C
- 73. C
- 72. B
- 71. A
- 70. B
- 69. B
- 68. C
- 67. A
- 66. D
- 65. B
- 64. A
- 63. A
- 62. C
- 61. A

## PHYSICS

- 60. C
- 59. C
- 58. A
- 57. C
- 56. D
- 55. B
- 54. D
- 53. C
- 52. D
- 51. B
- 50. A
- 49. D
- 48. C
- 47. C
- 46. B
- 45. B
- 44. D
- 43. B
- 42. A
- 41. C

## DIGITAL TECHNOLOGY

- 40. B
- 39. C
- 38. A
- 37. B
- 36. C
- 35. D
- 34. D
- 33. D
- 32. D
- 31. A
- 30. D
- 29. A
- 28. D
- 27. B
- 26. A
- 25. C
- 24. D
- 23. C
- 22. D
- 21. A

## TRANSDUCERS

- 20. A
- 19. B
- 18. B
- 17. C
- 16. D
- 15. B
- 14. C
- 13. D
- 12. C
- 11. D
- 10. C
- 9. D
- 8. C
- 7. A
- 6. A
- 5. C
- 4. B
- 3. B
- 2. D
- 1. C

## ACOUSTICS

## Future Format Wars

By Laurel Cash-Jones and Fred Jones

**H**ot on the heels of Philips' introduction of the Digital Compact Cassette comes Sony's announcement of yet another digital consumer format, one that will compete head-to-head with DCC.

The new optical disc wonder is called MD, short for Mini Disc, its brand name, and magneto-optical disc, the kind of media it uses. Because it will be a while before you see this little wonder, and because today's engineers and producers have to be familiar with all the formats that their product will be released on, let us give you a run-down on this exciting new format.

MD is a record/playback system designed to replace the cassette (not unlike the CD replaced the LP), sometime before the turn of the century. Wait a minute. Didn't we hear this before with another format, DAT? Yes, you did.

However, according to all the people we have talked to, DAT is dead in the consumer business. This demise can be attributed to various reasons: the price was too high, lack of prerecorded software, congressional meddling, the various copy protection schemes and record industry's unwillingness to make it happen.

Fortunately, DAT has found a comfortable niche in the professional audio business, will probably find its way into the home as a high-end format for the "prosumer," and be used by recording artists and producers who want to take home copies of work in progress. However, digital recording for the home is going to happen.

Philips one-upped everyone with the upwardly compatible DCC, scheduled to be introduced next spring. You can be sure of one thing: Sony does not like to be one-upped. Besides, the company is convinced that the future is not tape-based. It is optical. The problems of the DAT launch, such as little pre-recorded software and expensive hardware, will not be repeated with MD (Sony hopes). The licensing of this technology to other hardware manufacturers is already being discussed, so that it will become as standard as the CD

(it is hoped). Record companies are also being contacted, so that pre-recorded software will be available.

It is also interesting to do a little gazing into your crystal ball and envision some of the variations in the type of discs possible with MD: record/play, play-only (perfect for the record industry) and perhaps a data disc in the future for your computer (a new type of CD-ROM?).

As far as hardware is concerned, because it is a different form of recording from standard CDs, you will need a special player to enjoy this new toy. Sony announced this new product with a demonstration of its prototype models of the various consumer items it expects to market.

This leads us to the technical description of this new format. First, the disc is a 2.5-inch optical disc enclosed in a plastic housing that looks very similar to a 3.5-inch floppy disk.

A very smart feature that is included is a memory chip that provides three seconds of buffer memory. Sony is calling this "Shock Proof Memory." This buffer will be particularly handy to the portable players, due to the fact that it will all but ensure the elimination of these annoying skips we have all experienced in our Discman's from vibration while driving or jogging.

When MD is released, about September 1992, you can expect to see some of the following products wandering into your life: a home stereo recorder/player, a boom-box type player with CD, car stereos and a portable Walkman-type player that fits in your dress shirt pocket. We wonder: how soon a multi-disc player for your pocket will be introduced?

Your first question is probably, "How does it sound?" We can't tell you. Sony is merely giving all of us a peek at what it is going to be marketing in the future. It is quite interesting that they would show a product this early in its development. However, the speculation is that because DCC has been announced and demonstrated to the public, it may have necessitated Sony having to jump the gun a bit on its MD announcement.

When pressed about the audio quality, a Sony spokesperson said that when it comes to market in 1992, the quality of the recording and playback of the new format should be comparable to current CDs.

Next question: How much recording time does the MD disc have? Approximately 74 minutes. Followup question: How in the world is that possible on a disc that small? Sony has developed a propri-

etary data reduction algorithm, ATRAC (which is short for Adaptive TRansfer Acoustic Coding), which uses a 5:1 data compression scheme, as the disc has only about one-fifth the area of a standard CD.

ATRAC samples the 16-bit data stream from the disc at the same data rate as a current standard CD, approximately 1.4mbits/second, but it will be fed into the decoder at 300kbits/second. ATRAC then decides to store/interpret the data according to its own built-in intelligence. It is claimed that the ear cannot hear the data loss due to psychoacoustic masking, a factor the Philips system also relies on.

Digital inputs and outputs will be available on the units, but the SCMS copy protection scheme implemented in DAT will be included on MD.

The MD unit uses a unique dual-function, single-laser that allows the unit to both record and playback without the use of two lasers, which will keep the cost down. Speaking of money: How much will it cost? The best guesstimate is that pricing will be less than DAT and a little more than a CD Walkman. Blank discs are expected to be comparable to a high bias metal cassette. Watch for this item to change the way you listen to music in your home.

### ARE YOU SINGLE-MINDED?

From Singular Solutions comes an A/D interface set that currently operates exclusively on the NeXT computer. The A/D 64x features 16-bit Delta Sigma conversion with exceptionally low linearity error (0.2 LSB), 64x oversampling, a three-stage linear phase digital anti-alias filter and error-cancelling self-calibration.

The system accepts EIAJ CP340, IEC 958, AES/EBU and S/PDIF digital signals at 32kHz, 44.1kHz, and 48kHz, and has a direct digital out with optional sample rate conversion.

The A/D converter also has a studio quality mic pre-amp on-board, with switchable 48V phantom power supply built-in, a defeatable low-cut filter and variable gain. It can also double as a high gain, low-noise dc or ac differential instrumentation amplifier.

Software is under development to allow for digital signal processing and editing capabilities on the NeXT computer.

Circle (101) on Rapid Facts Card ■

Laurel Cash-Jones is R•E•P's editorial consultant and a Los Angeles-based free-lance writer. Fred Jones is an audio industry observer and a Los Angeles-based free-lance writer.

# Cutting Edge

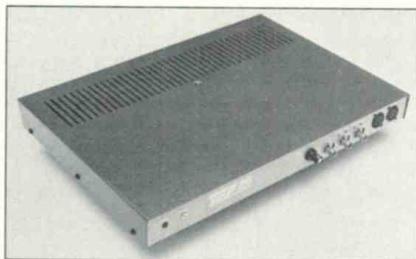
## EMC DUPLICATION HEADS

Electro-Magnetic Components is now offering replacement heads for the Otari DP-4050 and Sony in-cassette duplication systems. Heads are made with EMC's patented materials that exceed the life of ferrite heads while maintaining gap integrity. Heads also feature EMC's patented 2-piece design that allows the worn crown to be replaced for substantially less than the cost of a new head. Frequency response and crosstalk specs exceed manufacturer specs, making them ideal for music and spoken word applications.

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## TECHRON ANALYZER

The Techron System 20, the successor to the system 12, is driven by proprietary Sound Lab software and is available for either Macintosh or MS-DOS computers. Smaller in size and less expensive than its predecessors, the analyzer features the ability to digitally filter out ambient noise



and make measurements with higher signal-to-noise ratios. Sound Lab comprises three basic sections that allow its operator to make noise level, intelligibility and TDS measurements. Other features include pull-down menus and "one-button" measuring. Prices are \$4,250 for Macintosh or DOS software or \$4,500 for both versions.

Circle (105) on Rapid Facts Card

## SENNHEISER MD 422 MIC

Designed for road and studio use, the MD 422 dynamic features all-metal construction and a hardened steel basket. Its cardioid polar pattern rejects crowd noise and feedback, and a spring-suspended mic element adds to its durability. Accurate at high sound pressure levels, it also offers flat response across the audible spectrum. A built-in 5 step attenuator permits users to tailor low frequencies as needed. Suggested retail price is \$535.

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## AMEK MEDIA POST-PRODUCTION CONSOLE

Designed by Amek in association with Rupert Neve, the Media console's main input channels have 32 buses configured in groups of eight with multiformat panning consisting of three controls — Pan, Divergence and Surround — with a configuration that allows output formats from mono to Dolby Stereo to be selected. Media also has assignable routing where channel outputs are selected from a central control panel. With 2- or 3-person consoles, several assignment panels are fitted. Available options include retrofitting Bias switching linked to the JSK film machine control systems and a recently developed recall system.

Circle (119) on Rapid Facts Card

## REVOX C221 CD PLAYER

The Revox C221 uses 1-bit processing; according to the company, this allows total linearity, better error-correction capabilities and eliminates almost all crossover distortion. Features include a "true" stop mode, cue-to-music function, balanced line outputs, parallel and serial remote and digital outputs.

Circle (106) on Rapid Facts Card

## SMITHLINE MONITOR, SUBWOOFER

The Smithline Audio 2x4 close-field studio reference monitor was designed to achieve flat frequency response, high sound pressure level and high power handling capacity whether they are upright or on their sides. Features include removable cloth grills and 5-way banana jacks for No. 12 speaker cable, an integral fuse that allows high power transients to be handled easily and safely, and cabinet construction that can be custom-mounted on ceiling or on 19-inch rack-mounting brackets. The Smithline subwoofer system was designed to extend the bass response of close-field monitors. Because each subwoofer contains its own passive crossover network, they can be added to almost any other 4Ω or 8Ω speaker system. Internal passive crossover electronics may also be bypassed for optional bi-amping.

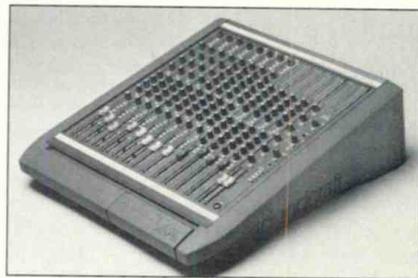
Circle (112) on Rapid Facts Card

## MIDAS XL3 CONSOLE

Designed for use as a front-of-house or monitor console, the Midas XL3 has eight mute groups, eight VCA masters and 18 discrete sends. The 16 main outputs are assignable to the eight auto mutes and the two VCA "Grand Masters."

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## SOUNDCRAFT DELTA AVE



Replacing the Series 200 B/VE console, the Delta AVE is designed to enhance the level of audio in video editing. The desk is in configurations of 8-, 16-, or 24-channel frame sizes; all frames include a master module, four subgroups, a stereo mix output and power supply. Six factory standard configurations featuring depth of fade fader on the input modules are available, including mono only (8-, 16-, 24-channel), stereo only (8- or 16-) or a 24-channel with 16 mono inputs and eight stereo inputs.

Circle (108) on Rapid Facts Card

## SAKI REPLACEMENT HEADS

Saki Magnetics has introduced ferrite replacement record heads for Studer A-80 and Otari MTR-10 and MTR-12 master maker recorders. Saki Master Maker heads deliver 2dB more output at 10kHz for Studer, with similar improvements for Otari, and require no electronic modification. The Studer replacements are available in 1/2-inch and 1-inch models for all A-80 MKII configurations, including side-by-side, inline and interlaced. The Otari replacements are furnished in 2-track 1/4-inch, 2-track 1/2-inch and 4-track 1/2-inch models. Prices for the 4-track 1/2-inch models are \$895 per Studer head and \$795 per Otari head.

Circle (109) on Rapid Facts Card

## JFX ATMOSPHERE LIBRARIES

Freelance film sound editor John Foster has issued the first six DATs of atmosphere effects. Compiled on the DAR SoundStation II, the JFX Library is organized so that all effects on the same themes are easily at hand. According to Foster, logarithmic crossfades allow the effects to last from three to nine minutes, and they can be easily looped to create longer sequences. The collection presently comprises 125 effects ranging from open space atmospheres, bird/insects in different environments, ships — inside and outside effects, to a selection of wind and sea atmospheres.

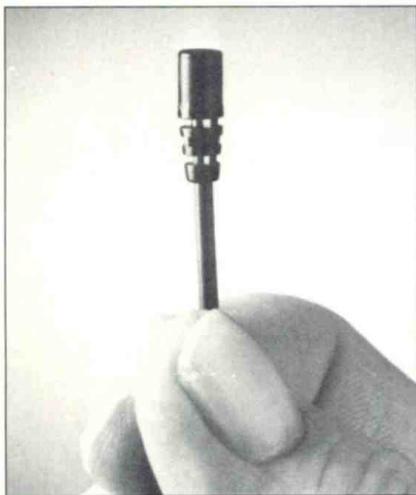
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### TIMELINE CCU

TimeLine's Console Control Unit is a miniature keypad that mounts directly into standard Neve, SSL and other consoles. Using Lynx Time Code Modules, the CCU controls up to six analog or digital audio tape recorders, VTRs or sprocketed film transports. Any transport may be designated as the master without switching cables. The CCU offers variable speed control of the master for pitch changes of a synchronized machine group and an optional jog/shuttle wheel. Features include a 16-character alphanumeric display, machine time code locations and offsets readout, status lights for each machine indicating lock, code, record, busy and aux, and group and solo functions.

Circle (111) on Rapid Facts Card

### TELEX LAPEL MICS



Telex ELM lapel mics are designed for applications requiring free movement and inconspicuous mics. The ELM-22 omnidirectional mic is 0.2-inch in diameter and 0.3-inch long with sensitivity of -56dB. The ELM-33 unidirectional mic, with a 0.2-inch diameter and 0.75-inch length, has -65dB sensitivity. The belt pack transmitter supplies bias voltage for wireless applications. The PS-9 power supply provides balanced output and mic bias voltage from an internal 9V battery or an external phantom power supply. Four termination options are available: stripped-and-tinned leads; Switchcraft TA4F receptacle connector; 4-pin LEMO receptacle connector; and a complete system, including lapel mic and PS-9 in-line power supply. The ELM series ranges from \$160 to \$325.

Circle (117) on Rapid Facts Card ■

## HARDWARE AND SOFTWARE UPDATES

### APOGEE DA-1000-E

Apogee Electronics upgraded its D-1000 digital to analog converter by adding two AES or S/PDIF digital inputs, which operate at sampling rates between 32kHz and 55kHz. Like the DA-1000, the DA-1000-E includes 964-IV filters, C384 low-jitter clock, P818 low-noise power supply



and a wide selection of standard interfaces and runs off 12V. The software upgrade is free to all DA-1000 owners. List price is \$1,695.

Circle (118) on Rapid Facts Card

### CROWN COM-Q CONTROLLER

The COM-Q Controller is designed to quickly initiate a series of system control commands. The unit can record digital control data on analog or digital systems, and it can produce taped source material capable of managing the control functions, including amp gain, inversion, auxiliary line feed control, mic mixing and sound system routing. The unit is compatible with most analog tape sources, including multitrack decks. It automatically records whatever has been recorded digitally onto the tape source. The COM-Q also houses internal dubbing circuitry that recreates digital signals for making duplicate tapes.

Circle (120) on Rapid Facts Card

### MICROTECH WARRANTIES

Microtech International has extended the warranty on its Europa hard drives for Macintosh. External configurations are available in 20Mbytes, 40Mbytes and 100Mbytes, and internal drives in 50Mbytes and 100Mbytes.

Circle (121) on Rapid Facts Card

### WOHLER INPUT OPTION

AMP-2 and AMP1-A rack-mount stereo audio monitors may now be ordered with 10 mono or 10 stereo inputs, allowing audio monitoring of multiple sources from a single location. A buffered output is also available, allowing either to function as an audio routing switcher and high-fidelity stereo audio monitor. Input connectors are 25-pin terminal blocks in a horizontal or vertical configuration. With mono inputs, two rotary switches are provided to allow routing of any one of the 10 inputs to either the left or right monitor channel; stereo inputs are switched in pairs.

Circle (149) on Rapid Facts Card

### NADY HT-1

The HT-1 is a handheld wireless mic for the Nady 101, 201, 650, and 750 systems. The all-metal case features an audio mute switch and a threaded sleeve for battery access. Nady has also begun soldering (instead of drilling) miniaturized components to the surface of the circuit boards in its bodypack transmitters.

Circle (150) on Rapid Facts Card

### MICROTECH DRIVE

Microtech's OR650, a rewritable magneto-optical drive for large scale archival storage, has undergone hardware and software changes, including a full height case, an improved drive mechanism and driver software. An improved filtration method reduces the chances of contamination, and its driver software reads 33% faster and writes 40% faster. The driver's full height enclosure more closely matches the design of other Microtech and Macintosh products. The drive's \$4,799 list price carries a 2 year warranty, and additional preformatted 5.25-inch 650Mbytes cartridges list at \$249.

Circle (122) on Rapid Facts Card

### MEDIAVISION MULTIMEDIA UPGRADE KIT

The Multimedia Upgrade Kit from Media Vision allows the conversion of 10MHz or faster PC/AT into a multimedia system. The kit's software includes Microsoft Windows 3.0, Multimedia Windows extension 1.0 and the HyperGuide CD-based on-line user manual. All necessary hardware is enclosed, with an option for an internal or external Sony CD-ROM drive. The Pro Audio Spectrum adaptor board provide stereo sound and full MIDI mixing capabilities. Suggested retail price for the kit with the internal CD-ROM drive is \$995 and \$1,295 for the external drive.

Circle (123) on Rapid Facts Card ■

## SOUND BUSINESS

Continued from page 18

areas of discussion manufacturers didn't address.

- Attendees talked with one another sharing experiences with the various systems and the technology in general.

- Manufacturers as a group openly discussed the problems and concerns the technology has created for everyone.

- Attendees had the opportunity for hands-on experience with each of the systems represented.

- The social dialogue that took place during lunch, dinner and cocktails allowed participants to gain some perspective on this entire range of technology.

What an education!

Trade shows (such as those presented by AES, NAB and APRS) offer similar, if somewhat daunting, opportunities for the same kinds of information experiences. These generally require an organized plan of attack and generous amounts of patience and persistence as you share the opportunities with thousands of other seekers.

Manufacturers should not be overlooked in the struggle to stay informed. In New York, Dolby holds regular technical seminars on a variety of noise reduction and film sound issues. If you are seriously considering investing in new technology few manufacturers will turn their backs on you. All manufacturers want happy customers, and they know that knowledgeable customers are generally happier customers. To the extent of their time and resources, most will make themselves and their products available to educate potential customers.

### WORK THE PHONE

All this is well and good, but what if you own a small studio in Nebraska and want to know about digitally controlled consoles, reset, recall, automation and such? Maybe you anticipate purchasing a console of this sort but don't know much about them. Maybe you can't afford the trip to New York or Los Angeles for the AES Convention. Once you've read all you can, what do you do next? *You get on the phone!* As a member of SPARS, ITS, SMPTE or AES, you have colleagues all over the country who are not competitors and who own or use the technology you are interested in. Call and ask. Be courteous and considerate of the person whose time you are taking. Offer thanks and return of the favor when you're done. You've both made an acquaintance and probably

both learned something.

If new technology equipment is part of your capital expenditure plan, then build into the capital cost a few dollars for education. When I was a recording studio president and we wanted to purchase digital multitrack recorders, one manufacturer was unable to arrange a demonstration at our facility. After reviewing the capital cost, I called a SPARS colleague on the West Coast who had the machine in question (I had not met him before this call) and explained the situation. If I was going to buy a couple of hundred thousand dollars of hardware, I wanted to see it work. My chief tech and I flew to California and spent a day with our colleagues and the new machine. For an investment of less than 0.5% of the capital expense we answered all our questions, learned an enormous amount about the technology, made several lasting friends and did some extra business while we were there. We ultimately purchased this manufacturer's machines, but even if we had not, the cost of the trip was nominal considering the gains.

The cost of errors is the nightmare of any businessman. Errors of ignorance are no less costly than any others, but they are also emotionally disastrous because *we should have known better*. The time, energy and dollars you invest in the education of your staff and yourself is never wasted and may well mean the difference between success and failure.

We have long since passed the time when a high school education prepared a person for success in life. Indeed, a college degree barely seems to equip a person for the day after graduation in the 1990s. And in our industry the pace of technology development makes museum pieces out of the tools we just mastered yesterday. Now we must all be Technology Masters: Post Graduate Perpetual Students. But the choices of curricula and teachers and classrooms are all up to us. Keeping abreast is the name of the game. Using knowledge to move ahead is the goal. ■

The Society of Professional Audio Recording Services is the industry's best source of business information. For details on activities or membership, contact SPARS at 4300 10th Ave. N., Lake Worth, FL 33461; 407-641-6648; fax 407-642-8263.

## DIGITAL DOMAIN

Continued from page 22

### LESSON NO. 5

Plan for the future. Dolby encodes its data at 48kHz using 18-bit A/D converters on the front-end for higher resolution. This way the encoding system is not constrained by current technology. The main reason Dolby wants 18-bit performance is that SR-encoded material won't fit in normal 16-bit digital audio.

Dolby is not the only company doing this. At least two digital workstation manufacturers store their sound on disk at greater than 16-bit resolution, so they are ready when quality 18- and 20-bit D/As are widely available. Too bad Sony and Philips didn't do the same when they designed the compact disc.

Enough tech talk: how does Dolby SR•D sound? In a word: impressive. When you listen to a conventional mono-optical soundtrack without picture, it is surprising how little dynamic range is present.

What audible differences can you hear between Dolby SR and Dolby SR•D? SR•D has a cleaner top end with less hiss. Of course, the dynamic range seems greater with a digital system, but practical peak levels are limited by power amps and speakers. Also, SR•D is much more tolerant of speed variations projectors have, so there is *no wow* and flutter.

Two of the most remarkable features demonstrated in Los Angeles were its outstanding soundtrack durability and channel separation. The channel separation of Dolby SR•D is remarkable. One of Dolby's audio-only demos featured a different person speaking in a different language in each of the five channels. With a normal Dolby SR print, the surrounds seemed to collapse into the center of the room. The SR•D print had perfect separation.

Currently all major films are still being made using conventional analog recording techniques. Because Dolby SR•D is a mastering process, the sound can only be as good as the original film mix. Until we see widespread use of digital dubbers or SR-encoded analog on the re-recording stage, the true potential of digital film sound may not be realized.

Dolby has clearly done its homework and appears to have learned from some of the mistakes of earlier systems. The real question now is how long will it take to get the technology from the laboratory to the local cinema. ■

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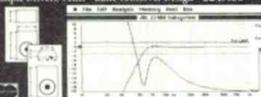
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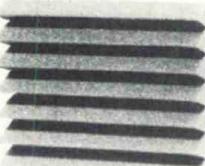
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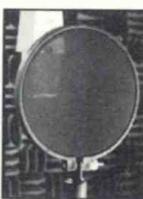
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# Answer Sheet and Drawing Entry Form

## Instructions:

Use this sheet to note your answers from the National Audio Test which begins on page 28. When you have completed the test, the correct answers may be found on page 60. Tally each of the sections independently in the boxes below. One point is allotted for each proper answer, with a maximum of 20 points in each section, or 100 possible points for all five sections. Please use the comment line listed below to request explanations on specific questions. These will be addressed in an upcoming issue.

Answers and specific scores will remain confidential — your name on this form is for the prize drawing only! In a future issue, however, we will present a summary of how our readers scored *in total*, by category, following an independent tally of the answers. Good luck. Have fun!

Acoustics	Transducers	Digital Technology	Physics and Electronics	Audio Production
1. (A) (B) (C) (D)	21. (A) (B) (C) (D)	41. (A) (B) (C) (D)	61. (A) (B) (C) (D)	81. (A) (B) (C) (D)
2. (A) (B) (C) (D)	22. (A) (B) (C) (D)	42. (A) (B) (C) (D)	62. (A) (B) (C) (D)	82. (A) (B) (C) (D)
3. (A) (B) (C) (D)	23. (A) (B) (C) (D)	43. (A) (B) (C) (D)	63. (A) (B) (C) (D)	83. (A) (B) (C) (D)
4. (A) (B) (C) (D)	24. (A) (B) (C) (D)	44. (A) (B) (C) (D)	64. (A) (B) (C) (D)	84. (A) (B) (C) (D)
5. (A) (B) (C) (D)	25. (A) (B) (C) (D)	45. (A) (B) (C) (D)	65. (A) (B) (C) (D)	85. (A) (B) (C) (D)
6. (A) (B) (C) (D)	26. (A) (B) (C) (D)	46. (A) (B) (C) (D)	66. (A) (B) (C) (D)	86. (A) (B) (C) (D)
7. (A) (B) (C) (D)	27. (A) (B) (C) (D)	47. (A) (B) (C) (D)	67. (A) (B) (C) (D)	87. (A) (B) (C) (D)
8. (A) (B) (C) (D)	28. (A) (B) (C) (D)	48. (A) (B) (C) (D)	68. (A) (B) (C) (D)	88. (A) (B) (C) (D)
9. (A) (B) (C) (D)	29. (A) (B) (C) (D)	49. (A) (B) (C) (D)	69. (A) (B) (C) (D)	89. (A) (B) (C) (D)
10. (A) (B) (C) (D)	30. (A) (B) (C) (D)	50. (A) (B) (C) (D)	70. (A) (B) (C) (D)	90. (A) (B) (C) (D)
11. (A) (B) (C) (D)	31. (A) (B) (C) (D)	51. (A) (B) (C) (D)	71. (A) (B) (C) (D)	91. (A) (B) (C) (D)
12. (A) (B) (C) (D)	32. (A) (B) (C) (D)	52. (A) (B) (C) (D)	72. (A) (B) (C) (D)	92. (A) (B) (C) (D)
13. (A) (B) (C) (D)	33. (A) (B) (C) (D)	53. (A) (B) (C) (D)	73. (A) (B) (C) (D)	93. (A) (B) (C) (D)
14. (A) (B) (C) (D)	34. (A) (B) (C) (D)	54. (A) (B) (C) (D)	74. (A) (B) (C) (D)	94. (A) (B) (C) (D)
15. (A) (B) (C) (D)	35. (A) (B) (C) (D)	55. (A) (B) (C) (D)	75. (A) (B) (C) (D)	95. (A) (B) (C) (D)
16. (A) (B) (C) (D)	36. (A) (B) (C) (D)	56. (A) (B) (C) (D)	76. (A) (B) (C) (D)	96. (A) (B) (C) (D)
17. (A) (B) (C) (D)	37. (A) (B) (C) (D)	57. (A) (B) (C) (D)	77. (A) (B) (C) (D)	97. (A) (B) (C) (D)
18. (A) (B) (C) (D)	38. (A) (B) (C) (D)	58. (A) (B) (C) (D)	78. (A) (B) (C) (D)	98. (A) (B) (C) (D)
19. (A) (B) (C) (D)	39. (A) (B) (C) (D)	59. (A) (B) (C) (D)	79. (A) (B) (C) (D)	99. (A) (B) (C) (D)
20. (A) (B) (C) (D)	40. (A) (B) (C) (D)	60. (A) (B) (C) (D)	80. (A) (B) (C) (D)	100. (A) (B) (C) (D)
<b>Total</b> _____	<b>Total:</b> _____	<b>Total:</b> _____	<b>Total:</b> _____	<b>Total:</b> _____

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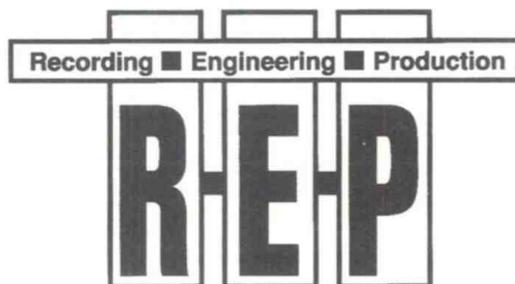
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Test results will not be a factor in eligibility, and you need not be present to win. However, you must be on the R•E•P circulation list or include a completed subscription form (available in this issue). Manufacturers, employees of Intertec Publishing or professional audio industry magazines are not eligible.

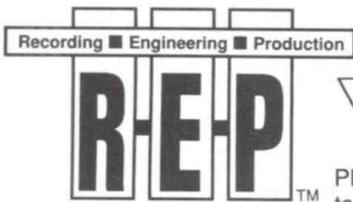
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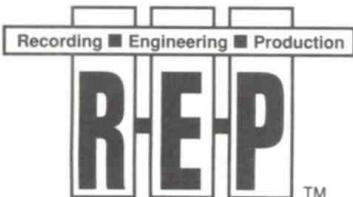
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S8B

**3** Please check below the ONE category that best describes your primary job function:

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**4** What statement best describes your role in purchasing professional audio recording equipment, systems and software?  
**A**  Make final decision to buy specific makes, models, services or programs.  
**B**  Specify or make recommendations on makes, models, services or programs.  
**C**  Have no part in buying or specifying.



- New Subscription**
- Address Change**
- Subscription Renewal**
- Information Request**

### AFFIX LABEL HERE

Please print or type:

Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone No. (\_\_\_\_\_) \_\_\_\_\_

### FOR FASTER ACTION!!!

I have an immediate interest in the items I've indicated here. Please have a sales person call me.


Please send me information about the following items.

- |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91  | 101 | 111 | 121 | 131 | 141 | 151 | 161 | 171 | 181 | 191 |
| 2  | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92  | 102 | 112 | 122 | 132 | 142 | 152 | 162 | 172 | 182 | 192 |
| 3  | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 93  | 103 | 113 | 123 | 133 | 143 | 153 | 163 | 173 | 183 | 193 |
| 4  | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 94  | 104 | 114 | 124 | 134 | 144 | 154 | 164 | 174 | 184 | 194 |
| 5  | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95  | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | 195 |
| 6  | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 96  | 106 | 116 | 126 | 136 | 146 | 156 | 166 | 176 | 186 | 196 |
| 7  | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 97  | 107 | 117 | 127 | 137 | 147 | 157 | 167 | 177 | 187 | 197 |
| 8  | 18 | 28 | 38 | 48 | 58 | 68 | 78 | 88 | 98  | 108 | 118 | 128 | 138 | 148 | 158 | 168 | 178 | 188 | 198 |
| 9  | 19 | 29 | 39 | 49 | 59 | 69 | 79 | 89 | 99  | 109 | 119 | 129 | 139 | 149 | 159 | 169 | 179 | 189 | 199 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |

R8B

## RAPID FACTS

For issue of August 1991  
 Use until December 1991

**1** Do you wish to receive/continue to receive R-E-P?  Yes  No  
 Signature \_\_\_\_\_ Date \_\_\_\_\_  
 Title \_\_\_\_\_

- 2** Check the ONE type of facility or operation that describes your business:
- 25  **Recording studio:** (commercial fixed location and mobile recording trucks, systems and studios)
  - 26  **Sound reinforcement:** (installers, operators and designers of concert and other temporary sound systems)
  - 27  **Radio broadcast production:** (including non air-chain station-based and independent radio production facilities)
  - 28  **TV broadcast audio production:** (including non air-chain station-based and independent television audio production facilities)
  - 29  **Independent engineer/producer:** (free-lance audio producer, engineer, technician, director, musician/artist)
  - 30  **Video sweetening/post-production facility:** (independent audio for video production and post-production service companies)
  - 31  **Film re-recording:** (in-house and independent film sound production and post-production companies and facilities)
  - 32  **Disk/CD mastering**
  - 33  **Audio/acoustic/technical consultant:** (system and equipment consultant, studio and production facilities designer)
  - 34  **Corporate, educational, government:** (audio recording facilities in manufacturing and service companies, arfd other businesses, schools, universities, governmental facilities)
  - 35  **Audio equipment retailer/dealer/distributor/rental company:** (sales and/or service of professional audio product lines)
  - 36  **Other (please specify)** \_\_\_\_\_

**3** Please check below the ONE category that best describes your primary job function:

- 06  **Audio Engineer/Producer:** Audio producer, sound engineer, mixer, post-production engineer, mastering engineer, staff/independent sound engineer, producer, editor or other audio engineering titles.
- 07  **Technical Management:** Maintenance engineer, engineering manager or other technical titles.
- 08  **Corporate and Operation Management:** President, owner, partner, vice president, director, general manager, studio manager and other corporate and financial officials, as well as consultant, professor or instructor.
- 09  **Musician/artist**
- 10  **Other (please specify)** \_\_\_\_\_

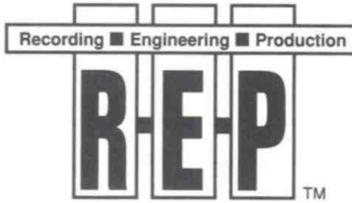
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What professional audio products have you purchased within the last 90 days? (List brand name, model number, product type, etc.)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

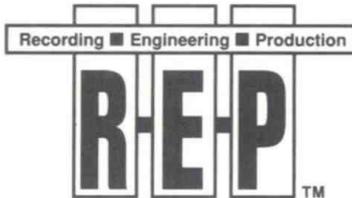
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