Master Class: Lexicon MPX 100 & 500 • Korg Karma, TC-Helicon VoicePrism, and 9 more reviews

Electronic Musician®

www.emusician.com

August 2001

DVD-R

A WORLD OF POSSIBILITIES

Vexed Vocals?

11 TIPS FOR BETTER RECORDINGS

Ka-Ching!

DISTRIBUTION SECRETS OF THE PROS

WebPage:

VISIT THE MOOG ARCHIVES!

14 complicated reasons (and 2 simple ones)

WHY THE 1604-VLZ® PRO MIXER

can make your creative product sound better.

Year in and year out, more professionals use Mackie VLZ® PRO mixers than any other brand. For TV and film soundtracks, ads and bumpers, for song demos, for video post and for submixing into larger consoles.

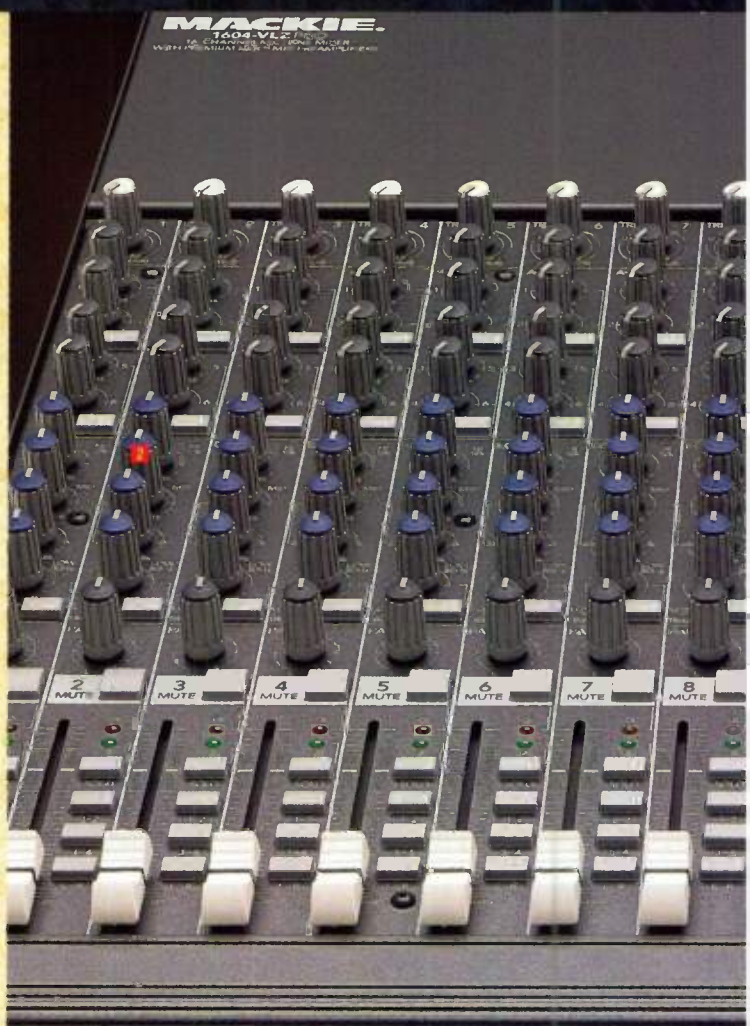
While this ad features our "industry standard" 1604-VLZ® PRO, you'll find many of the same innovations on our three other models, right down to the diminutive 1202-VLZ® PRO.

If you're serious about your creative product, you owe yourself the low noise, high headroom and sweet musical sound we've designed into all four VLZ® PRO compact mixer models.

1 16 XDR™ mic preamps get the most from any microphone. Meticulously designed to achieve the same fine definition and pristine specifications as $2000-per-channel outboard mic preamps, XDR™ provides 130dB dynamic range to handle hot digital inputs, ruler-flat response (down just 3dB at 192kHz!) and 0.0007% THD. Our exclusive design also has the best RF rejection of any compact mixer mic preamps.

2 Warm, musical equalization. 12kHz and 80Hz shelving EQ plus swept mid with gentle 2-octave peak. The 1604-VLZ® PRO's "midrange" actually sweeps from 3kHz all the way down to 80Hz, so you can realistically use it as a second mid-bass LF equalizer, too.

3 VLZ® circuitry for ultra-low noise. 1604-VLZ® PRO owners tell us it's by far the quietest mixer they've ever used. With all 16 channels wide open, they "can't even tell it's on." Judicious application of Very Low Impedance circuitry dramatically reduces thermal noise at critical signal path points as do new, advanced 2068 op-amps.



1202-VLZ® PRO

12 total channels • 4 XDR™ premium mic preamps • 4 mono line level chs. • 4 stereo line level chs. • Extra ALT 3-4 stereo bus • 3-band equalization • 75Hz low cut filters on mono chs. • 2 aux sends per ch. • 2 master stereo aux returns with EFX to Monitor • Control Room/Phones source matrix • Rotary gain controls • Built-in power supply

1402-VLZ® PRO

14 total channels • 6 XDR™ premium mic preamps • 6 mono line level chs. • 4 stereo line level chs. • Extra ALT 3-4 stereo bus • 3-band equalization • 75Hz low cut filters on mono chs. • 2 aux sends per ch. • 2 master stereo aux returns with EFX to Monitor • Control Room/Phones source matrix • 60mm log-taper faders • Switchable AFL/PFL

4 Easy level setting. Just press a channel strip PFL Solo button and adjust the Trim Control to minimize noise and optimize headroom.

5 Constant Loudness Pan pots maintain uniform sound level when you pan hard right or left.

6 6 aux sends per channel, each with 15dB gain above Unity for cranking effects and running outboard gear at optimal output levels.

7 Sharp 18dB/oct. 75Hz Low Cut filters minimize room rumble, truck noise, mic stand thunks and P-pops without losing audible bass.

8 Flexible stereo aux return routing. Aux Returns 1 & 2 can be folded back into Aux Sends 1 & 2 (so musicians can hear EFX in their headphones); Aux Return 3 can be sent to the main mix or either Sub Bus 1-2 or Sub Bus 3-4; Aux Return 4 can sent to Ctl Rm/Phones only.

Simple reason ❶: It's built like a tank. Solid steel main chassis. Thick mil-spec fiberglass circuit boards. Sealed rotary controls. Real metal jacks. Buy a 1604-VLZ® PRO now. Leave it to your kids in 20 years.

Simple reason ❷: It just plain sounds better. Don't believe us? Ask one of the thousands of satisfied owners. Or better yet, demo a VLZ® PRO series compact mixer at a Mackie dealer today.

9 Separate Aux Returns Solo button.

10 Control Room/Phones Source Matrix lets you route any combination of Tape, Subs 1-2, Subs 3-4 or Main Mix to headphones or control room monitors.

11 Separate Tape input gain control and Tape To Main Mix switch so you don't have to tie up a channel strip adding CD EFX or click tracks.

12 RUDE Solo light flashes brightly any time a channel is soloed. Doesn't sound like a biggie until you're sleep-deprived at 3 a.m. and can't figure out why no sound is coming out of the @%&$#! mixer.

13 4-bus design with L/R assigns on each bus and bus assigns on each channel strip.

14 60mm log-taper faders provide linear level change throughout their length of travel. You can do precise fade-outs all the way down to ∞ instead of losing the sound at about -20dB. Compare to our competition and hear the difference.

1642-VLZ® PRO

16 total chs. • 4-bus w/double-bussed outputs • 10 XDR™ premium mic preamps • 8 mono line level channels • 2 hybrid mono mic/stereo line-level channels • 2 mono/ stereo line level chs. • 3-band EQ w/swept mid on mono channels, 4-band on stereo channels • 75Hz low cut filters on mono chs. • 4 aux sends per ch. • 4 stereo aux returns with EFX to Monitor • Control Room/ Phones source matrix • 60mm log-taper faders

MACKIE

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Get the MX-2424 Advantage!

You probably machines in is the What you advantages multitracks, transition just getting understand

"The 'Golden Ears' all found the TASCAM performed extremely well, nearly beating out a unit priced four times higher. The listening tests confirmed what I already knew: the MX-2424 is a solid performer at a great price."

- Glen O'Hara,
Pro Audio Review Magazine

"...the MX-2424 puts high-resolution sound quality and professional recording features at your fingertips."

- Electronic Musician Magazine,
2001 Editor's Choice Award

"...the TASCAM MX-2424 is a rock-solid, excellent studio recorder that performs well, sounds great and is priced right."

- George Petersen,
Mix Magazine

"The machine alone is impressive enough to warrant close attention, but the implications inherent in the control and networking capabilities make it potentially astounding."

- Rob James,
Studio Sound Magazine

* based on an average 3 1/2 minute song of 24 tracks at 24-bit/48kHz. Your mileage may vary.

† Offline CD-R backup is possible with an Ethernet-equipped computer. The $749 (USD) reference is based on TASCAM's CDR-Pro Bundle.

MX-2424 24-TRACK 24-BIT HARD DISK RECORDER/EDITOR

know that with thousands and thousands of use around the world, the **TASCAM MX-2424** most popular 24-track recorder ever made. might not know is that the MX-2424 offers huge that aren't available on other standalone hard disk regardless of price. Whether you're making the from analog and tape-based digital recorders or into recording, here's some info to help you truly the MX-2424 advantage.

Ph.D. in Nuclear Physics Not Required

If you've ever recorded before, you'll find the MX-2424 as easy to use as any multitrack recorder. Flip the Power switch, arm a track and hit the Record and Play buttons. Voila...you're tracking to its internal hard disk. Since TASCAM has been the world leader in multitrack recording for over 25 years, we know how to create gear that's powerful and sophisticated without making the learning curve too steep.

Edit How *You* Like: MX-View™ Waveform Graphic Interface and Extensive Front Panel Editing

One of the main reasons to get into hard disk recording is the incredible editing power versus tape. Running in native Mac and PC versions and connected via a fast 100Mb Ethernet interface to your computer, the upcoming MX-View is a powerful graphic editing interface that offers sophisticated, sample-level editing on par with full-featured digital audio workstations. You can drag and drop on the fly, get onscreen metering for up to six MX-2424s, set up custom configurable keyboard shortcuts, manage virtual tracks and much more. If you want to use the MX-2424 in the field, its extensive built-in front panel editing tools let you edit without lugging around a keyboard, monitor and mouse.

True Recording Power: Take the Punch-In Challenge

24-track, 24-bit digital audio requires a powerful hard disk recording engine. The MX-2424 is so strong that it allows for seamless, gapless punches across 24 tracks, with up to 72 tracks of throughput to accomplish this considerable task. If you're brave, try arming 24 tracks on any other standalone 24-track hard disk recorder and quickly punching in and out. It's just one example of the MX-2424's awesome dual-processor recording power and extremely fast SCSI bus. You can choose between TapeMode and Non Destructive recording, and access up to 999 virtual tracks per project with 100 locate points, 100 levels of Undo and much more.

Sound Designer II, Broadcast Wave Files and SCSI Drives for Ultra Flexible Compatibility

TASCAM understands the reality that you may need to interface your audio with other pieces of equipment. Since the MX-2424 writes Sound Designer II™ audio files to Mac-formatted disks and Broadcast Wave audio files to PC disks, it's easy to move sound back and forth between your computer and the MX-2424. With these standard time-stamped file types and professional SCSI drives, you're ensured sample-accurate compatibility with Pro Tools™, Nuendo™, Digital Performer™ and more. With compatibility being so important to MX-2424 owners, it's no surprise that its 24-channel interfaces are ready to connect to just about any console, digital or analog. Or that its analog, TDIF and AES/EBU interface modules are 96kHz ready.

Back Up Your Tracks: As Low As A Buck Per Song

Media	Cost of Drive	Media/10 Projects	Total Cost
90 Minute IDE Drive	$299	10 Drives	$2990
Orb Drive	$299	1 Drive + 86 Disks	$2879
TASCAM DVD-RAM	$599	1 Drive + 20 Disks	$1739
Offline CD-R Backup*	$749	1 Drive + 290 Disks	$959

If you're forced to use cheap disk drives to backup, you'll pay in the long run. DVD-RAM drives may be connected to the MX-2424's front panel or rear SCSI port, and offline CD-R backup via Ethernet transfer to your computer is the most cost-effective backup method available on any HD recorder by far.

Hard disks are great for recording...but not so great for archiving and transferring audio. That's why the MX-2424 gives you choices like 9.4GB DVD-RAM discs for your backup solution. Or simply transfer your audio to your computer and backup to CD-ROM for as low as one dollar for an average pop tune*.

Get the Advantage of the Most Powerful and Most Affordable 24-Track Hard Disk Recorder Available Today

There's much more to the MX-2424 than what fits on this page, like its award-winning sound quality, professional built-in synchronization tools and TASCAM's amazing online support forums. So if you're getting into the hard disk revolution, you might as well take advantage of the recorder with all the advantages. Just go to **www.mx2424.com** for the complete MX-2424 story, or check out the MX-2424 for yourself at any TASCAM dealer.

Available soon, the new MX-View graphic editing software offers DAW-style waveform editing power, drag-and-drop editing on the fly, control of up to six MX-2424s with metering and much more.

www.mx2424.com

TASCAM
a whole world of recording

I N S I

FEATURES

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DEPARTMENTS

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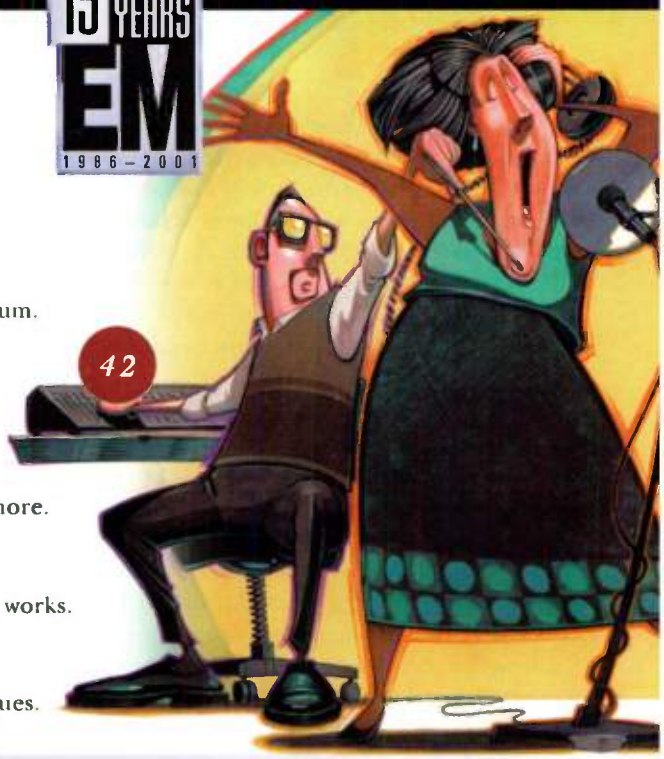
15 YEARS EM 1986–2001

COLUMNS



REVIEWS

Organization, Man

Creating systems that enable people to work together smoothly and productively is a kick for me. Before becoming a magazine editor, I was a political organizer, built and led bands, wrote arrangements, and managed the operations of a couple of small businesses. **EM**'s steady, long-term growth has allowed me to further expand my organizational skills.


ANTHONY PIDGEON

After all these years, I sometimes feel like an old dog, but recently I have learned some new tricks. I volunteer with a dog-rescue group that decided to split into two sister organizations, and I was asked to help organize the new one. A colleague of mine is a professional consultant who specializes in teaching small businesses to organize themselves. In applying her methods to the new dog-rescue group, I have discovered that the approach can also be applied to building musical groups and projects. Here are some key parts of the approach.

Visualize the future. Anticipate where you want the project to be three to five years down the road.

It's not enough to say that you want to build a studio business, make your band the hottest ticket in town, or found an independent label. Visualize and write down what your hot band would be like, including musical style, business philosophy, financial ambitions, the types of gigs you would be playing, and the type of stage show you want to have.

Tell the story. After brainstorming and then listing your ideas, write a short story about the group or project as you visualize it. For the dog-rescue group, I wrote a fictional story from the viewpoint of a new volunteer as she learns about the group five years from now. Don't worry if you aren't a great writer; the story is just an organizing tool.

Identify the job functions necessary to achieve your goals. Write on a separate sticky note each job that must be done if you are to reach your goals. For instance, if you are putting together a road band, people must book gigs, handle the sound and lights, sell merchandise, select the tunes, provide transportation, handle PR, and do the books. You might need session players and a graphic artist. Each job gets a sticky note.

Make an organization chart based on the functions you identified. Start placing the sticky notes on a large blank piece of paper or cardboard. Move them around until the job functions are logically grouped. You have now created a basic organization chart for job functions.

Applying that to a band, you might have Music, Marketing, Business Management, and Technical function groups, just to name some possibilities. You could break it down lots of ways as long as the organizational structure potentially provides what you need to make your vision a reality.

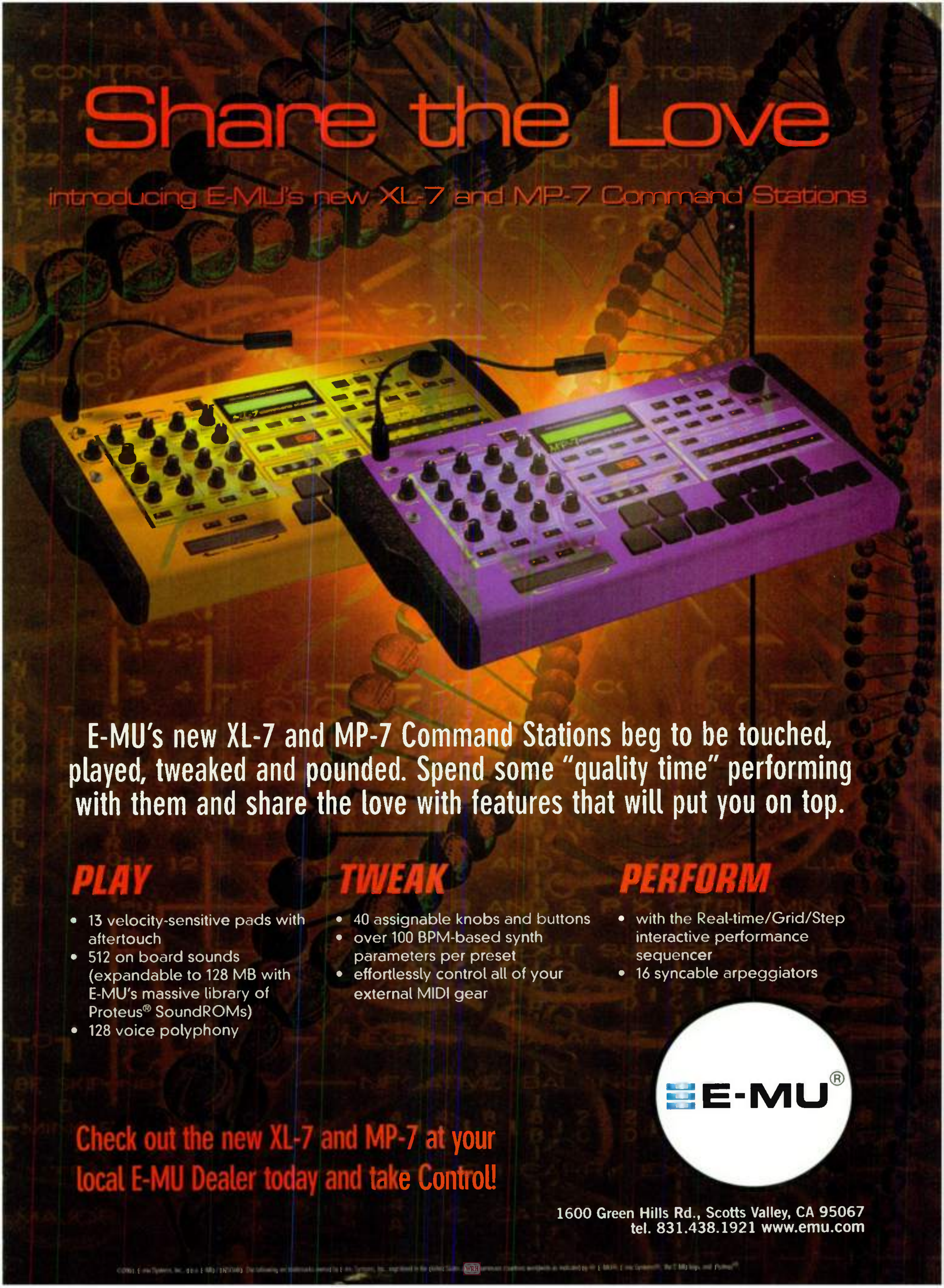
Set priorities and build a schedule. Start looking at the steps it will take to build the organization you outlined and achieve the goals you envision. Again, write everything down.

Fill the jobs. You now know where you want to go, how you want to organize yourself to get there, and when you expect to reach each stage. You are ready to start thinking about the types of people you need in order to make the project work. From there, you can begin recruiting and interviewing bandmates or other business partners.

In our dog-rescue group, most people wear several hats, and in your band or studio, you probably wear most of the hats. But you still need to work with outside services for some things. Having organized your ideas and needs, you are ready to determine what types of companies or individuals you should seek as partners.

This organizational work can be done surprisingly quickly, and it really pays off. Of course, being well organized doesn't guarantee success, but your chances of success are far better than if you followed the classic "just shuffle along and hope" pattern.

We welcome your feedback. E-mail us at emeditorial@intertec.com.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It does more than burn. It sizzles.

Introducing the new Korg D1600 Digital Recording Studio, the most complete and affordable solution for home and project recording. This 16-track digital recorder packs recording, mixing and final CD mastering into a professional quality all-in-one unit. With even more features and capabilities, the D1600 has everything for your music-making needs.

The D1600 comes with a massive 20 GB hard drive for more recording time and less worry about running out of time or space. And thanks to its unique user-swappable design you can easily change drives from session to session using standard IDE mechanisms. The D1600 supports the largest drives possible, so say goodbye to making backups and clearing your drive for the next project. Simply swap it!

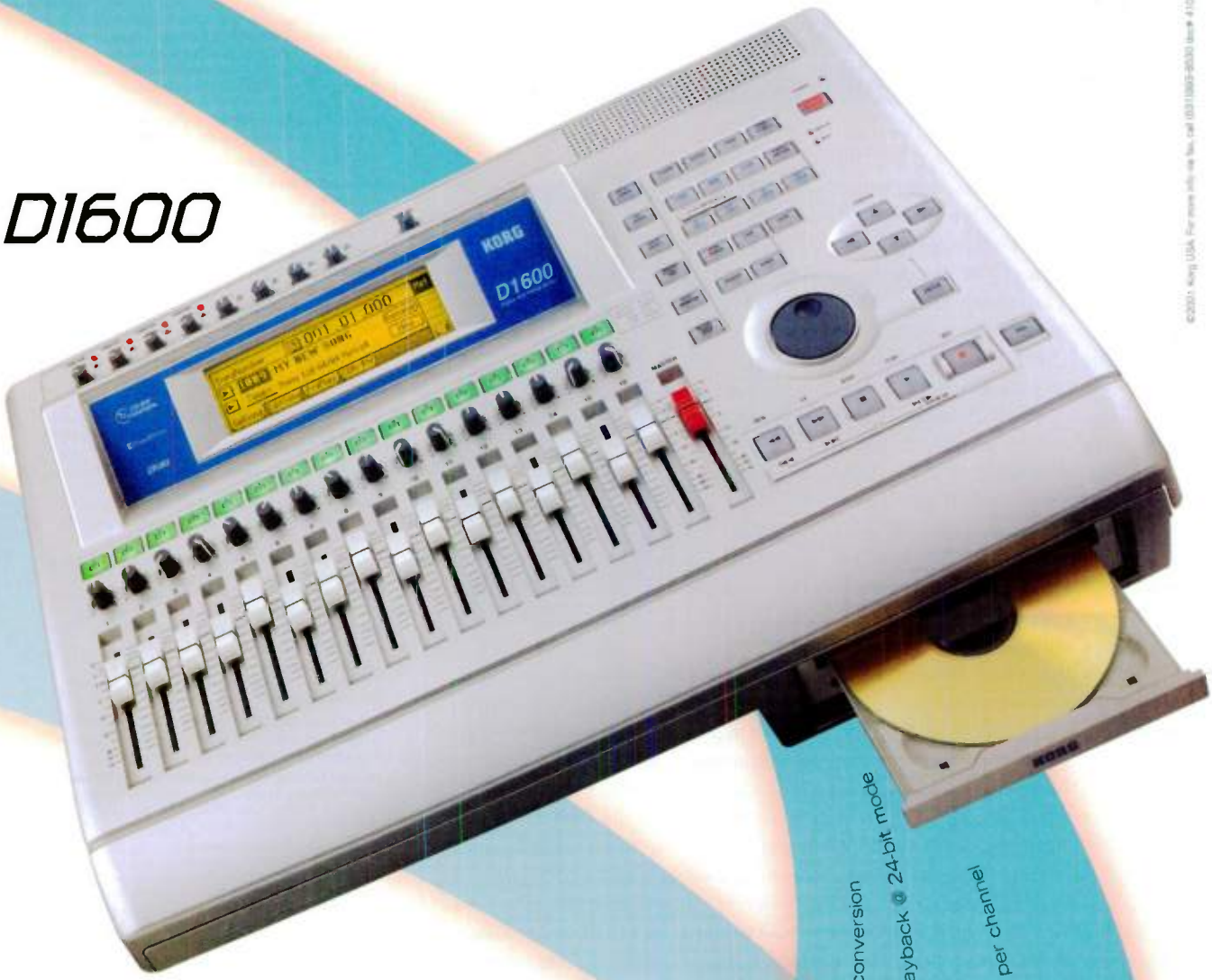
When it comes time to master or backup a project to CD you'll appreciate the D1600's internal CD-RW drive bay. (The Korg model CDRW-2 and many ATAPI-compatible devices can be used.) No cables. No additional power supplies. You can even record audio directly from the internal CD-RW drive. Try doing that with an external unit!

The effects power of the D1600 really shines when recording and mixing. Have up to eight Insert effects configured any way you like, plus two Master and one Final effect. It's like having a professional rack of high-quality effects processors with everything from reverbs and delays to compressors, limiters and EQs. Plus, our special REMS™ models of mics, guitar amps and speaker cabinets.

With its user-friendly TouchView graphic display and intuitive operating system, the D1600 is just begging to be touched. Lay your hands on it and let your creativity take over. Once you heat things up, there's no telling what you'll be able to burn.

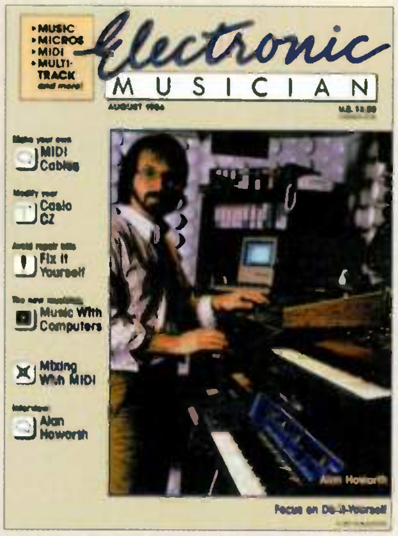
KORG

D1600



- Recording Format: 24-bit/16-bit uncompressed, 44.1 kHz
- 8 track recording/16 track playback @16-bit mode
- Total of 128 tracks (8 virtual tracks per track)
- 24 channel, 8 bus digital mixer with scene memory and MIDI automation
- Four XLR inputs w/phantom power
- 215 PCM drum rhythms
- 24 bit A/D, D/A conversion
- 4 track recording/8 track playback @ 24-bit mode
- 100 scenes/4 locate points per song
- 106 effects algorithms
- 3-band EQ per channel
- Built-in tuner
- 24-bit optical S/PDIF I/O

FIFTEEN YEARS AGO IN EM



The August 1986 issue was not bad, but it wasn't one of my favorites, and I think it had less long-term value than most. Tony Thomas's cover interview with synthesist and film-scorer Alan Howarth was short and not particularly memorable. Thomas did offer one nice question and response about the film-scoring process. The rest of the story was pretty fluffy.

The August issue featured three computer-oriented stories. Craig Anderton gave a light overview of what you could do on the computer in 1986, which mostly meant MIDI sequencing. If you missed it, well, you didn't miss much. We also presented Tim Dowty's program-it-yourself MIDI echo/delay program for the Commodore 64. In those days, digital delays were expensive, and MIDI delay offered a cheap substitute. Today, the C64 is a doorstop, digital effects processors are commonplace, and MIDI delay can be easily created in a sequencer.

The best computer story was Thomas's in-depth tour of the Yamaha CX5M music computer, which was designed entirely for music production. The development of more powerful personal computers doomed the CX5M, but for awhile, it had its fans.

We presented five hardware DIY projects in the issue. Alan Gary Campbell's collection of modifications for the Casio CZ-101 and CZ-1000 synths stands the test of time best, because a lot of people still use CZ synths. Most of the other DIYs are less useful today, except for Jack Orman's tutorial on wiring a 3-conductor MIDI cable and a MIDI cable tester. Michael Dosa showed us how to add an external sound module for the long-dead MXR Drum Computer, and Mark Kovach explained how to interface a Roland SBX-80 synchronizer to an Oberheim DMX drum machine. Thomas Figueiredo designed a remote-control A-B switch box that let guitarists switch between amp or effects channels from multiple footswitches scattered around the stage.

The most unusual article in the issue was Terry Fryer's "An Acoustic Mixer." You set up a pair of mics and one speaker and amp for each synth voice in a room selected for its sonic ambience. Then, play your tracks back in that ambient space, recording them to two tracks with the mics. I wouldn't use that approach for mixdown, but I like the idea of rerecording a single track or a 2-track mix in a nice ambient space.

We ran only three product reviews in August 1986. The Yamaha SPX 90 review was significant because the SPX 90 was one of the first affordable all-purpose multi-effects processors. Previously, most effects processors were dedicated to a single function. Kirk Austin nailed the unit's pluses and minuses: its versatility was unprecedented, the reverbs were decent but not very smooth, and the unit's 12 kHz bandwidth was fine for reverb and echo but not for compression and EQ.

Geary Yelton reviewed three sequencers for the Mac that are long gone now: Assimilation's *MIDI Composer*, Electronic Arts' *Deluxe Music Construction Set*, and Great Wave Software's *Concertware+ MIDI*. Finally, Jim Johnson evaluated Harmony Systems' SynHance M1X and M1X+ MIDI processor/mergers, which used a dedicated microprocessor to sort out and buffer the data from two MIDI sources before merging them, avoiding overloading the data stream.

—Steve Oppenheimer

Electronic Musician®

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A Legacy of Tone

Mini-Pre

Vacuum Tube Preamp

New from the company that has been redefining the standard of signal processing for 30 years, comes the **Mini-Pre Vacuum Tube Preamp.** From the 386 Tube Microphone Preamp to the 586 Dual Channel Tube Microphone Preamp, dbx has been the Professional's choice when it comes to the classic sound of tube microphone preamps.

The Mini-Pre takes the classic dbx Silver Series Tube Microphone Preamp tone and puts it in an easy-to-use, compact, affordable package. With the dbx Mini-Pre, you will no longer need to compromise tone for affordability.

From its uncompromising crystal-clear, high-bandwidth, low-noise circuitry, to its road-worthy construction, the Mini-Pre offers a feature set that includes: a hand-selected, Soviet-made premium 12AX7 vacuum tube, selectable 48 volt phantom power, balanced Neutrik™ locking XLR connectors, and balanced 1/4" connectors. The Mini-Pre has the features that you would expect, at a price that would have been unthinkable just a few years ago. Stop by your local authorized dbx Professional Products dealer, and take the Mini-Pre for a complete test drive today.

Features

- **Single-channel vacuum tube microphone preamp**
- **Hand-selected, Soviet-made premium 12AX7 vacuum tube**
- **60 dB gain and - ∞ to +10dB of output level**
- **XLR microphone input**
- **Neutrik™ Locking XLR connectors**
- **Balanced 1/4" TS line input**
- **Balanced 1/4" TRS and XLR outputs**
- **Selectable +48 volt phantom power**
- **20 dB pad**
- **Phase reverse switch**
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MIKE CRUZ

GET A LIFE

Anyone crying "discrimination" ("Letters," June 2001) from an article focusing on women in the music industry has a seriously inadequate understanding of what discrimination means and what the phrase *dominant paradigm* means. That person sounds like he has an ax (or ex) to grind. Or maybe the letter was a joke.

Keep up the good work.

Wendy DeWitt
via e-mail

MIXING IT UP

I enjoyed Neil Leonard's "Score with QuickTime 4" (January 2001) very much. I'm writing a score for an independent film, and the article pretty much straightened it out for me. But I'm curious about one thing.

What formats can be used to present the final mix to the director? I know one way is to record everything back to VHS. Would he use the audio from the VHS tape itself? Also, if I gave him a DAT or a CD, how would that lock to the edited video? He's using Adobe *Premiere* to edit the film, but that's about all I know. I want to be prepared for a variety of scenarios.

Leonard's article shed a lot of light on things, but I'm hoping to squeeze a bit more information out of him. Thanks for a great magazine.

Taggart Snyder
via e-mail

Taggart—There are several ways to submit a final mix when working with QuickTime, so it's important to work out a game plan ahead of time with the director to avoid last-minute confusion. Recording back to videotape is certainly one option, but because VHS is an analog format, transferring audio to and from the tape may degrade the sound quality more than necessary.

Because the director is working in Premiere, *you could play back the soundtrack to a small-screen 30 fps QuickTime movie and burn it to a CD-R. That would be cheap, portable, and easy to do. The director could then audition the soundtrack with the picture, extract the audio, and fly the audio into the large-format video in* Premiere.

On the other hand, if you use a bunch of external sound modules and processors, it might make sense to mix everything down to a stereo DAT or CD master. Then digitally transfer the master mix back into the computer and save the cues as AIFF files. (Label the cues logically and keep an accurate cue sheet.) The director would then have to realign each cue with the video, which shouldn't be too hard in Premiere. *If your workprint and the director's print have matching time code windows, it would be even easier to realign the cues: find the start frame for each cue using the time code numbers.—David Rubin*

HOLD THE CHEESE, PLEASE

It's rather cheesy to waste a column of type and a picture on a band that doesn't even have a music sample on its Web site ("Web Page," May 2001). I give Lavay Smith and Her Red Hot Skillet Lickers two thumbs down for their site's usefulness. Surely there are good bands out there worth mentioning that let you hear what they sound like without having to buy the CD first.

Jim King
via e-mail

Jim—There are plenty of "good bands out there worth mentioning" in "Band on the Web." However, we can only cover one per month. In choosing sites for "Band on the Web," author Peter Drescher and I look for Web pages that stand out in some way from the dozens we look at each month. A musician's site should be compelling on a number of levels.

An artist's Web site is an expression of the artist. Business-savvy musicians design their sites with promotional and commercial intentions, but many band pages we see are stronger in one area than the other. In terms of concept, looks, navigational ease, and balance of promotion and sales appeal, Smith's site was a winner. Although Smith's omission of audio samples should be addressed, a number of clever promotional items kept us at her site. For example, how many indie artists post scrapbook photos of themselves with luminaries on the level of Bill and Hillary Clinton or Johnny Otis?

Smith makes it easy to buy her CD, should you decide to do so without first hearing the music. Click on the album cover you want on the CDs page, and you are instantly transported to the correct spot on Amazon.com. We often find Web sites that actually hinder viewers' ability to make that all-important CD purchase.—Gino Robair

A MIDI WIND CAME BLOWIN' IN

Thanks for the informative article by Scott Wilkinson about wind controllers ("In Control," May 2001). I'm a full-time musician and have been a wind-controller player since Yamaha introduced the WX7 in the late 1980s. I consider the WX5 to be the best wind controller in the WX series.

"An amazing keyboard, especially for the price."

End-user review at harmony-central.com

"The S80 is a great instrument with significant advantages over other instruments in its price range – that's why we've given it the Key Buy award."

KEYBOARD

JANUARY 2000, PAGE 98

★★★★★

"All I can say is that this is the sweetest board that I've ever gone near."

End-user review at MusicianREVIEW.com

"The S80 blew me away in terms of the sound, playability and ability to integrate within my setup."

End-user review at harmony-central.com

"My overall opinion: sell some blood to buy it!"

End-user review at harmony-central.com

"Start playing the luscious Yamaha S700 grand piano sample...and you know you're in the presence of greatness."

"As a controller, the S80 is in a very select class."

Electronic Musician

APRIL 2000, PAGE 150

"The weighted keys feel great."

End-user review at MusicianREVIEW.com

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YAMAHA S SERIES

Although the article was well written, I disagree with a couple of points. First, when Wilkinson compares the Loose Lip mode and the Tight Lip mode, he says, "This [Tight Lip] mode more closely resembles sax technique, but it's difficult to maintain a steady pitch." The Tight Lip mode does more closely resemble sax technique, but anyone with adequate sax or clarinet technique will have no trouble maintaining steady pitch in the Tight Lip mode. Yamaha added an adjustable flat spot in the response curve at zero Pitch Bend of the reed to help novices keep a steady pitch, even if their lips waver.

Second, Wilkinson mentions glitching between notes. If the WX5 player has adequate woodwind technique, audible glitching will not be a problem. The glitches are there, but their durations are too short to trigger a note in my sound modules (Yamaha VL70-m, Yamaha TX81Z, and Peavey SP).

I can record my WX5 in a sequencer and see the glitches on the Piano Roll editor. Setting the sequencer to 240 ticks per quarter note and 140 bpm, the glitches are less than ten clock ticks. At ten clock ticks, they are only a few milliseconds. That's shorter than the response time of most synths. Even if they triggered the synth, they'd be too short to be detected by the human ear.

Wilkinson recommends using Slow mode to correct glitching, and he says that it feels more like an acoustic instrument and doesn't seem to impede playing speed. That's bad advice. Slow mode should not be used. It makes fast passages impossible and the response feel sluggish. I can understand why he missed those points—they would get by anyone who doesn't own the WX5.

Setting up the WX5 properly can be a bit confusing. As a contributing member of the International Wind Synths Association and the Windlist, I created a Web page explaining how to set up a WX5. The free instructions are the result of my longtime familiarity with the WX controllers. WX5 owners can go to http://www.nortonmusic.com/wx5.html to find out how to get the most out of the WX5.

Not long ago, the members of the Windlist voted on our favorite freeware patches for the VL70-m. Those patches sound better than or complement the factory patches. They can be downloaded from http://www.nortonmusic.com/VL70-m.html.

Thanks again for writing about my favorite instrument.

Bob Norton
via e-mail

Bob—Contrary to your assumption, I own all Yamaha WX models, and I wrote the review of the WX5 in the June 1999 issue. The wind-controllers article was not intended to be a review but rather an overview of the available instruments, so I suppose I should not have ventured opinions about which modes work better. I admit that I'm not a sax player per se; I do play recorder and other woodwindlike instruments professionally, but I do not have a well-developed sax embouchure, so I prefer Loose Lip mode on the WX5. I can see how Tight Lip mode would work better for a real sax player, though the Pitch Bend range in each direction is less than it is in Loose Lip mode (albeit in only one direction).

As far as the fingering mode is concerned, skillful technique can overcome much glitching, but it also depends on the patch you're playing. Sounds with very quick attacks, such as piano and percussion, can audibly glitch no matter how accurate you are, especially during fast passages. Maybe I haven't found it necessary to play as fast as you have, but I find Slow mode to be plenty responsive for what I play, and it significantly reduces glitching.—Scott Wilkinson

WE WELCOME YOUR FEEDBACK.

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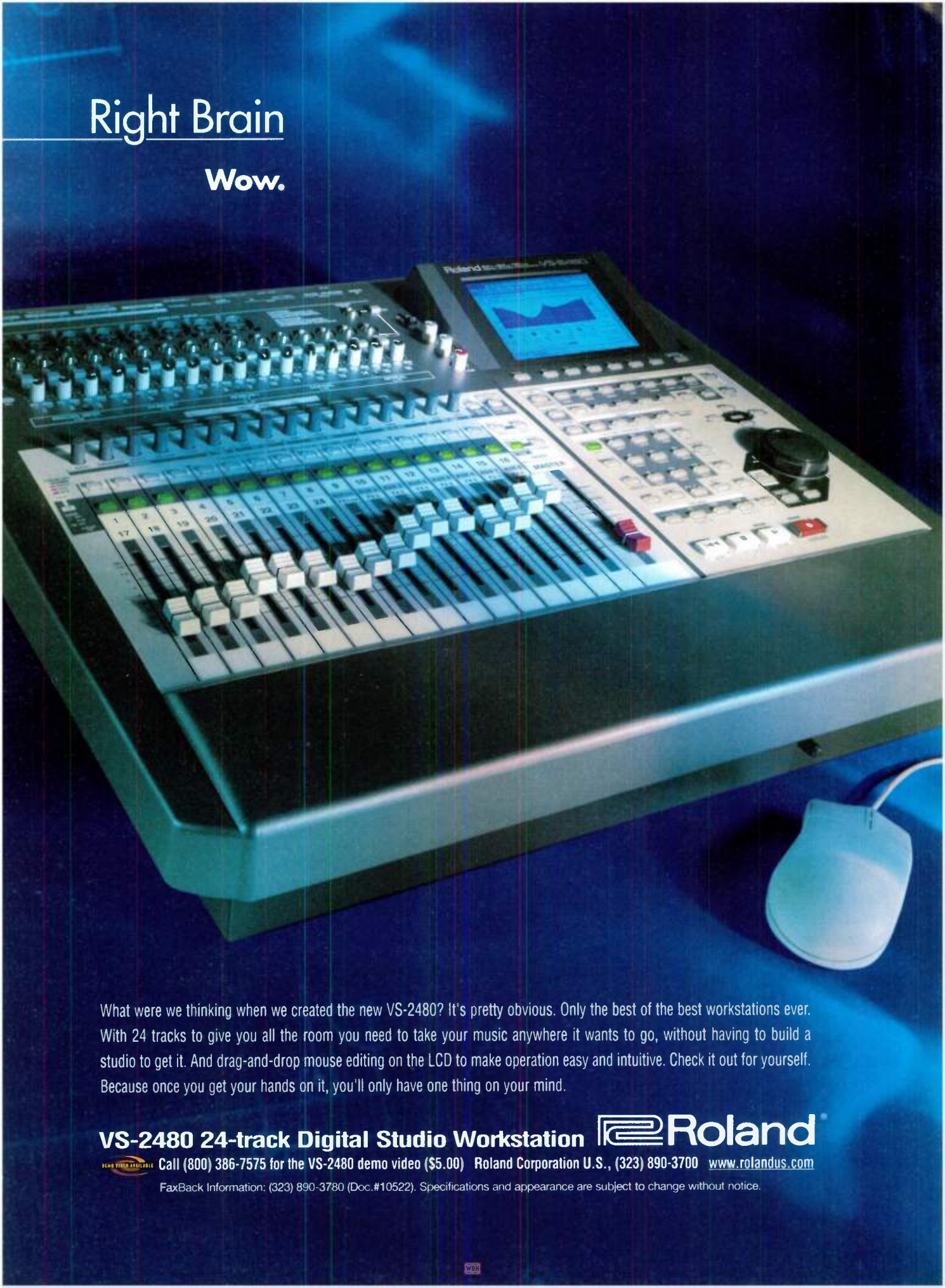

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WHAT'S NEW

By Marty Cutler

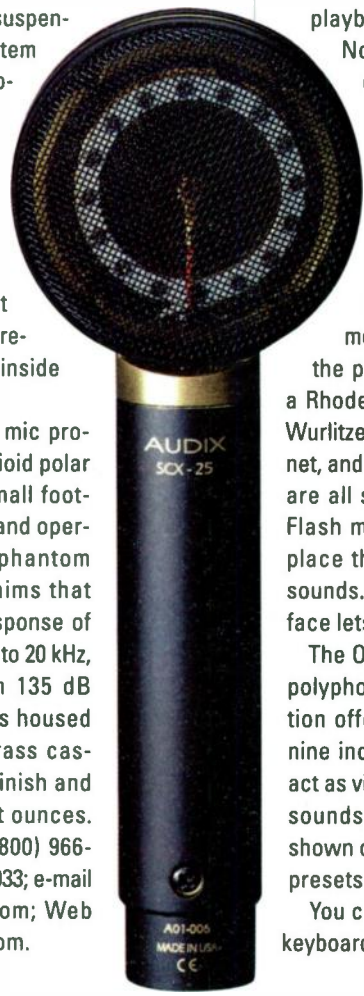
RADIAL JD7 INJECTOR

A guitarist's rig could easily consist of four different guitars, a multi-effects processor, a slew of stompboxes, and a couple of amps. The Radial JD7 Injector ($700) is a 1U distribution amplifier that lets you route guitars to seven simultaneous signal paths without changing the quality of the original signal.

Inputs A and B feature two ¼-inch unbalanced, high-impedance input jacks. Input B provides an 8 dB pad. The unit includes seven ¼-inch unbalanced outputs: outputs one and seven are direct, and the other five have Jensen transformers, ensuring minimal phase and amplitude distortion. The fifth and sixth outputs offer selectable effects loops. You receive a balanced XLR input with gain control, and an isolated balanced XLR output. CableTek Electronics (Radial Engineering); tel. (604) 942-1001; e-mail info@cabletek.com.

AUDIX SCX25

The Audix's SCX25 condenser microphone ($799) features a capsule that has a 25 mm gold-sputtered diaphragm and a suspension mounting system that guarantees isolation from electronic as well as housing components. That setup eliminates the necessity for an external shock-mount clip and minimizes reflective surfaces inside of the mic as well.



The condenser mic provides a wide cardioid polar pattern with a small footprint (5.5 inches) and operates on 48V of phantom power. Audix claims that the frequency response of the SCX25 is 20 Hz to 20 kHz, with a maximum 135 dB SPL. The SCX25 is housed in a machined brass casing with a black finish and weighs only eight ounces. Audix USA; tel. (800) 966-8261 or (503) 682-6933; e-mail info@audixusa.com; Web www.audixusa.com.

NORD ELECTRO

You won't find filter-swept pads or square-wave lead sounds here; the Nord Electro concentrates on electromechanical keyboards of years past. The 61- and 73-key instruments ($2,199 and $2,399, respectively) combine sample playback with physical modeling that Nord says accurately reproduces electromechanical artifacts in vintage keyboards.

The Nord Electro models the Hammond B-3's chorus and vibrato scanner as well as its built-in preamp's frequency characteristics. However, the Electro has more than organ emulations; the pianos include samples of a Rhodes Mark II Stage Piano, a Wurlitzer 200A, a Hohner D6 Clavinet, and a Yamaha CP-80. Samples are all stored in battery-backed Flash memory, and you can replace the instruments with new sounds. The Electro's USB interface lets you download sounds quickly.

The Organ section gives you 112-note polyphony, and the Electric Piano section offers 24-note polyphony. You get nine increment/decrement buttons that act as virtual drawbars for shaping organ sounds; adjustments are immediately shown on the LED display. Nine drawbar presets are stored in ROM.

You can set up the organ sounds with keyboard splits, which arrange two drawbar settings across the keyboard. Dual Manual mode lets you play a second drawbar setting on a separate MIDI channel from an external keyboard.

Organ effects include Swell (a characteristic B-3 volume pedal simulation), organ percussion effects, and chorus and vibrato. The Organ section shares global effects with the pianos: overdrive, rotary speaker simulation, EQ, chorus, phase, flange, wah, and pan.

The Nord Electro has 64 memory locations for storing user settings, in addition to a velocity-sensitive keyboard with semiweighted action. Audio outputs are on two ¼-inch unbalanced connectors and a ¼-inch stereo headphone jack. You get an expression pedal jack, a sustain pedal input, and a jack for an optional switch to control a rotary speaker. MIDI In, Out, and Thru jacks are also included. Armadillo Enterprises; tel. (727) 519-9669; e-mail info@armadilloent.com; Web www.armadilloent.com.

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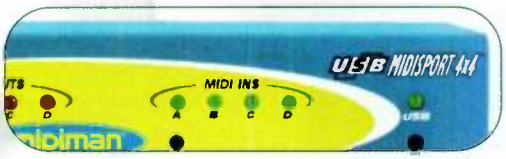
USB MIDISPORT 1x1 - 1 in/ 1 out MIDI interface.

DELTA 1010 - 10 in/ 10 out PCI digital recording system.



USB MIDISPORT 4x4 - 4 in/ 4 out MIDI interface.

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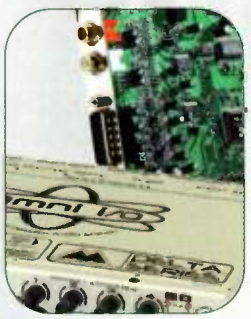

Omni Studio - 24bit/96kHz integrated desktop audio station

USB MIDISPORT 2x2 - 2 in/ 2 out MIDI interface.

Logic Delta - A powerful 24bit/96kHz audio & MIDI program optimized for and included with the Delta 1010, 66, 44, and OMNI Studio.

USB MIDISPORT 8x8/s - 8 in/ 8 out MIDI interface with SMPTE.

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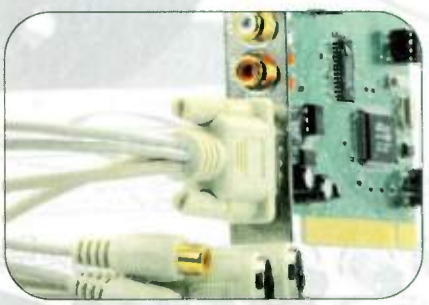
How does it sound? Well, in a word, stunning. This has to be one of the best sounding cards we've had in for review for some time."

Computer Music



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GET SMART ▲▲▲▲

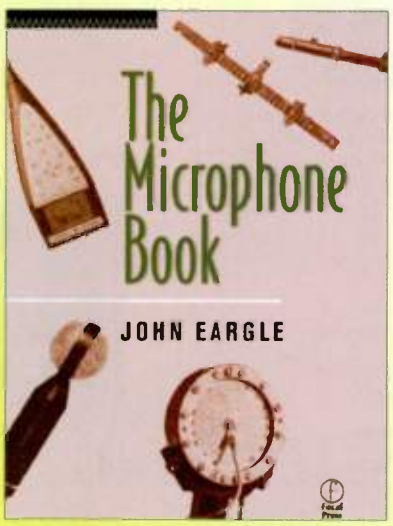
▼ FOCAL PRESS

John Eargle's *The Microphone Book* ($39.95) is a guide to recent developments in mic technology, application, and technique. It has detailed chapters devoted to mic types, including pressure and pressure-gradient mics, directional and high-directionality mics, and wireless technology.

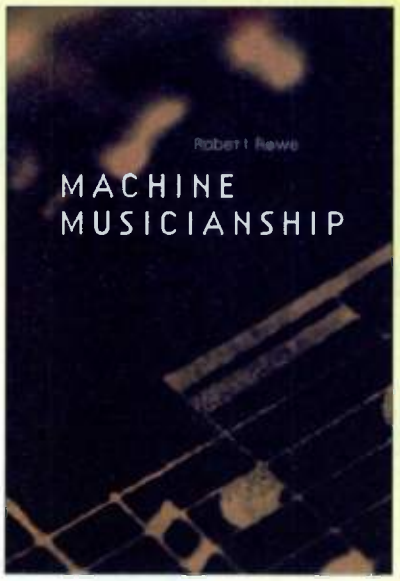
Several chapters cover applications based on studio and news-gathering recording sessions. Other chapters describe performer and mic positioning, arrays, stereo-sound staging, perspective, and balance.

The book delves into a short history of the mic, basic sound transmission and operational forces, classical recording techniques, speech and music reinforcement, and care and maintenance.

Modern Recording Techniques, 5th ed., by David Miles Huber and Robert A. Runstein is an update to their acclaimed manual for aspiring professional recordists. Huber and Runstein cover the latest industry changes and trends, including surround sound and DVD production. Topics include sound and hearing, studio acoustics, analog- and digital-audio technology, synchronization, monitors, and streaming audio.



The authors' Web site contains such ancillary material as examples, demonstrations, updates, user manuals, and a discussion group. Focal Press (Butterworth Heinemann); tel. (781) 904-2500; e-mail marketing@focalpress.com; Web www.focalpress.com.



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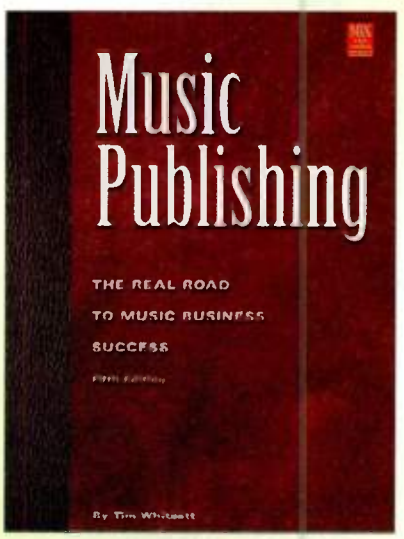
Machine Musicianship is more than a tutorial in writing code for musical applications; it explores fundamental concepts of musical analysis, performance, and composition, and integrates music theory with computer music, musical cognition, and artificial intelligence. The book offers examples given in C++ and Max. You get a CD-ROM with working versions of the examples, source code, and a hypertext document linking code to musical functionality.

Machine Musicianship investigates the technology behind using a computer to process performance data, such as segmentation, pattern-processing, and interactive improvisation. The book shows how the applications can be used for performing interactive compositions and designing interactive Web sites. MIT Press; tel. (617) 253-5646; e-mail mitpress-orders@mit.edu; Web http://mitpress.mit.edu.

▼ ARTISTPRO.COM

If you're interested in starting a music publishing company, the fifth edition of Tim Whitsett's *Music Publishing,* published by Artistpro.com ($49.95), may be just what you need. Whitsett begins with reasons to start a company and then demystifies the process by defining and drawing distinctions between music and other types of publishing. The chapter about starting your company includes choosing a name; finding office facilities, equipment, and furniture and whether to lease, buy, or rent; finding insurance; and how to raise money to cover startup expenses.

The book discusses songwriter contracts, copublishing, and licensing songs for advertising. The appendix contains a list of consumer and mechanical-rights associations, online databases, helpful books, and contact information for performing-rights societies and overseas licensing associations. Hal Leonard Corp. (distributor); tel. (414) 774-3630; Web www.artistpro.com.



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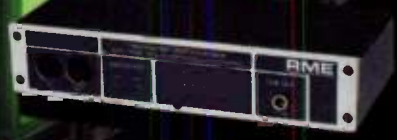

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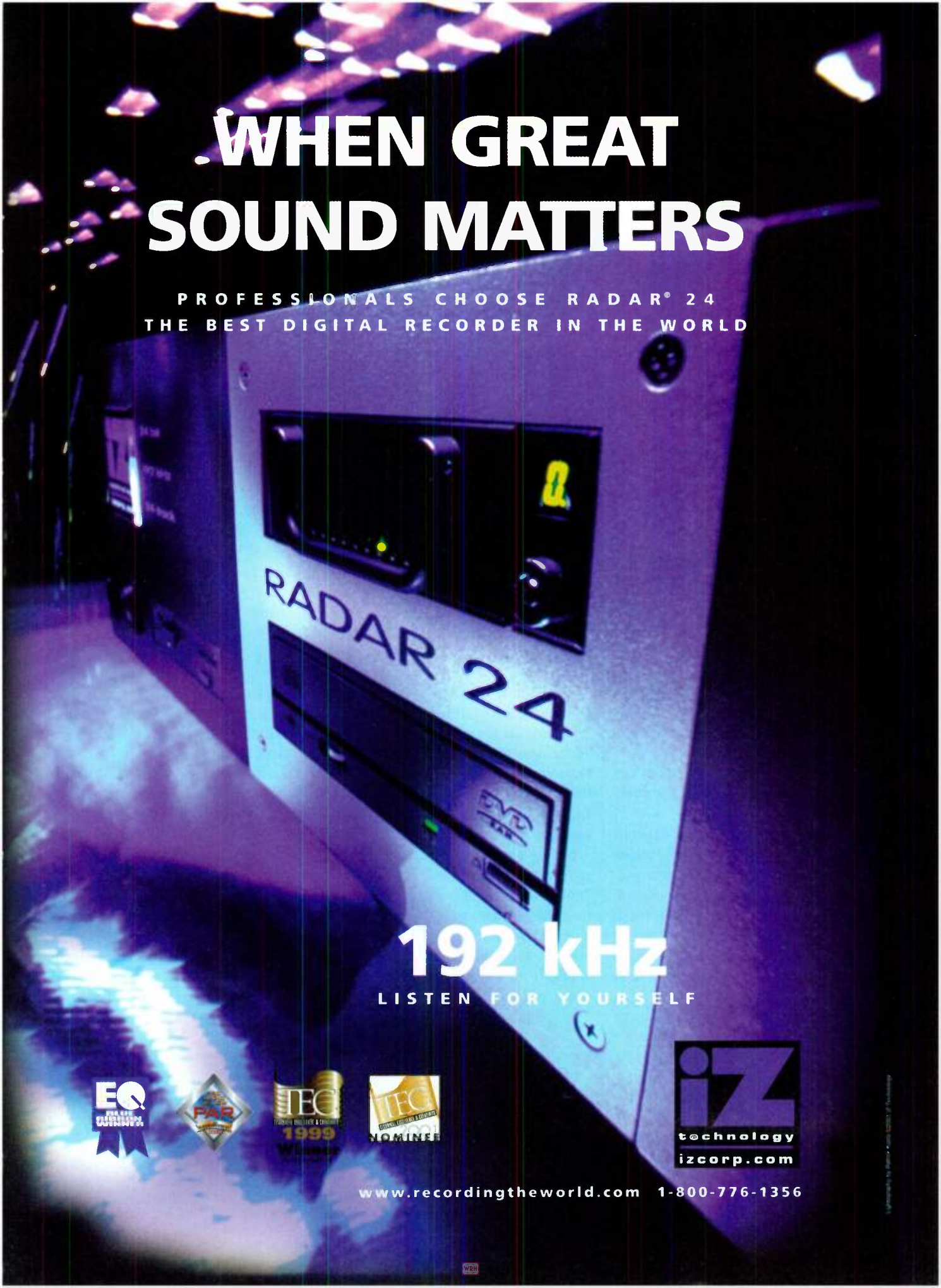
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▼ TERRASONDE AUDIO TOOLBOX PLUS

The Audio Toolbox Plus from TerraSonde ($1,699) combines a wealth of audio testing and analysis utilities with computer connectivity. The Audio Toolbox Plus boasts more than 20 tools in a single device.

Among the utilities gathered in the Audio Toolbox Plus are a ½-octave real-time analyzer, an ANSI sound-level meter, a noise-criteria meter, and a utility for measuring reverb time (RT60). You also get test functions, including a sweep-signal generator with pink and white noise, a decibel level meter, and a digital sample scope with X/Y phase capability. The Audio Toolbox Plus even provides a time code reader/generator that supports all frame rates and formats. You can also compute offset times and detect frame-rate drifts

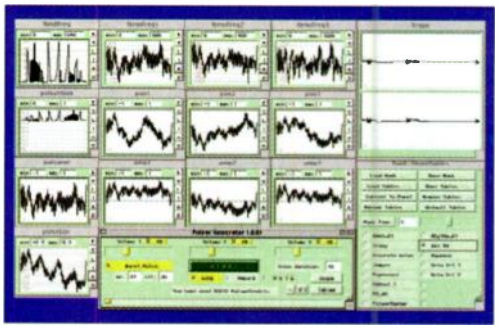
to 0.001 fps resolution. Other utilities can be employed for testing cables and phantom power.

Upgrades and additional applications are easily loaded into the Audio Toolbox Plus, and the 40 nonvolatile memory locations can be used to store measurements. The package includes a set of software applications that are geared toward sound contractors who specialize in corporate, church, arena, or theater venues.

The unit provides a backlit, graphical LCD, a detachable microphone, and a built-in rechargeable battery. All functions are controlled with a single rotary encoder. Inputs and outputs include balanced ¼-inch, XLR, RCA, and BNC connectors. Interface cables for PCs and Macs are also included. TerraSonde; tel. (888) 433-2821 or (303) 545-5848; Web www.terrasonde.com.

▶ CREATE PULSARGENERATOR

The Center for Research in Electronic Art Technology (CREATE) at the University of California at Santa Barbara has released Alberto de Campo and Curtis Roads's *PulsarGenerator* ($49), a software synthesizer for Macintosh OS. The synth is named for the sound generation technique, Pulsar Synthesis, which can generate streams of sonic particles. However, you can also import samples or extract envelopes from waveforms for a variety of timbres. The application is also capable of producing analog-like timbres.



PulsarGenerator can produce rhythmic or sustained sounds that change radically over time. The synth offers three resonant peaks for each *PulsarGenerator Train*. Each Train, or oscillator, has independent frequency and pan parameters and can be ring-modulated, mixed, or muted with any sound file as a second source. You can also crossfade in real time between wavetable sets. You can control and edit synthesis parameters in real time, and many editing commands can be accomplished with a single keystroke. As you alter sounds, you can record directly to disk. A meter at the top of the screen informs you of the application's CPU load, and you can set limits for processor usage.

To run *PulsarGenerator*, you need at least a PPC 604e/200 MHz running OS 8.5.1 and 25 MB of free RAM. Center for Research in Electronic Art Technology (CREATE); tel. (805) 893-2932; e-mail info-pg@create.ucsb.edu; Web www.create.ucsb.edu.

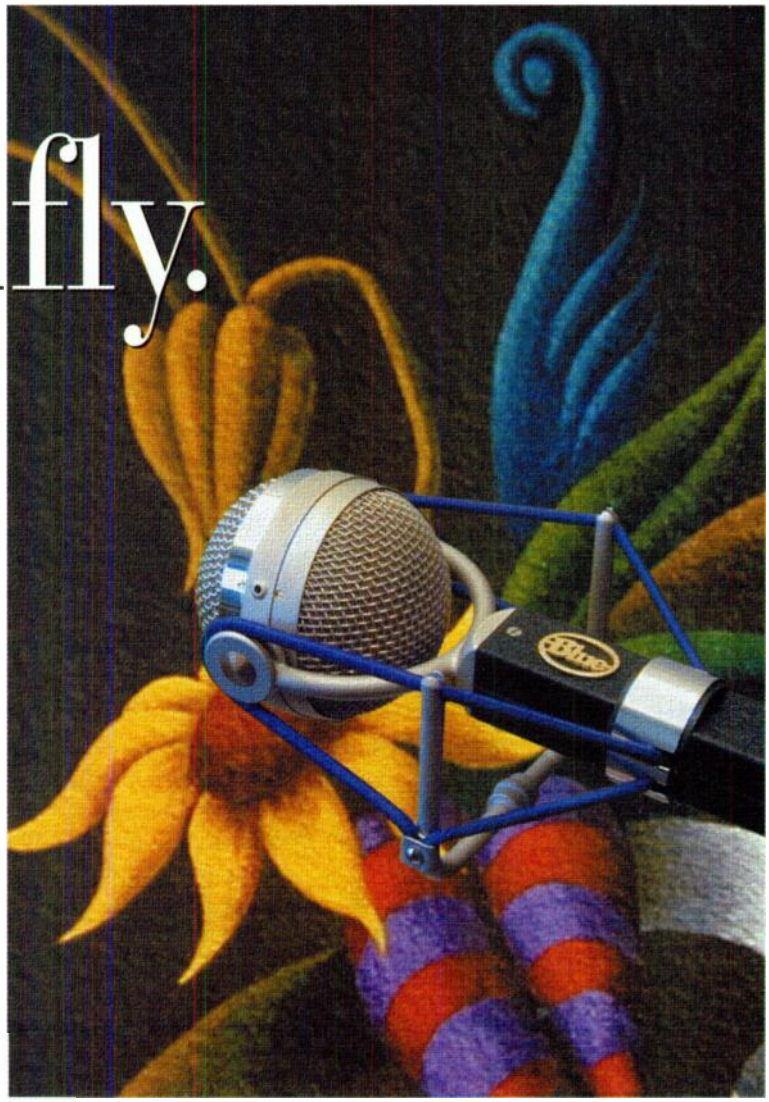
▼ RED SOUND ELEVATA

The sound generator of the Elevata ($995) analog modeling synthesizer, so named for its ability to angle the front panel, is based on Red Sound's Darkstar synth. However, Elevata offers an improved feature set, more outputs, and more controls.

Elevata gives you 16-note polyphony with as many as eight multitimbral parts. The Sound Wizard feature generates random parameters for filters, envelopes, LFOs, and more. Elevata offers two four-stage envelopes per voice, assignable to waveform, pitch, pulse width, oscillator mix, ring modulation, filter frequency, and resonance. Waveforms include square, sawtooth, sine, and formant waves with pronounced peaks. You also get an assignable joystick for modulation.

The unit provides a pair of ¼-inch unbalanced inputs for processing external sounds through the synthesizer engine. The synth also provides an expansion slot for additional boards; as many as three additional software applications can be loaded for other synthesis types, drum sounds, and vocoding. Six assignable outputs on ¼-inch unbalanced jacks, and MIDI In, Out, and Thru complete the scene. E-mu–Ensoniq (distributor); tel. (831) 438-1921; e-mail sharon@redsound.com; Web www.redsound.com.

Year of the Dragonfly.



Fast, maneuverable and beautifully engineered, the BLUE Dragonfly employs an innovative design that offers fine tuning and precise placement to please the most discerning recordist, combined with an ease of use that is without equal among contemporary microphones—and at a price that's considerably less than anything in its class. The Dragonfly is a unique pressure-gradient cardioid condenser microphone, employing the BLUE hand-built single-membrane large diaphragm capsule coated with a 6-micron mylar film of pure gold and aluminum. Enclosed within a rotating spherical grille, the capsule can be positioned and adjusted in the smallest spaces. Complete with an integrated elastic shockmount, the microphone's electronics are based on a class A discrete circuit, with a transformerless output. Its neutral sonic character gives flight to everything from vocal to percussion, electric guitar and bass, as well as more "difficult" sources such as saxophones and stringed instruments. Oh, and did we mention that among its rave reviews, the Dragonfly is one of *Electronic Musician's* 2001 Editor's Choice award-winners?

Matched sets of Dragonflies can be purchased exclusively from BLUE. This limited edition set is uniquely colored in deep green lacquer with gold accent trim and housed in handmade cherrywood boxes. Contact BLUE for more information.

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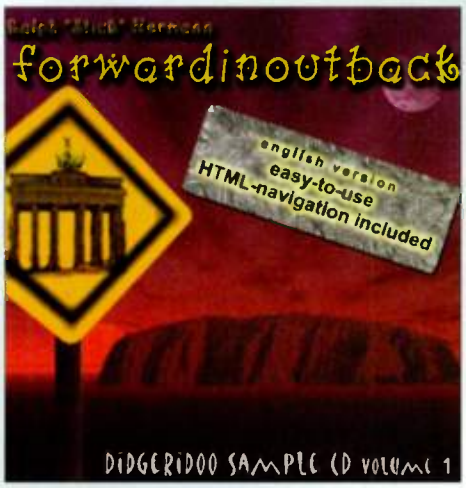
SOUND ADVICE ▲▲▲▲



▲ FORWARDINOUTBACK

The *Didgeridoo Sample CD*, vol. 1 ($49; CD-ROM), is a collection of processed and natural didgeridoo samples played on a variety of homemade instruments in 16-bit, 44.1 kHz WAV format. Many samples are set up as loops and arranged by bpm.

The collection has individual short and long sounds as well as drones as long as six minutes. Loops are from one to eight measures long with time signatures ranging from 2/4 to 11/8. Samples are processed with reverb, pitch shifting, flanging, and more. The instruments were built by Ralph "Stick" Hermann from metal and a variety of woods, including birch, spruce, and bamboo. Forwardinoutback; tel. 49-30-455-8432; e-mail feedback@didgeridoo-samples.de; Web www.didgeridoo-samples.com.

WIZOO

Three new banks of sounds for three different synthesizers are available for download from Wizoo's Web site. Synthesizer programmer Peter Krischker programmed all three of these sound collections.

Magic Synth ($27.95) gathers 128 patches for the Access Virus Indigo and focuses on fat analog sounds. The programs make extensive use of the Indigo's new features.

Synth Basics ($15.95) offers a variety of polyphonic, analog-style patches for Yamaha's CS-series and S-series synthesizers. The collection features 64 patches, including pads, leads, basses, filter-sweeps, and atmospheric sounds.

Electrix ($15.95) provides sounds for Native Instruments *Pro-52* and *Pro-5* software synthesizers. The sounds are targeted at trance, electronica, and ambient styles. You get 64 patches and 32 sequences demonstrating the sounds. Wizoo GmbH; tel. 49-421-701870; e-mail info@wizoo.com; Web www.wizoo.com.

KID NEPRO

Triton vol. 8–Analog Heaven ($25) combines the Korg Triton ROM waveforms with samples from the Triton Vintage Archives PCM expansion board to provide a grab bag of synthesizer sounds. The company describes the collection as a hybrid of classic synthesizers with soundtrack textures.

Triton vol. 8–Analog Heaven's 128 programs and combinations include Mellotron-style choir and string sounds, vocoder patches, and special effects that take advantage of the Triton's dual arpeggiators and effects processors. Kid Nepro; tel. (246) 420-4504; e-mail kidnepro@aol.com; Web www.kidnepro.com.

▶ DISCRETE DRUMS.COM

Rick DiFonzo and a crew of legendary engineers with credits ranging all the way from ZZ Top to John Lennon, have recorded a collection of drum samples that is designed for composers, producers, and home recordists. *Discrete Drums* ($299) is a 24-bit, 44.1 kHz collection of 12 CD-ROMs in AIFF, WAV, and audio file formats.

Nine CD-ROMs feature full performances in song form, consisting of intros, verses, choruses, B verses, breakdowns, fills, and endings. Instead of just stereo files, the performances contain isolated kick, snare, tom, and room ambience, as well as stereo overhead recordings. That allows you to individually process and customize the performances to suit your needs. Also, you can mix and match eight tracks of drum sounds to taste.

One CD-ROM offers AIFF-format samples of every drum and cymbal used in the recording. Each sample is offered in 16- and 24-bit resolution, in dry and ambient versions. Two audio CDs for auditioning performances round out the collection and include the individual drum hits. The drummer captured on the sampling sessions was Greg Morrow, who has recorded with a variety of well-known artists including .38 Special, Bad Company, the Dixie Chicks, and Amy Grant.

Discrete Drums LE ($179), which includes three 16-bit CD-ROMs and an audio CD, is also available. Discrete Drums.com; tel. (800) 387-5720; Web www.discretedrums.com.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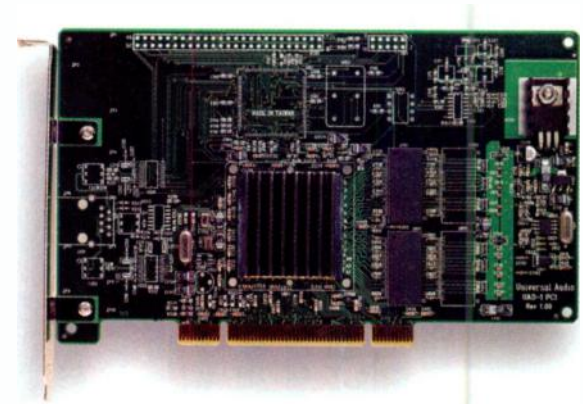
UNIVERSAL AUDIO POWERED PLUG-INS

Even as computer processing power increases, the demands of digital signal processing (DSP) plug-ins rise proportionately, and host-based processing can easily take its toll on your computer's workload. Universal Audio's Powered Plug-Ins package ($995) bundles several high-quality plug-ins and a dedicated DSP card to handle the requisite processing power without increasing the host's processing overhead. That frees the computer's CPU and lets you use more tracks, mix automation, and native plug-ins.

The UAD-1 is a PCI card endowed with a proprietary DSP chip that the manufacturers claim offers 10 to 15 times the horsepower of a Motorola 56,000-series or SHARC DSP chip. Universal Audio is guarded about its chip specifications but claims the chip has greater than 32-bit floating-point processing. That enables the UAD-1 to sustain as many as eight *RealVerb Pro* plug-ins, or 32 EQs, 11 compressors, and 3 *RealVerb Pro* plug-ins simultaneously without draining the host CPU. Additionally, the plug-ins can be controlled in real time without zipper noise or other artifacts. Plug-ins used with the UAD-1 can run alongside native plug-ins without conflicts.



The initial release of Powered Plug-ins supports Windows VST host applications only; Universal Audio promises a release for Mac OS in the third quarter of this year with support for VST and MAS (Mark of the Unicorn audio systems) plug-ins. Plug-ins bundled with the UAD-1 include Kind of Loud's VST versions of *RealVerb Pro*, the *Vintage Compressor 1176LN* and *Teletronix LA-2A*, and the *CS-1 Channel Strip*.

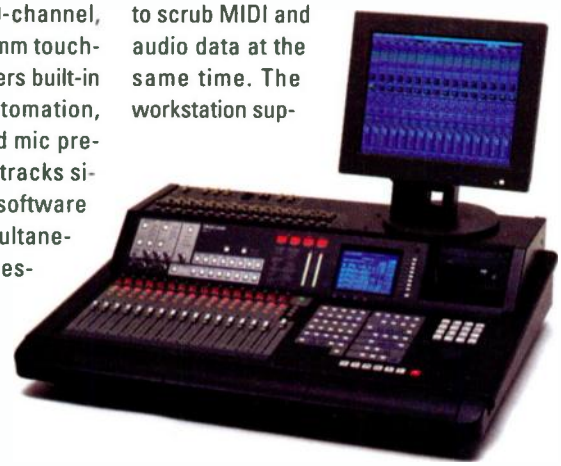
You can run the Powered Plug-ins on any Pentium-based computer with 128 MB RAM and a spare PCI slot; however, you will need Windows 95/98 or ME. Support for Windows 2000 is expected soon. You will also need a VST host application, such as Steinberg's *Cubase VST*, *Nuendo*, or Emagic *Logic Audio*. Kind of Loud Technologies/Universal Audio; tel. (831) 466-3737; e-mail info@uadio.com; Web www.poweredplugins.com; www.uaudio.com.

TASCAM SX-1

Following the trend toward putting greater functionality into ever-smaller spaces, Tascam packs 16 channels of 24-bit, 48-kHz digital audio, high-resolution MIDI sequencing, plug-in support, surround mixing, and CD mastering into the SX-1 ($8,999). The SX-1 is an integrated workstation that includes a 40-channel, 8-bus mixing console with 100 mm touch-sensitive faders. The system offers built-in scene-based and dynamic automation, as well as 16 phantom powered mic preamps. You can record on all 16 tracks simultaneously. Tascam says a software update, which will let you simultaneously record eight tracks at a resolution of 24 bits and 96 kHz, will be available soon.

The SX-1 records to an internal 40 GB IDE hard disk. You can add IDE drives from a front-panel slot or attach SCSI devices to the rear-panel interface. You can use the built-in CD-RW drive to print surround or stereo mixes, back up data, or import audio from CD. You can also author MP3 files and burn them to CD. An onboard LCD comes standard with the SX-1, providing editing and automation information. An XVGA monitor output is also included, giving you the option of adding a second monitor.

The recorder supports sample-accurate waveform viewing, MIDI, and automation viewing and editing. The Jog/Shuttle wheel allows you to scrub MIDI and audio data at the same time. The workstation supports digital-audio plug-ins; it also incorporates built-in effects from TC Works, Antares, and Tascam. You can add additional plug-ins as needed.



The MIDI sequencer and automation editing are sample accurate. The SX-1 gives you 128 multichannel tracks for MIDI sequencing with 64 MIDI-channel output. You can edit MIDI and audio tracks during playback. The sequencer provides step- and real-time sequencing. Each of the 64 MIDI channels can be mapped to channel strips with knobs and faders assigned to output your choice of MIDI messages. In addition, you can cascade the SX-1 with Tascam's DM-24 mixing console to add input channels and additional control.

The SX-1 offers a generous variety of inputs: 16 balanced XLR jacks; 16 ¼-inch balanced line inputs with TRS inserts on each analog input; eight channels of ADAT digital I/O; two S/PDIF input and output jacks; BNC connectors for word-clock I/O, two MIDI In jacks, and four MIDI Out jacks; one SCSI and two USB ports; and an Ethernet jack You also get video and Sony 9-pin connectors. Analog outputs are three pairs of balanced ¼-inch, XLR, and RCA speaker outputs, and two ¼-inch headphone jacks. The SX-1 offers three expansion slots for expanding analog and digital I/O. Tascam; tel. (323) 726-0303; Web www.tascam.com. ●

By Scott Wilkinson

Supreme Being

Restoring audio data discarded during MP3 encoding.

Unless you live in a cave (which is unlikely if you're an electronic musician), you know that MP3 data compression has revolutionized online music distribution. Short for MPEG-1 Layer III, MP3 can encode 16-bit digital-audio files at sampling rates of 32, 44.1, or 48 kHz and output a bitstream ranging in bandwidth from 32 to 320 Kbps, which represents a compression ratio of as much as 48:1. On the Internet, stereo music files are typically encoded with a final bandwidth of 128 Kbps, which represents a compression ratio of 11:1 for CD audio.

Like most lossy audio data-compression schemes, MP3 uses a process called *perceptual audio coding*, in which the audio signal is analyzed according to a psychoacoustical model to determine which frequencies are not perceptible to the human ear. Those frequencies are then discarded, which greatly reduces the storage and bandwidth requirements. MP3 primarily discards the frequencies above 16 kHz because most human adults can't hear much in that range.

However, even though frequencies above 16 kHz are mostly imperceptible, listeners often sense that something is missing when those frequencies are absent. They describe a lack of depth or presence in the sound. As a result, many find the audio quality of MP3 files unsatisfactory compared with uncompressed CDs.

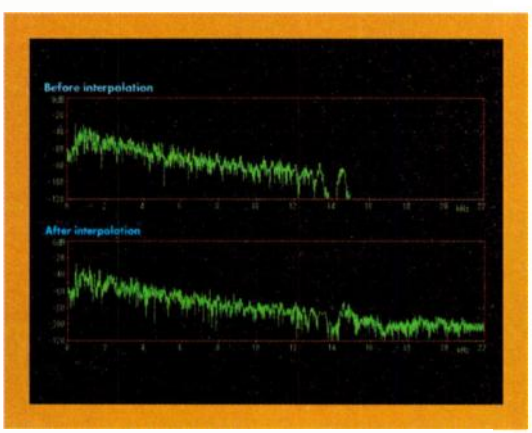
To address the problem, consumer-electronics giant Kenwood developed Supreme, a technology that allegedly restores the high frequencies lost during MP3 encoding. Supreme analyzes a bitstream that was decoded from MP3 to PCM and interpolates the missing high-frequency information in real time based on the signal's spectrum (see Fig. 1).

The Supreme Core, the algorithm that performs the interpolation, requires a stereo 16-bit datastream at a sampling rate of 44.1 kHz, so a sample-rate converter might be needed before the input stage. The amount of interpolation is variable and can be optimized for different music sources. Many experiments have demonstrated that the correlation between the original and interpolated frequencies is strong, indicating that the synthesized data closely matches the original, discarded harmonics.

Supreme is not limited to MP3 audio; it can be applied to stereo codecs such as Advanced Audio Coding (AAC, which is part of MPEG-2), Adaptive Transform Acoustic Coding (ATRAC, which is part of the MiniDisc format), and Windows Media Audio (WMA). A Windows-based dynamic link library (DLL) is also available, making it easy to implement Supreme in software on a minimum system consisting of an MMX Pentium/233 MHz with 32 MB of RAM and a 16-bit sound card running Windows 95, 98, or ME (but not Windows NT or 2000). The algorithm can also be embedded in firmware on a variety of digital-signal processing (DSP) chips.

The technology has many potential applications. In addition to implementing Supreme on a computer for music downloading and streaming, the most obvious example is incorporating it into an MP3 player with a DSP chip. It is already being used in two products available in Japan: TDK's *MP3 Audio Magic* encoding and decoding software and Sotec's Afina AV computer. Other possible applications include digital television, wireless handheld devices (such as cell phones and personal digital assistants), and Internet and satellite radio, all of which compress audio with lossy codecs.

The ability to recover data discarded during the encoding process holds considerable appeal for the Internet generation, which has so far endured an inevitable loss of audio quality in exchange for significantly lower bandwidth and storage requirements. If Kenwood can bring Supreme to the market for a reasonable price, it seems destined to become a ubiquitous part of the online-music landscape. ❦



COURTESY KENWOOD

FIG. 1: Kenwood's Supreme technology restores audio information discarded during lossy encoding by interpolation.

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WEB PAGE

By Gino Robair

WEB SITE OF THE MONTH

Of the many sites dedicated to modular analog synthesizers, one of the best is Roger Luther's Moog Archives (www.moogarchives.com). Launched in March 2000, the Moog Archives offer an extensive menu of Moogiana.

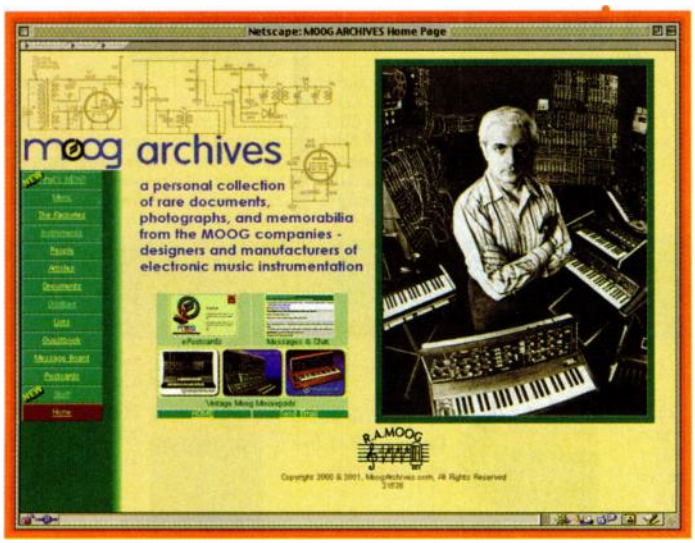
Luther, who traces his interest in synthesis back to his first experience with a Moog modular system in college, became an employee of R. A. Moog and stayed with the company through the various ownerships and name changes. During that time, Luther collected the items that make up his online resource.

As you would expect, the Moog Archives include photos of the major Moog instruments. However, you can also take a photographic tour of three Moog factories, learn about the people behind the scenes, and see one-of-a-kind instruments that are rarely covered elsewhere. For example, the site offers a photo of a Minimoog built into a Hammond XTP organ, shots of a large custom modular-Moog cabinet being built, and oddities such as the portable potentiometers called Port-a-Pots.

The Lists page includes a reference chart of celebrities who purchased Minimoogs and modular systems and the dates of their purchases. Would you have guessed that Micky Dolenz of the Monkees bought a Model III before the Stones, the Byrds, Hendrix, or the Beatles?

The Documents pages feature ads, the patent for the Filter Ladder, and technical drawings of early synth components. Two reprinted articles that are particularly interesting are Robert Moog's January 1954 piece about building a theremin, from *Radio and Television News,* and the historic "Voltage-Controlled Electronic Music Modules," which first appeared in the July 1965 issue of the *Journal of the Audio Engineering Society.*

Other treats include the RealMedia clips showing promotional material made for the 1976 NAMM introduction of the Polymoog. The video clips feature Dr. David Luce (who helped develop the Polymoog), Chick Corea, and a strange commercial that looks and sounds like a glam-rock version of *A Clockwork Orange.* Whether or not you're into vintage synths, visit the Moog Archives to see how well designed it is. It's attractive, easy to navigate, and well organized.



DOTDOTDOT.COM

Phil Burk's **SoftSynth.com** (www.softsynth.com) recently released an update to its audio toolbox for Java, JSyn 14.2. The upgrades include a pitch detector, EQ and resonant filter modules, new graphical user interface (GUI) tools, audio recording capabilities for Mac and PC, and support for multichannel audio cards. The most recent applet is the WebDrum (www.transjam.com), a drum-pattern editor that lets site visitors simultaneously jam online together. You can also chat with the other site visitors. To experience WebDrum, download the freeware JSyn browser plug-in. A JSyn software development kit is also available at SoftSynth.com. . . . Since 1969, Musicians Contact Service has been a useful and inexpensive fee-based way to find gigs. Its online presence, **MusiciansContact.com** (www.musicianscontact.com) offers similar services from your browser. Talent seekers visiting the site include booking agents, production companies, managers, and producers. The list of services includes job offerings for musicians and listings for artists seeking representation or seeking work with a band. Celebrity clients who have used Musicians Contact Service include Cher, Neil Diamond, Dr. John, Ozzy Osbourne, and Frank Zappa. Membership listing fees are $59 for six months and $99 for a year. . . . **Tone Depot** (www.hamptonplace.com/tonedepot) is a resource for settings and patches for amplifiers, keyboards, and effects pedals and processors. Site visitors can post their own patches. Vintage effects include the Ibanez TS9 Tube Screamer and Maestro Echoplex; amp companies

represented include Ampeg, Laney, Hiwatt, Marshall, and Mesa/Boogie; and pedal manufacturers covered include Boss, DOD, ProCo, and Zoom. There are also pages devoted to recording tips and the gear lists of well-known guitarists and bassists, including Jeff Beck in his Yardbird days, ZZ Top's Billy Gibbons, and even Stryper's Oz Fox. Tone Depot is aimed at the tweak-head within you.

WEBCAST

Have you ever wanted to play around with a really big echo chamber? The Silophone (www.silophone.net) was one of the biggest in history. Located in Silo No. 5, a monolithic grain elevator near the Quai des Écluses in Montreal's Old Port, the Silophone was a sonic art installation that let Web users listen to the effect the towering reinforced-concrete structure had on uploaded audio files. The brainchild of architect Thomas McIntosh and composer Emmanuel Madan, collectively and enigmatically known as [The User], the installation "recycled noise and ambience . . . finding poetry and meaning in the landfills of technocracy," according to the Web site.

Built in 1958 and since decommissioned, the silo was cited by architect Le Corbusier as a masterpiece of modern architecture. The structure is 650 feet long, 50 feet wide, and 150 feet tall. Its interior is divided into 115 vertical chambers, each 100 feet tall with a diameter of about 25 feet. That organ-pipe–like arrangement has complex acoustical properties and produced a reverb decay nearly 20 seconds long.

To play the Silophone, visitors picked one of more than 3,500 sounds from the Web site's library or selected a WAV or MP3 file to upload from their hard drive. The sound was then transmitted to the silo and broadcast on speakers inside. Microphones captured the resulting echo and transferred it over the Internet to desktops as a live RealAudio stream. The round-trip took about 40 seconds.

The Silophone was equipped with 15 telephone lines, an ADSL connection, an outdoor P.A. system to broadcast the interior ambience to the local environs, and an FM transmitter on the roof. Occasional concerts and performances held at the site were carried by Radio Canada's cultural channel, and an audio-CD collection of sounds produced by the gargantuan room during the installation's yearlong run (which ended June 16) is near completion. Program calendars, historical descriptions of the building, and a list of credits and supporters can still be found on the Silophone Web site.

—Peter Drescher

DOWNLOAD OF THE MONTH

Sound designers and musicians no longer need to spend hundreds of dollars on multidisc sound collections that often contain dozens of sounds they will never use. By purchasing sounds online, you can buy only the ones you need, any time of day or night; one of the fastest growing sources for sounds online is Sonomic (www.sonomic.com).

The Sonomic site is well organized and easy to use. From the opening page, you can search through its massive sound database. You can search the entire database, search by category (animals, explosives, machinery, voices, and so on), use keywords to look for a specific sound, or search by production company. Sonomic gets its sounds from some of the best-known sound designers in the business, including Doug Beck Music, Clack Sound Studios, Titus, Q Up Arts, and

Zero-G. When search results appear, you can audition the sounds using RealAudio's RealPlayer or Microsoft's Windows Media Player.

The search results window shows a number of useful elements about each sound file, including the file name, instrument, style, type of sample (loop or one-shot), bpm and key when appropriate, production company, artist, title of the sound collection the sample is drawn from, file size, and price. The sound effects window displays the file name, genre or category (humor, horror, and so forth), production company, duration, file size, bit rate, price, and whether it's a mono or stereo file.

Sonomic also features Soundbay, a free service that lets you store the sounds you purchase online and have complete access to your purchases without having to store them on your own disk drive. You can use the Sonomic search engine to search only your Soundbay once you establish it.

BAND ON THE WEB

Using synthesizers as live performance instruments in the late '60s and early '70s was a dicey proposition. To begin with, the instruments were cumbersome, expensive, and temperamental, and users had to repatch the instrument each time they wanted to significantly change the timbre. The first ensemble that rose to the challenge of creating a significant body of work intended for live performance was Mother Mallard's Portable Masterpiece Co. (www.mothermallard.cornell.edu).

Mother Mallard's Portable Masterpiece Co. (aka Mother Mallard) was the brainchild of composer David Borden, who had become familiar with Moog synths through an association with the R. A. Moog factory in Trumansburg, New York. After a few years of working with the instruments, Borden began composing pieces on them. By 1969, with the help of composer Steve Drews and keyboardist Linda Fisher, Mother Mallard's Portable Masterpiece Co. was born.

The group released a pair of LPs on its own Earthquack Records label, both of which have been reissued by Cuneiform Records (http://cuneiformrecords.com). Mother Mallard's eponymous first release documents the band's music from 1970 through 1973. The second release, *Like a Duck to Water,* contains the music from '74 to '76, with keyboardist Judy Borsher replacing Fisher. Both reissues include previously unreleased tracks.

Mother Mallard's instrument setup eventually included three Moog modulars, two Minimoogs, an RMI Electric Piano (which was the only polyphonic instrument onstage), and a pair of reel-to-reel tape recorders. The music uses repetition as a basic structural element and emphasizes slowly evolving textures, timbres, and melodic contours. The popularity of the group's long-form pieces and the mystique of the synthesizer helped Mother Mallard build a loyal following and attract media attention. For example, the group was asked to contribute music to the soundtrack of the film *The Exorcist.* Although the Moog version of the band ceased to exist in 1978, its legacy lives on within its influential recordings.

WEB APP

Although the music industry has a standard communication protocol and hardware specification to represent various aspects of a musical performance, namely MIDI, a standard format in the area of musical notation has been much slower to develop. The Notation Interchange File Format (NIFF) was designed to be a robust nonproprietary score format that isn't platform or application specific. NIFF lets you share scores among various notation applications, which makes it easy, for instance, to distribute scores on the Web.

NIFF is much more precise in managing notated score details than the Standard MIDI File (SMF) format. Like MIDI, NIFF came about through a collaboration among manufacturers in the music business—including Mark of the Unicorn, Musitek, Opcode Systems, Passport Designs, San Andreas Press, TAP Music Systems/MusicWare—and music publishers, musicologists, computer scientists, composers, and engravers. Besides the page-layout and graphic information required to create a musical score, a NIFF file also includes MIDI information.

Musitek's *SmartScore* 2.0 music-scanning software takes full advantage of NIFF. In addition, Musitek has a freeware NIFF viewer and player (Mac/PC) available on its Web site (www.musitek.com/niff.html). ●

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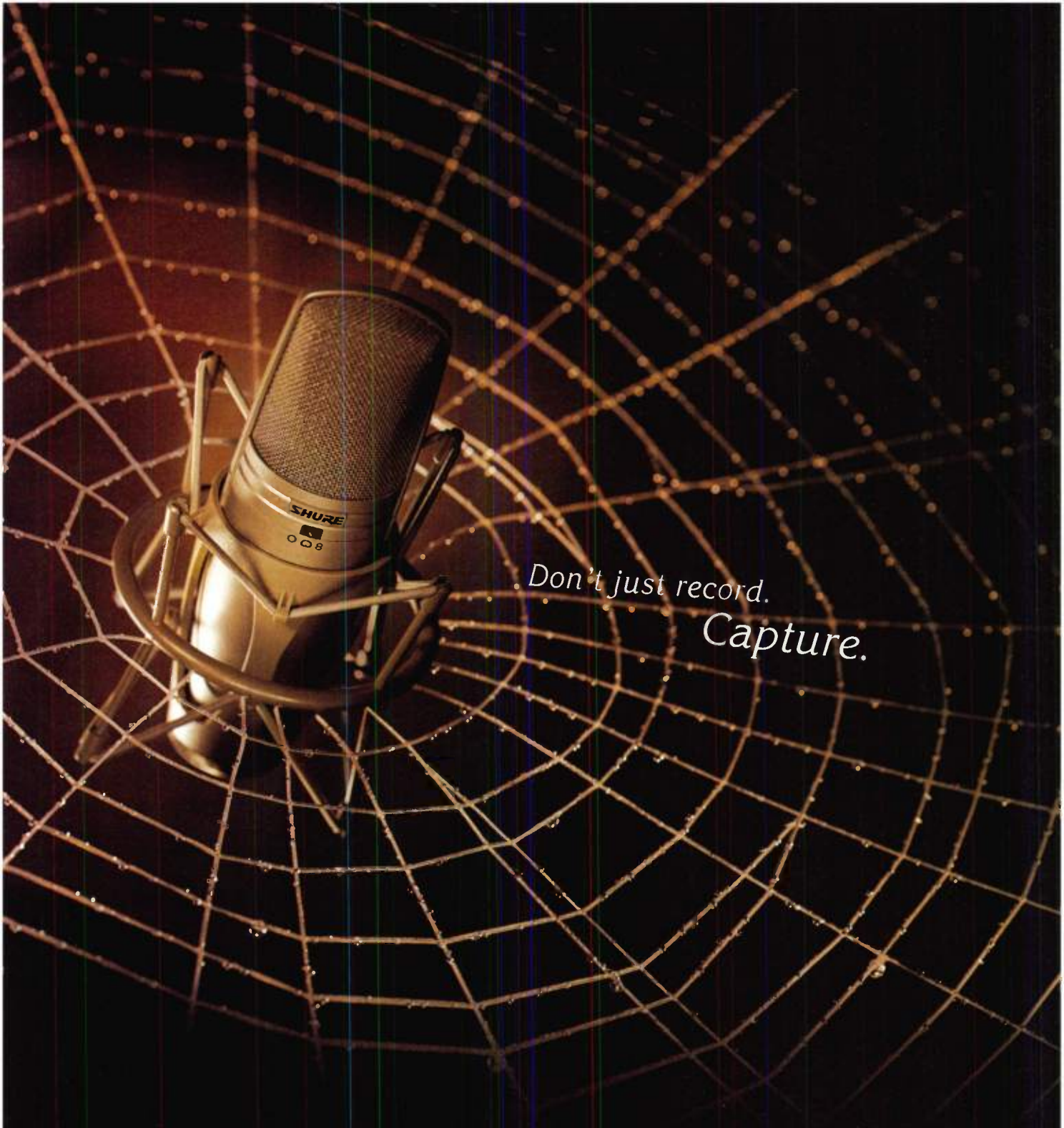

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PROFILE

By Matt Gallagher

Emphatic Statement

House and techno producer Warren Harris of Cleveland, Ohio, records as Hanna. He is a bass player who is educated in classical music and plays a range of styles, from heavy metal to jazz fusion. "Three years ago, I started doing electronic music out of the blue sky," Hanna says. "I don't listen to the music too much; I just listen to a vibe and incorporate my own colors into the music."

Hanna makes no bones about his bare-bones approach to drum 'n' bass.

Hanna makes his Shadow Records debut with *Scarlet Manifesto,* a blistering drum 'n' bass record that he recorded in his apartment. "This album is pretty dark compared with my house stuff," he says. "I guess it wouldn't be conventional drum 'n' bass, but there are some authentic shades in there." *Scarlet Manifesto* is his first full-length release in the United States and follows an album titled *Severance* that he recorded for the Sublime label, based in Japan. "That's a techno album," Hanna says. "I used one keyboard and a DAT machine for the whole album."

For *Scarlet Manifesto,* Hanna used the Korg Triton, Novation Nova, and Roland JX-305 synths as well as a Boss DR-660 drum machine and an Ensoniq ASR-X sampling drum machine. Hanna eschews digital-audio sequencers, opting instead to use the onboard sequencers in the JX-305 and the Triton. "I'm not a fan of creating in front of a computer sequencer, because I'm from the old school," he says.

Often, Hanna builds entire tracks using one device. For example, the track "Peacemaker" is the ASR-X alone. "Drum 'n' bass is a form of hip-hop, so there has to be some kind of groove there that will start me off," he says. "Mostly, it's the chords. I start a track from a texture of the sound of the chords. I'm trying to be a trendsetter harmonically."

A Roland SP-808 phrase sampler served as Hanna's sole tracking device. "That was my recorder, period," he says. "I can get by with what it does. There are limitations; you have to be creative. I went from the SP-808 to a Sony PCM-R300 DAT machine, and then I would make a digital dump of that to a CD." Hanna mastered *Scarlet Manifesto* on his iMac using Waves' Gold Native Bundle plug-ins.

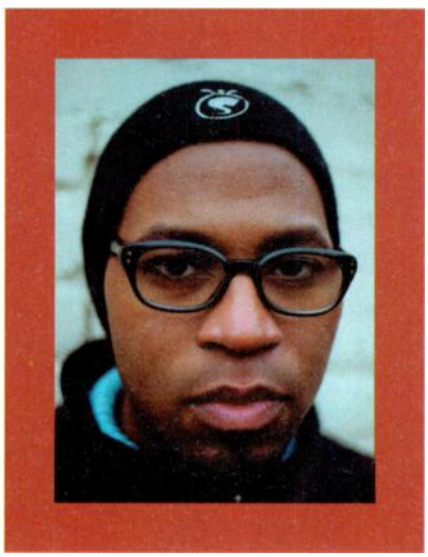
Hanna spent ten years working at a local television station as an engineer and credits that experience with preparing him for recording his own projects.

"It was probably a half-million dollar studio, and I ran it," he says. "I learned a lot in there. I used to do commercial jingles and stuff like that with [Akai] MPCs, so I'm used to hardware sequencers. I can use a sequencer and a keyboard for a few bars—just make little performances and piece them together. So that's the whole concept. I work with little sequences that I create and then sample, cut, and paste them. There's no outboard gear. The effects are from the keyboards or the SP-808.

"It's pretty amazing what you can do with those effects," he says, and argues that many musicians don't explore their gear's full potential. "These keyboards have great sounds, but a lot of people don't get into them. The effects that they give you can make your projects production-ready.

"Any way you make the music, it doesn't matter how you get there," Hanna says. "The music has to be good at the end of the day. Nobody really cares [about] or knows the process of how it got there. I'm all about doing stuff quickly. If it's laborious, I lose the vibe."

For more information about Hanna, contact Shadow Records; e-mail hannax@earthlink.net; Web www.shadowrecords.com.



DAVID HOBSON

***Scarlet Manifesto*/Hanna**

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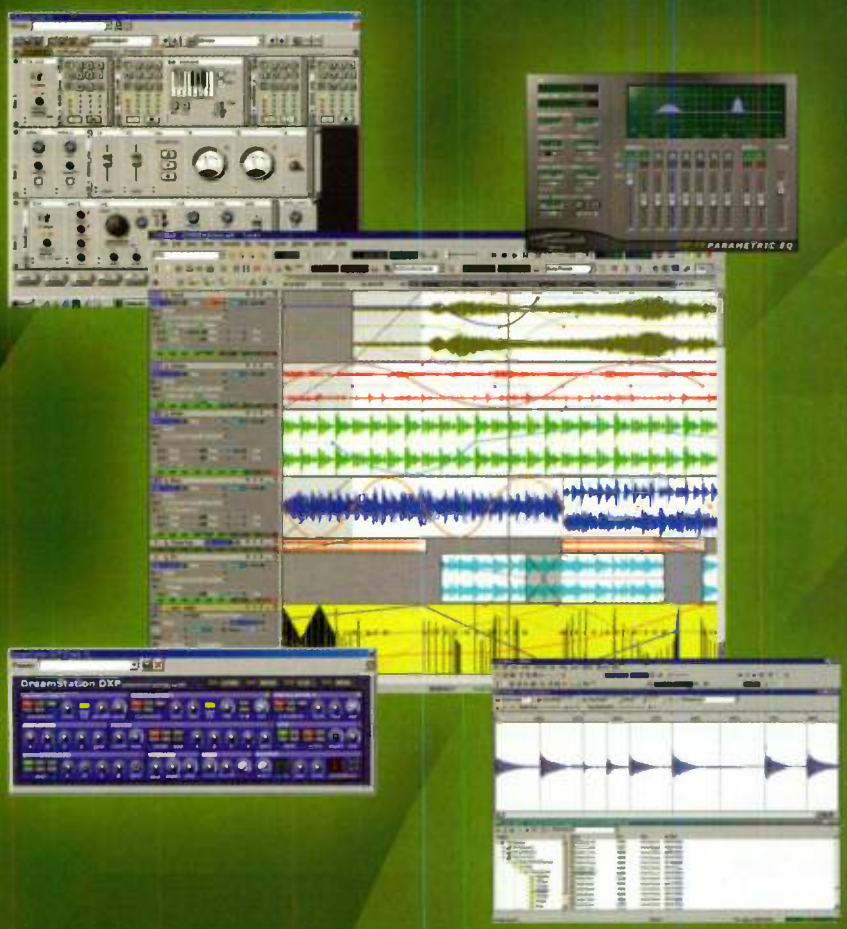

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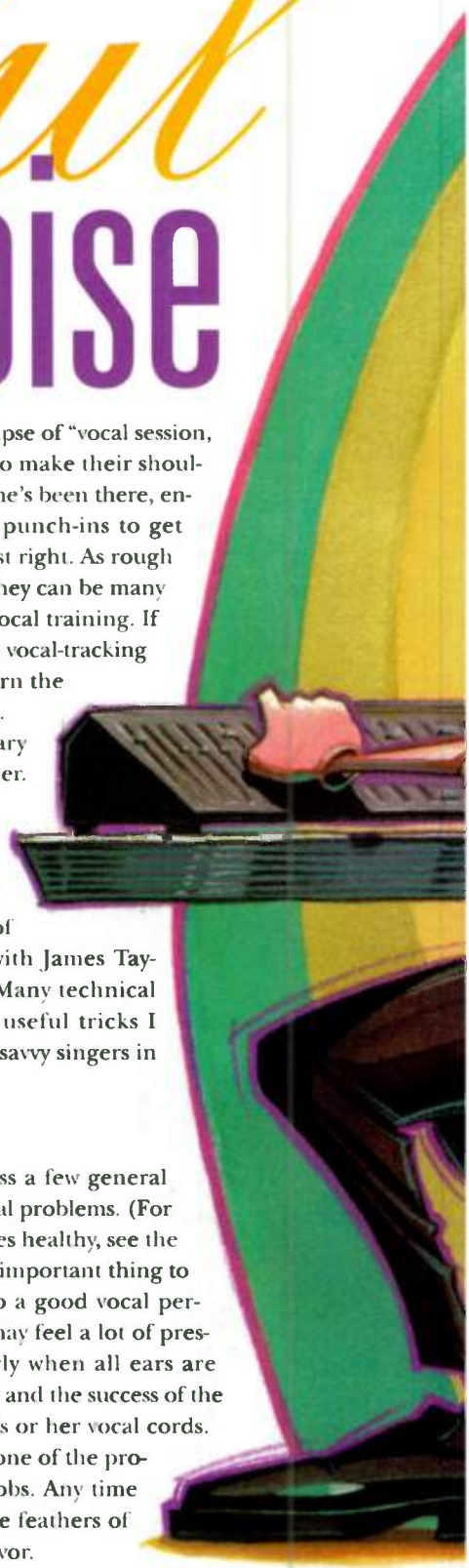
Making a Joyful Noise

Tips for averting vocal vexations and coaching singers to peak performance.

By Myles Boisen with Cary Sheldon



For some engineers, all it takes is a glimpse of "vocal session, 3 p.m." on the day's studio calendar to make their shoulders tighten and skin turn red. Everyone's been there, envisioning dozens of mind-numbing punch-ins to get that "baby, baby" or "whoa, whoa, yeah" just right. As rough as vocal sessions can be for the engineer, they can be many times worse for lead singers with limited vocal training. If you're already reminiscing about torturous vocal-tracking marathons you've endured, it's time to turn the tables and take control of vocal vexations.

For this story, I enlisted the help of Cary Sheldon, a respected Bay Area vocal teacher. Sheldon, a certified instructor of the Speech Level Singing technique, has wowed me on numerous occasions with her ability to coach and produce vocalists in the studio. She also has a long list of studio singing credits, including work with James Taylor, Todd Rundgren, and Henry Kaiser. Many technical tips in this article are hers; others are useful tricks I picked up while observing her and other savvy singers in sessions at Guerrilla Recording.

THE BIG PICTURE

Before getting into particulars, I'll discuss a few general guidelines that relate to all manners of vocal problems. (For information about keeping a vocalist's pipes healthy, see the sidebar "Vocal Vim and Vigor.") The most important thing to remember is that relaxation is the key to a good vocal performance. Be aware that a studio singer may feel a lot of pressure, particularly when all ears are listening intently and the success of the song rides on his or her vocal cords. Keeping anxiety out of the vocal booth is one of the producer's and engineer's more important jobs. Any time you can fix a problem without ruffling the feathers of your songbird, you're doing everyone a favor.

Illustration by Bruce MacPherson

Your singer's comfort and confidence levels are other factors that will affect the quality of the performance. Get sessions off to a good start by providing comfortable headphones, appropriate mood lighting, a music stand for lyric sheets, and a generous dose of studio hospitality to put the talent at ease. If and when the going gets rough, it's wise to diffuse tension by suggesting a break. Good-natured humor is another great tool for easing a vocalist's jitters, but it must be used in moderation. Too much wisecracking can be a distraction, and sarcasm can easily fall flat or backfire when heard over the headphones.

Now that the stage is set, put on your vocal-coaching cap. Hopefully, the following tips will increase your usefulness as a recording engineer by helping you identify and offer solutions to the most common problems facing studio vocalists. Before diving in, though, read the sidebar "Glossary of Vocal Terms"—even if you are already conversant in vocal terminology—because some terms used here, as well as many techniques described, are particular to the Speech Level Singing method and may differ from those common to other singing-instruction methodologies. (For more information about the Speech Level Singing technique, go to www.davestroud.com.)

CONSISTENTLY OFF PITCH

Intonation is a major issue for all vocalists, regardless of their ability, experience, and training. Often when a singer is off pitch, it's because he or she is not hearing enough voice in the headphones. Therefore, a good headphone mix is essential. On the flip side, it's also possible to fall prey to pitch problems when hearing too much of one's voice or when suffering through an overly loud mix.

At the start of a session, make sure the singer is getting a comfortable vocal level in both sides of the headphones—before you put any other instruments into the mix. Also, make sure all sustaining chordal instruments (piano, electronic keyboards, guitars, and the like) are in tune and make them more audible than the percussive elements. Listen carefully for consistent pitch problems during the first run-through; afterward, solicit the singer's opinion on the balance and overall level of the headphone mix.

At the first sign of pitch problems, increase the level of the most supportive chordal instrument in the mix. It may also help to turn down elements that don't contribute to intonation or vocal delivery. If you hear that a singer is consistently sharp, try rolling off some of the high-end information in the mix and cranking up the bass. Conversely, when a singer is constantly going flat, turn down the bass and nudge up the highs, particularly on the melodic tracks.

Simple headphone adjustments or even switching to a different brand of headphones will solve a surprising number of pitch problems. If that doesn't do the trick, you can undertake a number of other quick fixes. Lightly compressing the headphone mix will almost

VOCAL VIM AND VIGOR

Vocal endurance is a health and training issue rather than something the engineer should attempt to control. Folklore and vocal voodoo—such as swigging hot sauce to revive a flagging voice—are to be avoided when a singer's livelihood and future career are on the line. Singing while sick or when the vocal cords are tired or swollen should also be discouraged. Persistent pain or vocal fatigue must be treated seriously with proper coaching and possibly even medical treatment.

So what can the engineer do? Once you get to know a singer, you can help pace his or her endurance and schedule sessions and breaks accordingly. Be aware that stress, a busy schedule, allergies, and lack of sleep can also take their toll on a singer's stamina. You can't control what vocalists do before they come to a session, but it's well worth it to remind them of some important dos and don'ts while they're in the studio.

DO encourage vocalists to follow these positive vocal-health habits:

- Get plenty of sleep between sessions.
- Drink as much water as possible during a session.
- Drink warm tea with honey (not sugar) to soothe and moisten the throat and clear congestion.
- Steam the throat by using a humidifier or by standing over a pot of boiling water with a towel draped over the head.
- Try deep-breathing exercises during sessions.
- Minimize the use of allergy and cold medicines (which tend to dry out the throat) before sessions and drink as much water as possible during treatment.
- Gargle with hot salt water to reduce swelling of the vocal cords.

In the studio, DON'T let singers:

- Push their endurance or allow anyone to coerce them into continuing to sing once the voice becomes uncomfortable or painful. (Swelling or aggravation of the vocal cords can lead to physical damage.)
- Drink alcohol or orange juice. Caffeine and dairy products should also be avoided before and during sessions.
- Talk excessively.
- Whisper to save the voice. (It is actually worse for the voice than talking.)
- Cough or clear the throat loudly, because that is decidedly abrasive to the vocal cords.

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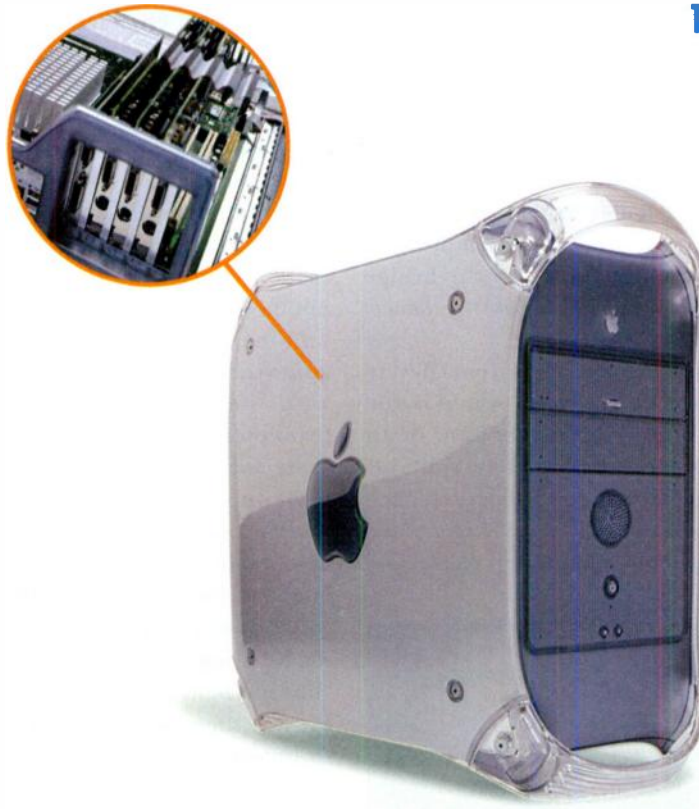

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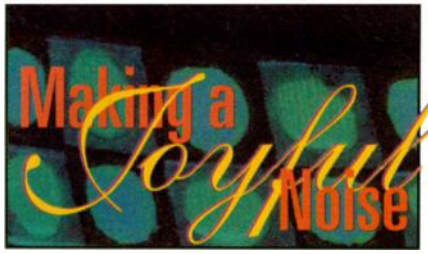


always help to support the vocalist. Assuming the singer doesn't need to be immersed in the music, you can also suggest that he or she tuck one side of the headphones behind an ear, thus creating a helpful balance of direct and reproduced vocal sound.

Singers who are inexperienced or unfamiliar with the material may benefit greatly by hearing the vocal melody in the cans while they are tracking. If an instrumentalist is available to record a guide track, invest a little time in that powerful vocal aid. A guide track can also increase your crooner's confidence, resulting in a better performance overall.

If none of those fixes adequately solve the pitch problems, the most important thing you can do as an engineer is be supportive and try to keep the session moving. After you've tried every trick in the book, the singer is sure to be painfully aware of his or her deficiencies, and any comments you make need to be diplomatic.

When all else fails, another solution is to gently suggest to the singer that something in the track is pulling him or her off pitch. That removes some pressure and often makes it possible to get a good take provided the vocalist can compensate by intentionally singing slightly sharp or flat.

OFF PITCH IN PLACES

It's usually easier to fix a few off-pitch notes or phrases than it is to redo an entire vocal performance. You can punch in on a single vocal track or record alternate phrases on another track and then comp them for the final mix. A guide track, whether playing the complete melody or just the problem pitches, will also help ensure success. If the vocalist is familiar with piano keys, it usually also helps to let him or her pick out note cues on an electronic keyboard routed to the headphone mix.

When singers are consistently flat on a particular word, it's often because they don't know how to sing up to and over a particular bridge (usually the lowest one). They are attempting to push the chest voice *over* the bridge rather than navigate smoothly *through* the bridge.

When a singer ascends from chest to head voice correctly, the sound is said to *split,* meaning that the flow of air and resonance is shared, or split, between the mouth, soft palate, and nasal passages. In Speech Level Singing, that combination of mouth, soft palate, and nasal passages is called the *mix* (not to be confused with the ordinary studio use of the term), and proficient singers know how to use the mix to navigate easily through a bridge.

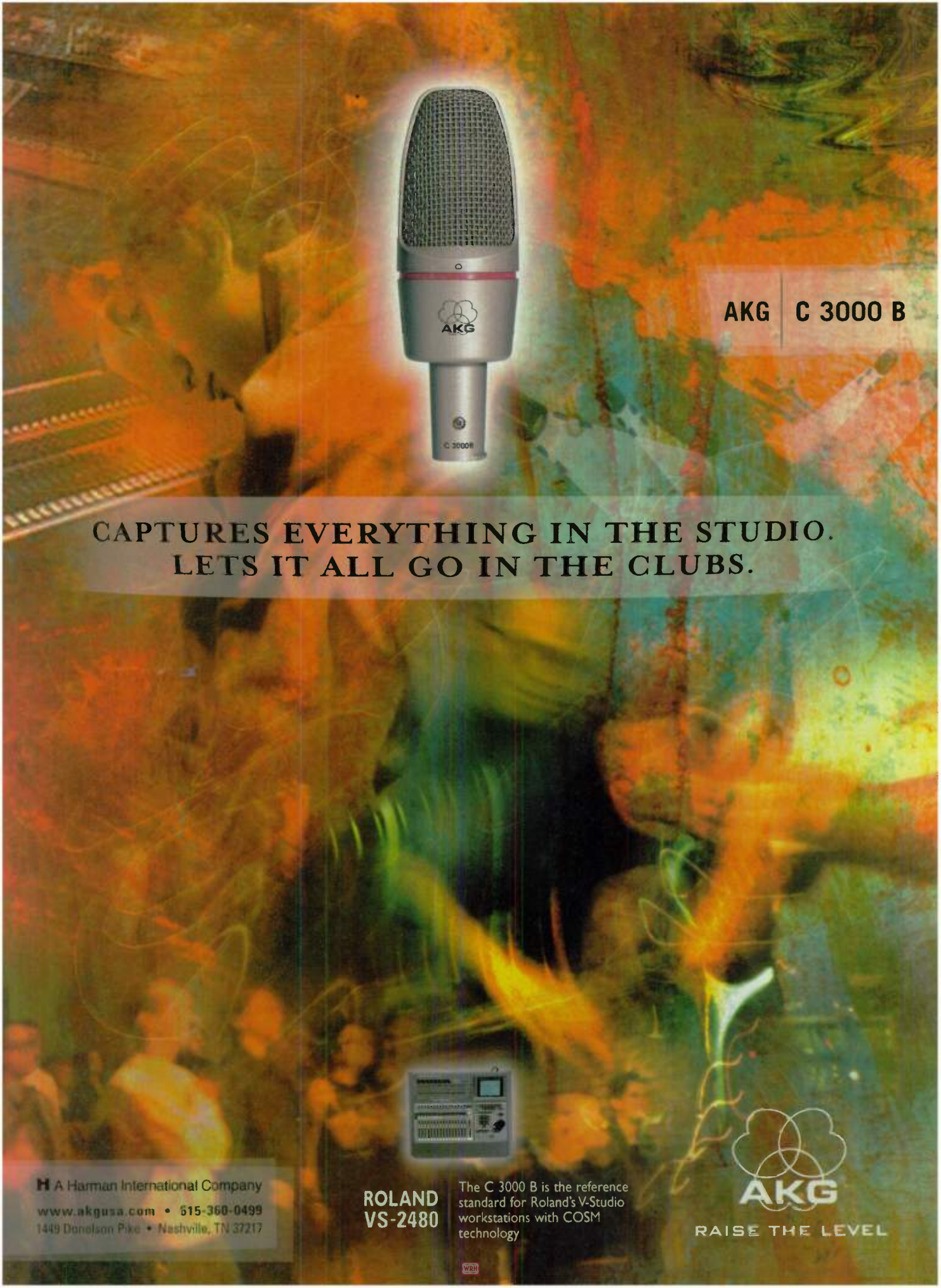
One problem is that untrained singers often think hitting a high note requires opening the mouth wide and pushing (see **Fig. 1**). However, that approach tends to push the chest voice over the bridge (as opposed to letting it move through the bridge). In turn, the tone doesn't split as the pitch rises, the larynx rises up in the throat, and the pitch comes out flat or the voice sounds strained. In such cases, the first thing to try is a vowel change, either on the word itself or in the sentence preceding it. Narrowing the vowels helps correct the pitch by forcing the vocal sound to split automatically. The first and easiest way to use that technique is to get the singer to physically narrow the mouth so it is shaped like an egg. In extreme cases, you may want to ask vocalists to put their hands on their cheeks to prevent the lips from pulling back and to guide the jaw into dropping down.

Another approach is to narrow the problematic vowels in the song. Assume, for example, on the lyric "let me back into your heart," that the word *heart* is consistently flat. To fix that, the *eh* sound in *let* becomes *ih,* the *aa* sound in *back* is changed to *eh,* and the troublesome *ah* vowel of *heart* is narrowed to *uh.* Notating those phonetic changes—"liht me behck into your huhrt"—on the lyric sheet makes the changes easier to incorporate, and usually, the improvement in pitch will make a believer out of everyone present.

When a singer is sharp only here and there on a line, it's usually because he or she is pushing too much air through the larynx. The easiest correction for the problem is to persuade the singer to relax and back off the volume. Another useful coaching tip is to suggest that the vocalist speak-sing the phrase. That helps decrease excess airflow and often makes the line progress more naturally. Again, it may also be advisable to adjust the headphone balance or have the artist "think flat" just for that problematic note.


BRAIN KNAVE

FIG. 1: Opening the mouth wider and pushing is the wrong way to hit high notes (left). Narrowing the mouth to an egg shape typically corrects the problem. If it doesn't, singers can put their hands on their cheeks to guide the jaw into dropping (right).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STRAINED TONES

When the prevalent problem of strained tones rears its ugly head, you can expand your options for coaching a singer by listening for bridges and knowing how to deal with them. In most cases, men are going to have their first or lowest break—the one between the chest

GLOSSARY OF VOCAL TERMS

Break: A sudden shift or loss of continuity in vocal tone caused when excessive airflow overcomes cord tension. For most voices, the break is in the area of the first bridge. It can be avoided by letting the vocal cords gradually thin and then "shorten" their vibrating length while allowing a corresponding gradual decrease in airflow so that excessive air pressure and muscle tension don't build up.

Bridge (also known as passagio): A transitional area in the vocal range where muscular adjustment or resonance activity makes it especially difficult to negotiate a balance between airflow and vocal-cord adjustment. Men usually have three such areas in their ranges, whereas women have as many as five or six. Note that breaks go away (with practice), but bridges do not.

Chest voice: The normal speaking voice and typically the lowest register of the vocal range. In chest voice, the full length of the vocal cord vibrates (see **Fig. B**), and vocal sounds project to the hard palate and out the mouth.

Comping: Short for *compiling*, this is the practice of recording vocal passes onto separate tracks of a multitrack recorder and then copying the best parts of each take onto a single perfected vocal track.

Falsetto: A high vocal register characterized by less bite and an airier tone than head voice. In falsetto, the vocal cords open up, releasing more air, and the vibration moves away from the edges of the vocal cords toward an area known as the *false cords* (see **Fig. D**).

Guide track: A track created to assist the vocalist in maintaining pitch, rhythm, and phrasing while recording. A guide track should be played on a fixed-pitch instrument (ideally a pleasant-sounding keyboard) and contain selected notes or a complete instrumental version of the vocal melody.

Head voice: This vocal register sounds like a higher-pitched extension of chest voice and is characterized as having power, projection, and bite (as opposed to the softer, airier sound of falsetto). In head voice, the vocal cords are partially closed and do not vibrate along their full length (see **Fig. C**). (In falsetto, the cords are more open.)

Larynx: The physical mechanism that houses the vocal cords and moves up and down in the throat cavity to control the process of swallowing (see **Fig. A**). The larynx is the lump in the middle of the neck, just below the chin.

Mix: A technique of Speech Level Singing that lets the singer make a smooth transition through the first bridge. The cords are allowed to gradually thin and then shorten, resulting in a *split tone* that is a blend of chest and head registers.

Plosive: Derived from *explosive*, this refers to a forceful blast of air from the mouth during speaking or singing. Plosives are usually caused by *p*s, *b*s, and *t*s and are problematic when they register on the mic or track as a low-frequency popping sound.

Speak-sing: An exercise in which the rhythmic patterns of normal speech are transferred to the melody line of a vocal phrase. The words are first spoken as if in conversation and then sung in a manner that mimics the conversational rhythm in the melody, but without sustaining the vowels.

Vocal cords (also known as vocal folds): A pair of soft-tissue cords that are joined at the front of the larynx but separated at the back. When closed, the back ends of the cords come together, forming a sort of reed, and the airflow is temporarily stopped. When the air pressure from the diaphragm overcomes the muscle pressure holding the cords together, the cords are blown apart, and audible vibrations result.

FIG. A: The larynx is the physical mechanism that houses the vocal cords.

FIG. B: The full length of the vocal cords vibrates in chest voice, which is speaking voice.

FIG. C: In head voice, the vocal cords are partially closed and not vibrating along their full length.

FIG. D: When singing in falsetto, the vocal cords open wider than they do in head voice.

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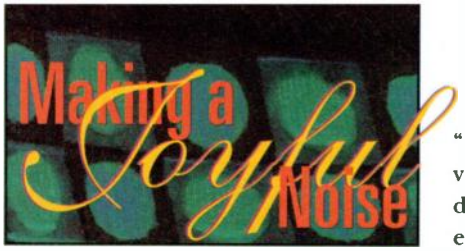

and head voice—on the D sharp above middle C. For women, the first bridge is predictably at A or A sharp above middle C.

Strained tone on the high or climactic notes in a phrase is almost always caused by the singer attempting to "push over" the bridge in his or her voice—essentially the same problem described previously in regard to singers who are consistently flat on particular words. Again, basic relaxation and breathing techniques combined with the aforementioned exercises for narrowing vowels will often solve the problem. In addition, some singers may be able to clear such hurdles by relaxing the muscles in and around the throat while tightening their stomach muscles. Although that is not really correct vocal technique, it can work in a pinch.

The problem could also be that the singer's vocal cords are too constricted, and more air movement is needed to open them up. In that case a breathier, more open tone can relieve some pressure, maximize vibration in the vocal cords, and free up the voice.

An alternate approach to smoothing out strained high notes in singers who can't move smoothly through their breaks is to have them jump directly to the desired note in head voice or falsetto. That maneuver—a mainstay of traditional country-yodel stylists, such as Jimmie Rodgers and Hank Williams, that is also heard in more mainstream artists such as Joni Mitchell and Dave Matthews—can radically alter the interpretation of a song and enhance the emotionality of the performance.

CAN'T HIT LOWS

When the singer is physically unable to reach the melody's lowest notes with satisfactory tone, you have a few quick fixes at your disposal. A producer's panicked reaction may initiate speeding up the backing track by a half step or more, rerecording for hours to put the song in a higher key, or giving a pink slip to the vocalist.

A more civilized solution (which also works with strained high notes) is to temporarily change the pitch of the multitrack recorder and then simply punch in the bothersome out-of-range notes; that is, either raise the pitch of the backing track to bring it into a more comfortable range or lower the pitch to prevent strained high notes. Be aware, though, that changing pitch by a whole step or more may produce noticeable timbral distortion—chipmunk or Darth Vader effects, depending on which direction you go—when the music is restored to its proper key. That kind of manipulation is usually less noticeable when it's used to compensate for an inability to hit low notes.

In addition, here's a technique for the vocalist that may make such manipulations imperceptible or even unnecessary. First, determine how low the

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tube condensers, though highly regarded for the majority of vocal sessions, can be too warm sounding for some vocal styles and sound muddy no matter what you do. It may be worthwhile to try a small-diaphragm condenser to increase highs and articulation, or even try a cutting dynamic mic such as the ubiquitous Shure SM57.

When technical solutions don't suffice, you can employ other novel methods for steering the vocalist toward clearer diction and a brighter, more intelligible tone. A Guerrilla Recording favorite known as "biting the apple" involves getting the talent to smile a bit and pull back the corners of the mouth—just as you do when chomping into an apple. Opening the sides of the mouth and exposing more teeth automatically lets more high frequencies escape the oral cavity. Because of its dramatic effect on the shape of the mouth, however, Sheldon advises using the biting-the-apple technique only when the singer is in chest voice.

As a fun, tension-busting route to crisp diction and projection, Sheldon recommends talking through the lyrics with an obnoxiously exaggerated New York City accent. For this exercise, it is vital to focus on keeping the mouth long and narrow, the jaw dropped, and the words centered in the low or back part of the mouth to avoid getting overly nasal.

SIBILANCE

Sibilance is a natural component of speaking or singing that results from the pronunciation of certain consonants and digraphs—primarily *s, c, sh,* and *ch.* It therefore exists in varying degrees for all singers. The problem is excessive sibilance—an obvious *ess,* or whistling sound—which can render a vocal track grating if not unlistenable.

When vocalists exhibit noticeable sibilance, it may be due to gaps or chips in their front teeth or certain types of dental reconstruction. Singers who move more air than most, either by singing loudly or by cultivating an airy tone, are also prone to sibilance. Whatever the cause, whistling *ess* sounds are often localized at the front of the teeth or are more prominent on one side of the mouth.

Just as sibilance can be greatly exaggerated by mic placement (not to mention signal processing), it can also be reduced by judicious mic positioning. You can often find a position that minimizes sibilance by moving the microphone slightly to one side (toward either cheek) or by having the singer slowly turn his or her head to each side while uttering, "she sells seashells by the seashore." In addition, try having the singer substitute *z* for *s,* or turn the slithering *ts* sound (as in *hearts*) into a *dts* sound.

In the absence of a discernible physical or physiological cause of sibilance, the culprit may be a condenser mic or compressor—or the subtle chemistry between the singer and the mic or compressor. Large-diaphragm vocal mics, even the most expensive vintage ones, often have pronounced presence boosts that can increase sizzly sounds by 6 dB or more in the 4 to 7 kHz range. Certain compressors (or the use of excessive amounts of gain reduction through almost any unit) can also bring a spitty presence to a vocal track while reducing the prominence of low-end frequencies.

The best work-around for sibilance traced to the signal chain is first to turn down the compression and then to try swapping compressors and microphones until the problem is solved—or at least judged to be manageable. A quality hardware or software de-esser is also good to have, especially when time or patience is limited.

OVEREXTENDED PHRASES

In Sheldon's and my experience, overly sustained phrases are more likely to come from dramatically inclined vocalists and from those who take up singing later in their lives. The problem comes when the dwindling supply of air results in strained or off-pitch notes at phrase ends. On top of that, the lack of a break makes it difficult or impossible for the engineer to execute the vocal punch-in required to fix the problem section.

The most obvious solution is for the vocalist to breathe in more air before the phrase or to shorten the sustained note at the end by one or two beats. It also helps to understand the physics of what's going on in the larynx. Usually when singers run out of breath quickly, it is because the vocal cords are too open. That is typically accompanied by an overly airy or heady tone, which can come across as excessively sweet or whistly sounding on the recording. In addition, pushing too much air through the throat raises the larynx (never a good thing), is abrasive to the vocal cords, and may result in an inferior tone with diminishing returns over a short period of time.

To counteract that tendency—and, if desired, to increase phrase lengths and thus dramatic delivery—Sheldon suggests that the singer talk through the phrase while holding back airflow on the sustains. That encourages cord closure and conserves breath.

If none of those approaches help, it's often possible to break up the long phrase with a strategically inserted breath. That will ease straining and allow time for the singer's airflow to be replenished. Such breaths should be boldly notated on the lyric sheet (a *V* or large slash mark between words is common) and rehearsed a few times before the take.

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Recently, there have been a number of exciting developments in digital versatile disc (DVD) technology. Just a year ago, recording to DVD was a big-budget affair. Today, however, DVD-Recordable (DVD-R) drives and media are hitting the streets at applications.

The benefits of using DVD technology in the personal studio are substantial. However, so that they can make intelligent decisions when mastering their music in this medium, it is important for musicians to learn about the various physical and application formats that come under the guise of DVD.

What are the differences between the various DVD formats? What can you do with a DVD that can't be done with CD? Let's take a look.

By Gary Hall

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Part One: Dissecting DVD

Like CDs, DVDs originally entered the marketplace as a nonrecordable format. However, unlike the development of the CD-Recordable format, which occurred a number of years after CDs were introduced, the first DVD-Recordable drives and media appeared within a few months of the release of DVD. DVD-R was created in part to meet the demands of content producers who needed a reasonable way to proof their releases.

The first drive to hit the market, the Pioneer S-101, was priced at $17,000. Although the price was steep, DVD producers quickly found that they couldn't live without this tool.

Recordable DVD technology got a giant boost in 1999 with the release of the Pioneer S-201 ($5,400). At less than a third of the price of the S-101, the S-201 opened DVD-R to a broader market. At the same time, inexpensive yet incompatible DVD-RAM drives and media became available. In January 2001, Pioneer announced the release of the Pioneer A03, a so-called Super Drive that handles write-once and write-many DVD formats as well as CD-R and CD-RW. Pioneer believes that it will be able to price the A03 substantially less than $1,000.

Other manufacturers (notably Panasonic) have now entered the market, and Compaq and Apple are bundling DVD-R drives with their products. Component drives priced less than $1,000 for existing computers were expected to hit the stores in June. By the time you read this, recordable DVD will be a reality for mainstream consumers, with multiple offerings available from a growing list of vendors.

WHY DVD?

DVD has three primary uses: in desktop applications as a giant "bit bucket" for data storage; in consumer-player applications using the standard consumer DVD formats; and in hybrid applications that can combine standard DVD features with special functions, such as Web linking, that are available only when the DVD is played on a computer.

Standard and hybrid DVD applications offer five basic benefits over compact discs: DVD audio quality surpasses the audio quality of a normal CD; DVDs are able to store discrete, multichannel surround sound and high-quality video; DVDs offer much longer playing times than do CDs; and PC-based interactivity can be authored into a DVD. Although you can combine these features, there are limits to the ways that video images, high-density audio, and surround sound can be used together. For example, with the DVD-Video format, multichannel surround audio is only available in a data-compressed form when it accompanies video content. If you want your audio uncompressed, you are permitted only two channels.

A BALL OF CONFUSION

You will need a little more than the usual knowledge and ingenuity to tap the DVD-R's full potential while staying within your budget. To begin with, there are a number of different formats to work with, and there are incompatible variants within the most prevalent format as well. Incompatibilities linger between the recordable media and some players on the market, which affects the range of practical applications.

In addition, there are multiple DVD applications for musicians to consider. The great majority of players play the DVD-Video format only. However, DVD-Audio offers important advantages for musicians (see the table "DVD-Video and DVD-Audio Capabilities").

Finally, although there are a number of affordable tools for preparing and mastering DVD-compatible content, such products tend to be biased toward video and often do not support the full range of DVD's audio capabilities. To use the current crop of DVD authoring tools solely for audio applications requires special knowledge and careful attention. Depending on your requirements, the costs of the tools can vary greatly.

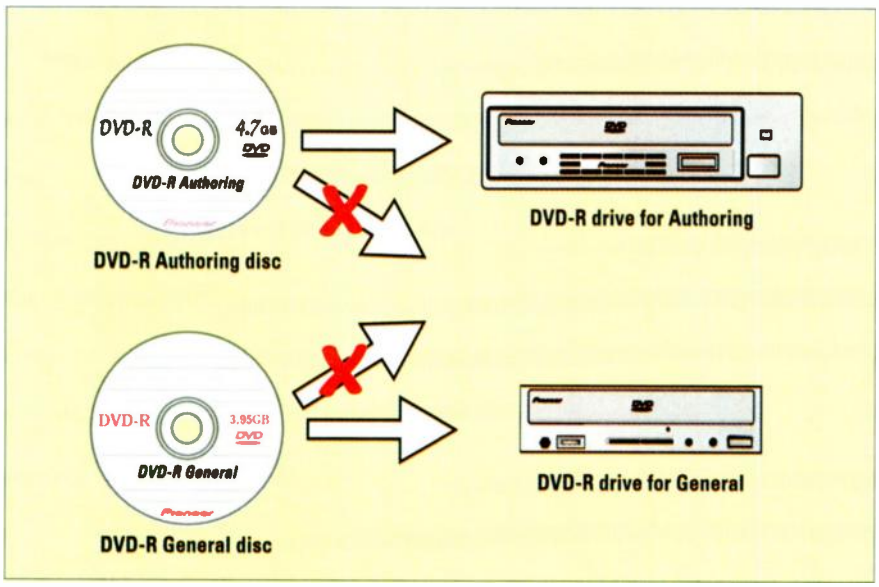

FIG. 1: The DVD Forum has defined two different types of DVD-R drives and media that are mutually incompatible. The lower-cost DVD-R General is intended to be a consumer format and includes features aimed at controlling piracy and illegal copying. DVD-R Authoring is a professional format that doesn't include the antipiracy features and is substantially more expensive.

RECORDABLE OR REPLICATED

In order for DVD to become a commercially viable format, two technological hurdles needed to be overcome. Disc manufacturers needed to be able to consistently meet the necessary tolerances in pit size and track pitch (which is the distance from one data track to another) in order to put several times more data on a DVD than they were able to put on a CD. The second requirement was a laser element that could read those much finer pits. The size of the pit that can be read by an optical drive (CD or DVD) depends on the wavelength (or color) of the light emitted by the pickup head. The lasers required for DVD, which read shorter wavelengths, became available in the late 1990s.

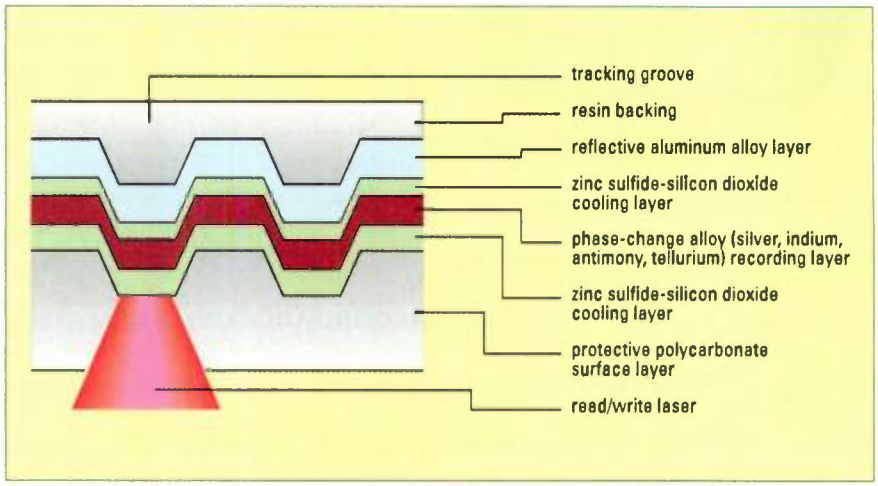

FIG. 2: A DVD-RW disc is a sandwich of resins, plastics, and metals. The material of the recording layer is a special alloy that takes on amorphous (nonreflective) or crystalline (reflective) states in response to heating and rapid cooling. Protective layers on either side of the writing layer draw heat away after the recording layer is heated to its critical temperatures.

For both CDs and DVDs, there are fundamental differences between a manufactured disc and the recordable medium. Up to this point, I've been referring to pits on the disc. In reality, the data on an optical disc can be represented in several ways. The player's laser-pickup head includes a light-emitting laser diode and a separate photo diode that responds to light and dark. The laser diode focuses its beam of light at the *target*. The photo diode sees the *return* signal as either light or

dark. In manufactured CDs and DVDs, data is represented by pits that scatter the light or lands that reflect it straight back to the pickup head.

In recordable DVD and CD technology, there are no pits. Light and dark states are produced by a photosensitive dye or a metal alloy, the reflectiveness of which changes in response to the writing laser.

Because DVD players are designed principally to play commercially mass-produced discs, there is no guarantee that the laser pickups on a given player will match the reflective characteristics of today's DVD-R discs. That is especially true with older DVD players.

Replicated DVDs also have a technology element not present in CD: the ability to put data on separate layers. Both data layers of a DVD disc are transparent, and both have a reflective layer behind them. The drive's laser-pickup head focuses on one layer or the other. That ability is similar to the way you can look out a window on a rainy day and selectively focus on the raindrops or on the landscape beyond. However, with DVD-R, in which the medium is opaque by nature, there is only a single layer.

RECORDABLE DVD FORMATS

One confusing factor for the novice is the variety of recordable DVD formats. Each format has its own features and is promoted by a different group of manufacturers. Although the dust hasn't completely settled on the issue, a few things can be said about the state of the technology and the market today.

DVD-R (the original). Sometimes referred to as *DVD minus R*, DVD-R is the most prevalent form of recordable DVD today. DVD-R drives have been on the market since 1997, and generally the technology has maintained a record of good compatibility and stability.

But just to keep matters confusing, DVD-R has now split into two separate trunks: DVD-R Authoring and DVD-R General. Technologically, the difference between the two is in the wavelength of the laser used. Economically, the difference is in the cost of the players and the blank media.

DVD-R drives and media sold prior to 2001 are now considered to be in the Authoring category. Authoring items are for use primarily in professional applications. Expect to pay about $4,000 for a professional-quality recorder and about $20 per blank disc.

Blank DVD-R Authoring media come in two sizes: 3.95G and 4.7G. (For an explanation of the difference between the disc-size indications G and GB, see the sidebar "DVD Capacity and Nomenclature.") The 3.95G discs, which hold slightly less data than standard replicated 4.7G DVDs, were first to hit the market. Of all recordable DVD forms, 3.95G discs have the best compatibility with existing consumer players.

DVD-R Authoring provides a means to create a replication master in the Cutting Master Format (CMF) that can be used directly for disc manufacturing. In addition, the DVD-R Authoring format is free of restrictions on copying that apply to the lower-priced General format.

The DVD-R medium most likely to be used by desktop musicians is known as DVD-R General. Blank DVD-R General discs come in only one size, 4.7G. The format employs a different laser wavelength—650 nanometers—than DVD-R Authoring, which means that DVD-R General drives cannot read or write to DVD-R Authoring media and vice versa (see **Fig. 1**).

DVD-R General is aimed explicitly at consumer-level users, so the drives and blank media are much less expensive than those for the Authoring format. That should lead to the widespread adoption of the General format for many kinds of applications.

The bad news is that a few specific functions are restricted with DVD-R General. Unlike the Authoring media, for instance, General media cannot be used as a direct replication master using CMF.

DVD-R General also includes ingenious measures aimed at preventing

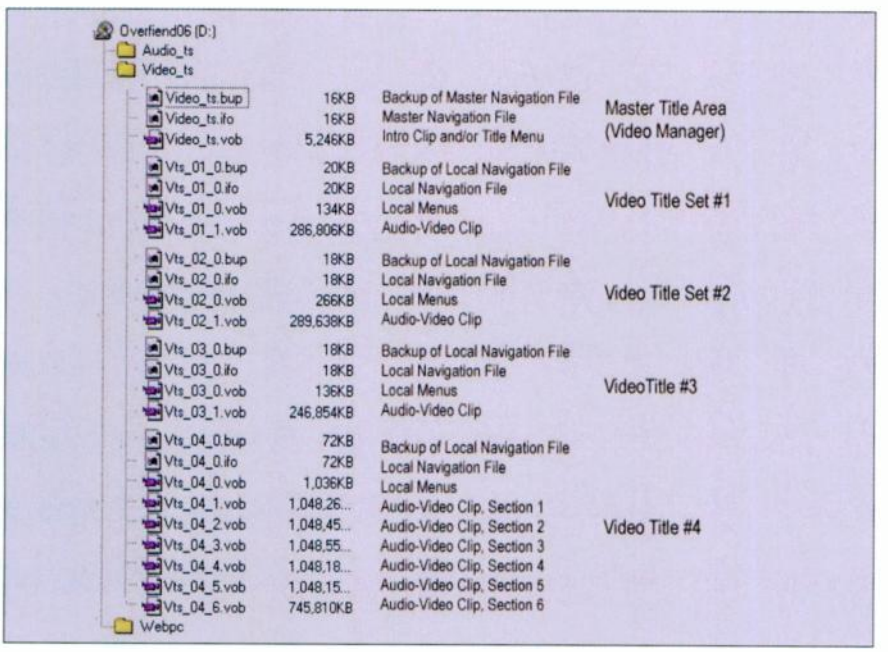

FIG. 3: The Video_ts directory of a DVD-Video disc consists of large media files (.vob) that contain multiplexed audio, video, and subtitle graphics, and much smaller navigation files (.ifo and .bup) that control the play of the disc. Those files are grouped together into a master area, called the Video Manager, and Video Title Sets that represent individual sections of content. Multigigabyte media data files are divided into multiple files no larger than 1 GB.

content piracy. Digital data scrambling in commercial discs prevents direct file copying, and DVD-R General discs also blank out specific areas of the disc that normally carry the decryption keys. The copy protection provisions in commercial DVD titles are intended to prevent analog recording of DVD-based video to tape. Although those provisions are unlikely to deter professional pirates, they should be effective in keeping casual duplication to a minimum.

According to manufacturer's white papers, both forms of DVD-R are fully compatible with consumer players; however, real-world experience belies that claim. The compatibility may be good, but it is clearly not perfect. For that reason, general distribution of productions on DVD-R won't be practical until the population of older, problematic players gets flushed out or reduced to a much smaller percentage of the installed user base.

You will encounter the smallest number of compatibility problems if you use the 3.95G version of DVD-R Authoring media. Though Authoring discs are a lot more expensive than blank General discs, you don't want to take a chance that your disc won't play when you hand over your demo to someone important. Therefore, establish a connection with a suitably equipped service bureau that can copy important projects to the Authoring format. In my experience, I have found it makes a difference.

FIG. 4: The Pioneer DVR-A03 is the first affordable standalone DVD-R and DVD-RW recorder to reach the market. Competition from Panasonic and the DVD+RW camp is hot on its heels.

DVD-RW. DVD-RW uses a different principle for recording than DVD-R, one that is inherently erasable and rewritable. Whereas DVD-R uses a dye that changes color, DVD-RW uses a metal alloy (of silver, indium, antimony, and tellurium, in case you were wondering) as the writing medium (see Fig. 2). That alloy can change back and forth many times between reflective (crystalline) and nonreflective (amorphous) states. The stated life of a DVD-RW disc is in excess of 1,000 write/erase cycles.

DVD-RW has compatibility issues

similar to those of the other forms of recordable DVD. Most players can play a DVD-RW, but if you don't know the player type and its compatibility with the media ahead of time, you can't be sure the disc will play.

Remarkably, the behavior of a player with a DVD-R disc does not predict its behavior with a DVD-RW disc or vice versa. If a DVD-R disc fails to play, it's generally because of difficulties with the reflectiveness at a given wavelength. The metallic *write* layer of DVD-RW has plenty of reflectiveness across a broad range of wavelengths, but the reflective characteristic matches what the DVD spec defines for the *second* layer of a dual-layer disc (also known as a DVD-9 disc). The firmware of some players sees that characteristic and assumes it should change focus to see deeper into the disc than it actually should. According to the manufacturers, the issue for a given player can be fixed by a firmware update.

Most DVD-R General drives also support DVD-RW, but blank DVD-RW discs are considerably more expensive. A good strategy might be for you to have a very small number of DVD-RWs to use as scratch discs and to use more affordable write-once DVD-R media for anything you want to give out or keep for an extended time.

FIG. 5: Compaq is the first computer manufacturer to offer the Pioneer DVR-103 DVD-R drive as an option for PC. It is part of the top-of-the-line Presario 7000 workstation series.

DVD+RW. Just to make life even more interesting, a group of companies (including Sony, Hewlett-Packard, and Phillips) is pushing an alternative read/write format that is incompatible with both DVD-R and DVD-RW. The format is called DVD+RW (pronounced *DVD plus RW*, with the implication that the other format is somehow DVD *minus* RW).

The availability of DVD+RW drives and media is lagging behind that of DVD-R. However, the DVD+RW Alliance has announced a full rollout of DVD+RW products during the summer of 2001. By the time you read this, DVD+RW may be much more widely available than it is at the time of this writing.

The DVD+RW Alliance claims that DVD+RW is more compatible with existing players than is DVD-RW and that the medium is better suited for real-time video recording and editing applications. That remains to be seen. Until real-world field experience with DVD+RW can be obtained, it's impossible to assess the relative merit of the format over DVD-RW.

DVD-RAM. The remaining competing format, DVD-RAM, has been available for years, is fully rewritable, and costs even less than DVD-R. The problem for DVD-RAM is opposite that of DVD+RW: it has essentially no compatibility with commercially available consumer players. For most purposes, DVD-RAM disks can be used only in computers with DVD-RAM drives.

However, DVD-RAM's proponents—notably Panasonic and Hitachi—are continuing to develop the format and have shown conceptual prototypes of

DVD-Video and DVD-Audio Capabilities

This table summarizes the features of the DVD-Video and DVD-Audio formats. Although DVD-Audio offers superior fidelity for surround applications, DVD-Video players and tools are far more prevalent and affordable.

	DVD-Video	DVD-Audio
Audio Features		
PCM stereo resolution and sampling rate	Up to 24-bit at 96 kHz	Up to 24-bit at 192 kHz
Multichannel surround options	Data-compressed in Dolby AC-3 or DTS format from 16- or 24-bit source at 48 kHz	PCM up to 24 bits at 96 kHz, with MLP lossless compression
Visual Features		
High-grade full-motion video	Yes	No
Slide-show features	Keyed to time and not advanceable by user without interrupting audio	Still pictures may be advanced or accessed randomly while audio plays
Multistream Media		
Alternate audio streams	8	1
Alternate subtitle or graphic streams	32	1
Alternate visual angles	9	1 (still only)
User Navigation		
Still menus	Yes	Yes
Motion menus and transitions	Yes	No
Random selection during play	Yes	Yes
Options for Interactivity		
Built-in scripting language	Yes	No

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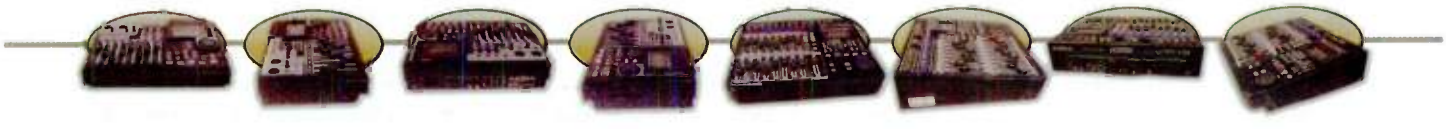

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a number of consumer appliances, such as video recorders, based on the format. In a nod to the way things are shaping up, though, Panasonic's new LF-D311 Combo Drive will record and play DVD-R and DVD-RW as well as DVD-RAM.

CHOOSE YOUR FORMAT

If you find all of this a bit confusing, you are not alone. Ultimately, market realities will help you narrow down your format choices.

Unless the DVD+RW format comes on strong during the middle of 2001, DVD-R and DVD-RW will be the de facto winners. Those formats have a strong installed base of drives and media that are compatible with the majority of DVD players in the field. Some share of those players will also be DVD-RAM compatible, which may give an edge to that format in certain applications. But my bet is that from here on out, the term *recordable DVD* will be synonymous with DVD-R and DVD-RW.

Still, the compatibility issues between recordable DVDs and consumer-level DVD players persist. Unfortunately, none of the manufacturers will admit that their products have those problems, so acquiring useful, objective information is difficult. To see the best publicly available compatibility listing for DVD-R General, visit Apple's Web site on DVD compatibility (www.apple.com/dvd/compatibility). The list is by no means complete, but it is updated on a regular basis as new products are tested.

Eventually, problems with player compatibility will go away. Newer players are generally fully compatible with DVD-R and DVD-RW, and the majority of consumers still have not bought their first DVD player. Therefore, we can expect the number of incompatible players to diminish.

COURTESY OF APPLE

FIG. 6: Apple refers to the optional Pioneer DVR-103 drive included in its high-end G4 workstation as a Super Drive because it writes DVD-R General, DVD-RW, and CD-RW media and reads all of those as well as DVD-ROM, DVD-Video, CD-ROM, and CD-Audio.

FILE SYSTEMS AND ACCESS

Physically, an optical disc is nothing more than a platter covered with pits and dots (or light and dark areas in recordable media) arranged into a very long spiral track, with *redundancy codes* and *marks* that allow the stream to be converted reliably into a string of digital bytes. Before anything very useful can be done with an optical disc, a means of locating the information stored on it is needed. The DVD specification provides more than one way for a reading device to retrieve information from a disc.

When the compact disc came into being, it was conceived as an audio playback medium, so a simple addressing scheme was developed: from the head of the disc, a CD player reads a *table of contents*, which identifies the location of tracks and indexes based on a *sector offset*. That addressing system gives the CD player its random-access capabilities.

When CD technology was first used with computer applications, developers found that there was no specification for arranging files hierarchically. The result was that for a long time the CD-ROM format had compatibility problems from one computer to another.

Eventually the computer industry created a standardized file system called ISO-9660. The ISO-9660 standard has certain limitations, for example, short file names and a limited ability to nest folders. Nevertheless, the standard allowed CD-ROMs to flourish as a common format.

In formulating the DVD specification, DVD Forum members were careful not to make the same mistakes. For example, CDs were originally designed as a consumer format. Later, developers had to graft the computer elements onto the consumer format to make CD-ROMs. The DVD Forum also recognized that the sector offset scheme employed in CD audio is frequently more suitable for low-cost consumer players because it doesn't take as much memory and processing power to execute.

DVD makers wanted to agree on a file system early in the game. As a result, the DVD specification mandates that every disc will include two complete file systems. One is a new, far more sophisticated file system called

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Twenty-four track masters for under $10 each!! Divide the cost of a Mackie Media M90 into the 20+ pop tunes you can record on it and you'll appreciate why we call it an affordable medium. Non-linear hard drives store audio data only, not silence. Tape (and linear hard disk recorders) just roll merrily along… eating oxide and costing money.*

*based on average of length of current pop songs using 24 tracks @48kHz/24-bits and a liberal number of extra regions and virtual takes. Does not apply to extended trance remixes.

Editing is easy with the HDR24/96.

Plug in an SVGA monitor, keyboard and mouse, choose from 2x, 4x, 8x, 12x or 24-track views and then watch them scroll smoothly past a centerline.

Mark hundreds of cue points and 4 locate points for looping and auto-punch-in modes.

Use the mouse to "scrub" individual tracks, Cue, Punch and Loop points with continuously variable velocity.

You can mark a segment (or multiple non-adjacent segments) as a *region* and then cut, copy and paste it anywhere — onto a blank track or right in the middle of an existing track without erasing anything. The part of the track after the insert just "slides down".

You can audition regions or modify their start/end points instantly, capture them as "sound elements" for later use or quantize them to user-defined time grids.

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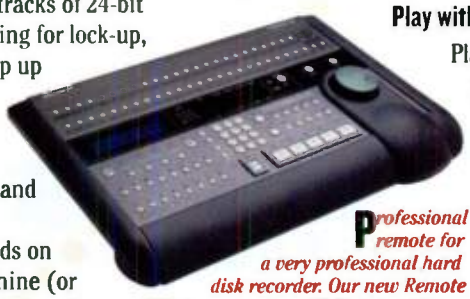

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Universal Disc Format (UDF) that overcomes many of the limitations of ISO-9660 while making the management of rewritable media much more straightforward. However, no computer at the time the DVD spec was formalized had UDF implemented, so it was necessary to include ISO-9660 as an alternative file system. The particular model of DVD player you have will determine which access scheme is used.

One powerful advantage of the standardized file system is that every DVD disc is inherently readable by computer, without any special preparation or software needed. That makes it easier to incorporate computer-specific enhancements into a DVD title, including bonus elements such as screen savers, wallpaper, games, and Web connections. Such enhancements have become a popular way to add value to commercial DVD titles.

APPLICATION LAYERS

The *application layer* is the specific arrangement of a set of files on a disc. For example, the definition of the DVD-Video application layer includes the kinds of media content that can be played, the options that are available, and the means of describing the intended relationships. That framework allows content creators to take advantage of the format's interactive possibilities, such as multiple audio streams, menu-based navigation, and switchable subtitles, with full assurance that the results will be compatible with any DVD player.

The specification of the physical format and file systems consumes approximately 100 pages of the DVD spec. Defining what goes into an application layer such as DVD-Video takes an additional 500 pages.

The definitions in the application layer appear on the disc as a specific set of files arranged inside a directory with a fixed name, such as Video_ts on a DVD-Video disc (see **Fig. 3**). You can look at the directory by putting the disc into a DVD-ROM–equipped computer and using the computer's browser to examine the file structure. Inside the Video_ts directory, different files are designated as media content (VOB files, which contain video, audio, and overlay information multiplexed together in a tightly defined pattern) and navigation (IFO) files. The navigation files consist of a set of tables and pointers that tell the player everything it needs to know about the content and how the author wants it to play. Every IFO file is accompanied by a backup (BUP) file.

A DVD's directory can be stored on hard disk or other media besides DVD. A subculture of DVD applications involving DVD-Video–format content stored on CD has already sprung up. Such discs are incompatible with the great majority of DVD players, but they play well on computers. That Mini-DVD format (which is not a standard, by the way) is not very useful for music, however, because computer-based DVD players do not tend to support high-density audio and are rarely connected to surround-sound playback systems.

DVD-VIDEO VS. DVD-AUDIO

Two different application layers exist that apply to the needs of musicians. What most people think of as DVD is DVD-Video. But another format, DVD-Audio, is specifically tailored to the interests and needs of audiophiles and music producers.

Although the DVD-Audio specification is attractive, the format is far less established in the marketplace than DVD-Video, and tools for producing DVD-Audio content are harder to find and more expensive. That set of circumstances could potentially change, but currently, producing DVD-Audio content is out of the price range of most musicians.

Tools for creating DVD-Video content, on the other hand, are readily available at a wide range of price points. It therefore makes sense to focus on the application of DVD-Video for music while monitoring the development of DVD-Audio. Even if DVD-Audio continues to develop slowly in the consumer world, a set of simple, low-priced authoring tools

DVD Capacity and Nomenclature

For a number of reasons (including marketing considerations), the data capacity for DVD discs is nearly always stated in billions of bytes, which is represented by a *G*, rather than in computer gigabytes (GB). That can lead to confusion because a gigabyte (1,073,741,824 bytes) is significantly larger than a billion bytes.

The stated capacities for various forms of replicated and recordable DVD may therefore be less than you think. The table below lists several forms of DVD—replicated and recordable—and their data capacities in gigabytes and billions of bytes. I've intentionally omitted double-sided forms of DVD from the table.

Most of the computer operating systems we use today (the various forms of Windows and the Mac OS) list the sizes of files and directories both in gigabytes and in absolute byte count. When assessing the size of a file or directory that you want to put on DVD, always look at the absolute byte count, and you won't go wrong.

Recordable Formats	Capacity in G (billions of bytes)	Capacity in GB (computer gigabytes)
DVD-R Authoring 3.95G	3.95G	3.678 GB
DVD-R Authoring 4.7G	4.7G	4.377 GB
DVD-R General	4.7G	4.377 GB
Replicated Format		
DVD-5 (single-sided/single-layer)	4.7G	4.377 GB
DVD-9 (single-sided/dual-layer)	8.54G	7.953 GB

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would make it a useful format for content development.

DVD-Video gives you 2-channel audio at 24-bit, 96 kHz resolution, as well as discrete surround channels (albeit compressed in Dolby AC-3 or DTS format). The DVD-Video standard stipulates that all DVD players must be able to play audio streams in Dolby AC-3 format with as many as 5.1 (three front, two rear, and one subwoofer) channels. The specification also provides for the use of audio compressed in the DTS format. Many consider DTS a higher-fidelity alternative, though player compatibility is not mandated by the DVD specification. To make use of DTS in a DVD title intended for the open market, it's necessary to include an alternate version in Dolby AC-3 or pulse-code modulation (PCM) stereo format.

A carefully compressed surround track in Dolby AC-3 or DTS can sound stunning and can be reproduced by commercially available home-theater systems. Compressed audio, however, is certainly not acceptable for archival or production. For those purposes, data can be placed as raw files in the ROM area of the disc, where any computer with a DVD-ROM drive can access it.

Although DVD-Video supports purely audio applications quite nicely, musicians must take into account the format's requirements. In particular, the DVD-Video spec requires that some sort of picture be present in order to play audio at all. To produce pure audio titles in the DVD-Video format and satisfy that requirement, DVD-Video authors place a single still image in the video track. The image can be black or a simple listing of the title. Not all DVD-Video production tools support the use of still images, so that is a feature to look for when you select DVD authoring software.

DVD-VR

An additional application layer definition is aimed at consumer video recording and editing applications using the three rewritable formats (DVD-RAM, DVD-RW, and DVD+RW). The Video Recording format (DVD-VR) specification allows for random-access assembly editing and for trimming of video and audio segments.

Pioneer and Panasonic have shown DVD-based consumer video editor/recorders using the recordable format favored by each (DVD-R and DVD-RAM, respectively). The devices are ingenious in their operation and capabilities, but whether they strike a chord with the buying public remains to be seen.

It is not clear at this point whether the audio capabilities of DVD-VR devices will be of interest to musicians, but it is a possibility. The next generation of portable audio workstations could certainly be based on some form

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of recordable DVD rather than depending on hard disk or MiniDisc.

PRO DVD-R DRIVES

The field of recordable DVD products is in considerable flux; affordable drives and media are just beginning to hit the market. The following describes the products available for summer 2001.

Pioneer DVD-S201. At $5,400, Pioneer's S201 (now venerable after almost two years on the market) may not be affordable for most **EM** readers, but there's no doubt that it's the standard for professional DVD production. It supports DVD-R Authoring media in both 3.95G and 4.7G formats as well as CMF for mastering directly from DVD-R. The drive is produced exclusively as a standalone unit with its own power supply and SCSI interface.

Although economics may dictate the use of DVD-R General products for most personal-studio musicians, there are many service bureaus that offer services using the S-201. It's a good idea to use such a bureau for the occasions when you need to burn a 3.95G disc for its superior player compatibility or to produce a CMF replication master.

Pioneer DVR-103 and DVR-A03. Pioneer currently produces the leading presence in DVD-R General drives: the DVR-103 and DVR-A03 (see **Fig. 4**). Those units, which are otherwise identical, are packaged for OEM and aftermarket, respectively.

Sometimes referred to as Super Drives (particularly by Apple), the DVR-103 and DVR-A03 drives record DVD-R and DVD-RW as well as CD-R and CD-RW. As players, they support all forms of replicated DVD and CD including CD-R, CD-RW, DVD-R, and DVD-RW. The drives do not support competing recordable DVD formats such as DVD-RAM and DVD+RW, however.

Both drives use the ATAPI interface, which might complicate the process of adding either drive to existing, heavily SCSI-based systems. Currently, the DVR-103 is shipping in limited quantities in computer bundles from Compaq and Apple, but at an estimated street price of less than $900, the standalone DVR-A03 is setting the pace for price and performance in recordable DVD.

Panasonic LF-D311 Combo Drive. Not to be outdone, Panasonic has announced that its LF-D311, a combination DVD-R and DVD-RAM (but not CD-R) drive, would be available in the early part of the summer. The company indicated that prices would be comparable to those of the Pioneer units.

Also using the ATAPI interface, the Panasonic drive is likely to be a strong contender in OEM and aftermarket configurations. The drive will be of interest to those who would like to use the lower-cost reusable DVD-RAM media during title development but who still want to be able to deliver a write-once player-compatible DVD-R to clients or replicators.

PC BUNDLES

DVD-R General drives are available only in bundled configurations. Here's a quick look at the two systems that are on the market.

Compaq Presario 7000. The current top end of Compaq's range, the Presario 7000, is available in a wide range of configurations. One option is the inclusion of the Pioneer DVR-103 drive (see **Fig. 5**). A representative configuration (1.2 GHz Athlon processor, 384 MB DRAM, and 40 GB hard drive, but no monitor) with DVD-R lists at $2,445 on Compaq's Web site.

Apple Power Mac G4. The G4 (see **Fig. 6**) is available with the Super Drive in a standard configuration at a price of $3,499. That setup includes a 733 MHz processor, 256 MB DRAM, and a 60 GB hard disk (without monitor).

Both systems come bundled with entry-level DVD-authoring software. Compaq includes Sonic Solutions *DVDIt;* Apple includes its own program, *iDVD.* For musicians, there's a good chance that the bundled software won't meet the needs of production, because those products tend to support only a small subset of DVD-Video's audio capabilities.

CONSUMER DVD RECORDERS

To date, both Pioneer and Panasonic have introduced standalone recorders for consumer use. In their current iterations, the DVD-R–based DVR-1000 ($2,035) from Pioneer and the DVD-RAM–based DMR-10 ($3,995) from Panasonic are focused entirely on home-video applications and support only two channels of data-compressed audio. Both units include capabilities for trimming and sequencing clips, similar to those on MiniDisc devices. However, discs recorded on either DVD recorder will not play on standard DVD-Video players.

Those particular commercial units may not be of immediate interest to musicians, but the possibility certainly exists that more sophisticated recording and production devices based on recordable DVD technology could become available in the near future. For example, application standards for DVD Audio Recording (DVD-AR) and DVD Stream Recording (DVD-SR), analogous to the DVD-VR standard on which these products are based, are currently being developed.

LOOKING AHEAD

In the coming months, you can expect the pace of technological development and product introductions to accelerate. DVD recordable drives will become increasingly prevalent, and more computer bundles and aftermarket add-on drives will become available.

I expect that, eventually, recordable DVD will replace CD-R and CD-RW in terms of affordability and market prevalence. Furthermore, standalone DVD-based recorders for video and audio will become more common. Surprises are still possible, but based on current trends, it seems that the majority of the drives installed in computers will be based on DVD-R and DVD-RW technology in combination with CD-R, CD-RW, DVD-RAM, or DVD+RW formats.

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Part Two: DIY DVD

No matter which recordable DVD formats become standard, musicians will want to use DVD for delivering music, video, and interactive content. In this section, I will examine the production processes and the hardware and software needed to create discs compatible with standard consumer DVD players.

DVD-AUDIO VS. DVD-VIDEO

Of the two consumer-oriented DVD formats, DVD-Video has caught on most quickly. DVD-Video has been as aggressively developed for distributing movies as the compact disc was for music. Standards were worked out early, compatible players have been manufactured in huge quantities, and many thousands of titles are available.

Whereas DVD-Video provides a rich set of features for movies and interactive entertainment, DVD-Audio focuses almost entirely on high-fidelity and advanced multichannel sound.

Because the specification took so long to solidify, DVD-Audio is just now entering the market. Factors that delayed the release for more than a year include intellectual-property rights protection and copyright infringement—the debate over DeCSS, which can be used to crack DVD copy protection, for example.

Until recently, most consumer players couldn't play DVD-Audio. Now, there are players available that play both DVD-Audio and DVD-Video. More players on the market will now have dual-format capability, so the population of compatible players will increase dramatically with time. Only a few dozen DVD-Audio titles are available, but the major labels that support DVD-Audio (Warner Brothers, primarily) promise to make a large body of titles available at the beginning of the 2001 holiday season.

WHY DVD-AUDIO?

With sampling rates as high as 192 kHz and digital word lengths to 24 bits, DVD-Audio offers the highest resolution available in a commercial digital-audio playback medium. That means that the information density of DVD-Audio is greater than that of CD by a factor of nearly 800, and DVD-Audio has double the highest audio density available in the DVD-Video format.

In terms of multichannel surround sound, DVD-Audio gives you six channels of uncompressed high-resolution PCM sound. On the other hand, delivering multichannel surround sound on a DVD-Video requires Dolby AC-3 or DTS data compression, which have lower audio fidelity.

DVD-Audio lets you use still pictures to accompany audio tracks. When connected to a video screen, DVD-Audio can display as many still pictures as desired, and you can switch from picture to picture without interrupting the audio track. DVD-Video also provides still images, but pictures are locked to sound and cannot be advanced without disrupting playback.

Most commercial DVD-Audio releases include at least one music video. The video is played from a DVD-Video area on the disc, so the audio specs accordingly decrease to those of DVD-Video. If your projects are based on audio accompanying video, DVD-Audio offers no fidelity advantage.

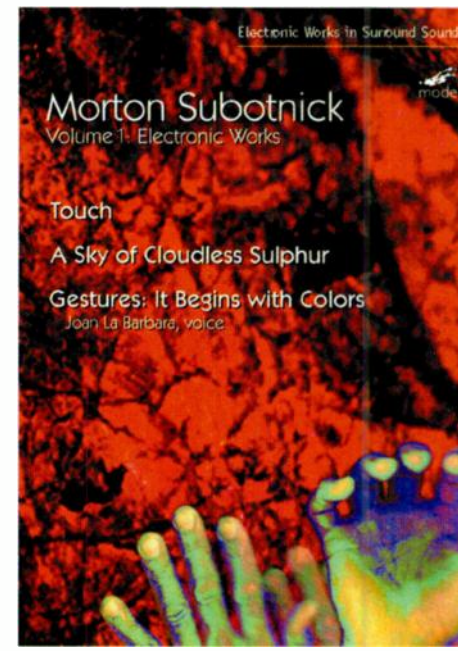
A single disc can include separate DVD-Video and DVD-Audio programs. Because the player population currently is disproportionately slanted toward DVD-Video players, nearly all commercial DVD-Audio releases are dual-format. Both formats have essentially the same program material, but with reduced audio specifications for the DVD-Video portion.

MASTER CHARGES

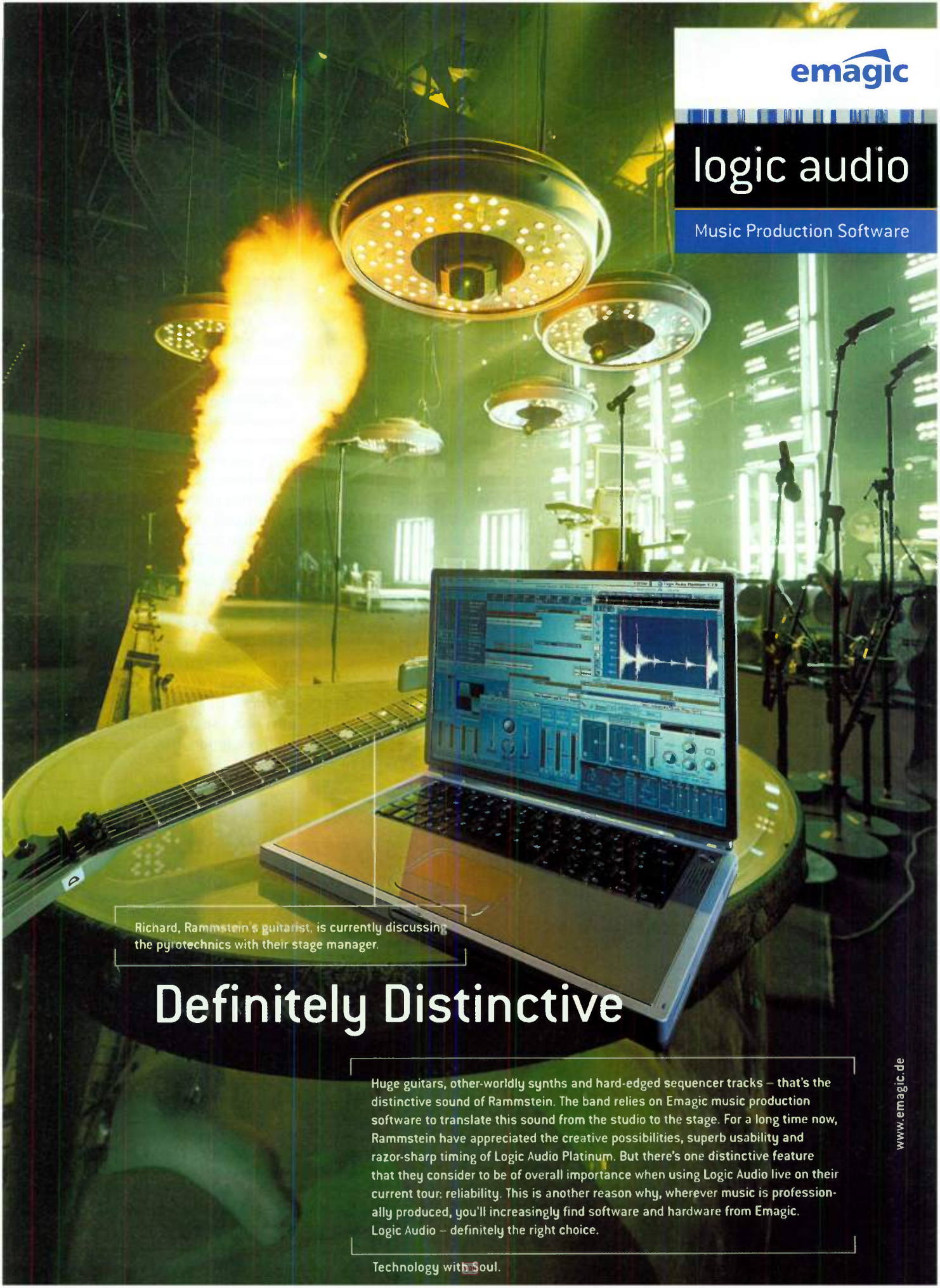
Because DVD-Audio has been slow to emerge as a consumer product, the state of the authoring software is about where it was for DVD-Video three to four years ago. Few programs are available for DVD-Audio, and they are expensive. The least expensive authoring package sells for $6,000 and doesn't cover all features in the medium. A full production system capable of authoring commercial DVD-Audio titles will cost in the low tens of thousands. Authoring tools for DVD-Video are available for a range of prices and include affordable offerings that support most, if not all, of DVD-Video's advanced audio capabilities.

Eventually, the price of DVD-Audio authoring tools will decrease. For now, musicians without major resources who want to take advantage of consumer DVD's capabilities will have to work in the DVD-Video format. That is not necessarily a bad thing: DVD-Video offers many of the capabilities of DVD-Audio as well as more options for interactivity and combining music with visuals.

I will now focus on the tools and techniques needed to take advantage of DVD-Video's audio, video, and interactive features with regard to musical applications.



Morton Subotnick's *Volume 1: Electronic Works* (Mode Records) is an excellent example of a multiformat DVD. One side offers uncompressed surround DVD-Audio. The other includes DVD-Video versions of the music in Dolby Digital and DTS and a stereo PCM version. The DVD also has interviews with the composer.



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AUDIO ON DVD-VIDEO

As mentioned previously, audio material can be put on a DVD-R in the DVD-Video format using readily available and reasonably priced software. Because DVD-Video was designed with video in mind, it has some special considerations.

Remember that the DVD-Video spec doesn't allow you to put audio on a DVD-Video disc without some kind of video track or still image. If your work is not video oriented, you can fulfill the requirement by placing a single still picture at the head of each audio track. You can also use a succession of stills to form a slide show to accompany your music.

Unfortunately, some of the DVD-Video authoring programs, especially inexpensive and bundled software packages, do not support the use of still pictures. When choosing a DVD-Video authoring program, be sure your selection will let you use stills in place of video.

DVD-Video lets you make as many as eight different audio programs available. The viewer can switch between audio streams, using the DVD remote control. For movie titles, the various audio programs commonly contain foreign language tracks, commentary, and alternate mixes for stereo and surround. Karaoke titles often use the alternate audio streams to provide versions with and without vocals and guide melodies.

Lower-priced DVD authoring packages may only support basic capabilities for data-compressed stereo. The audio options you want supported on your DVD may determine how much you will need to spend on an authoring package.

SOUND AND COMPRESSION

Data compression preserves disc space. For video content on commercial DVDs, the accompanying 2-channel audio is commonly compressed in the Dolby AC-3 format. However, producers may not want to use data-compressed audio unless they need longer playing time. Fifty-four hours of continuous stereo audio material can be put on a 4.7G DVD-R disc using AC-3 compression.

The question of choosing a data compression format for stereo sound in DVD-Video involves an interesting twist. The DVD-Video specification lists MPEG-1 Layer 2 audio (a sibling of MP3) as an option for DVD-Video, but it requires that a track be in Dolby AC-3 unless uncompressed PCM audio is used. MPEG-1 audio is effectively free, but Dolby collects a royalty on every AC-3 encoder and decoder in the field. For manufacturers and musicians looking to save money, the incentive is to try to get by with MPEG-1 Layer 2 compression. Unfortunately, the manufacturers of DVD players have interpreted the specs differently. Most American DVD players will play MPEG-1 Layer 2 audio. Note that MP3 is not a part of the DVD spec, although a few DVD players can play MP3s from CD or DVD.

HIGH-DENSITY PCM STEREO

Sampling rates for PCM audio on DVD can be either 48 or 96 kHz, with a bit resolution of either 16 or 24 bits. For stereo PCM audio, the only advantage that DVD-Audio has over DVD-Video is the support of 176.4 or 192 kHz sampling rates. To date, however, those rates have been used little even in DVD-Audio releases.

High-density PCM audio is bandwidth-hungry, and commercial DVD-Video titles generally use it only if audio is an important aspect of the program, as it would be in a concert video. The data-transfer rate for DVD is constrained to a total of 9.8 million bits per second (mbps) for audio and video combined. A program with 24-bit audio at a sampling rate of 96 kHz consumes more than 4.6 mbps, leaving a marginal amount of bandwidth for video and alternate audio streams.

DVD-Video does not support the CD sampling rate of 44.1 kHz. If you have occasion to transfer audio from CD to DVD, you need to convert the sampling rate of the audio before you can move it to DVD-Video. DVD-Audio, on the other hand, supports 44.1 kHz and its multiples, 88.2 and 176.4 kHz.

Lower-cost DVD authoring software may or may not support higher densities of PCM audio, and unfortunately, that information is not always evident from a manufacturer's data sheets. If you plan to make use of DVD-Video's capacities for ultrahigh fidelity, check that the authoring software you select lets you import and use high-sampling-rate and high-resolution PCM audio.

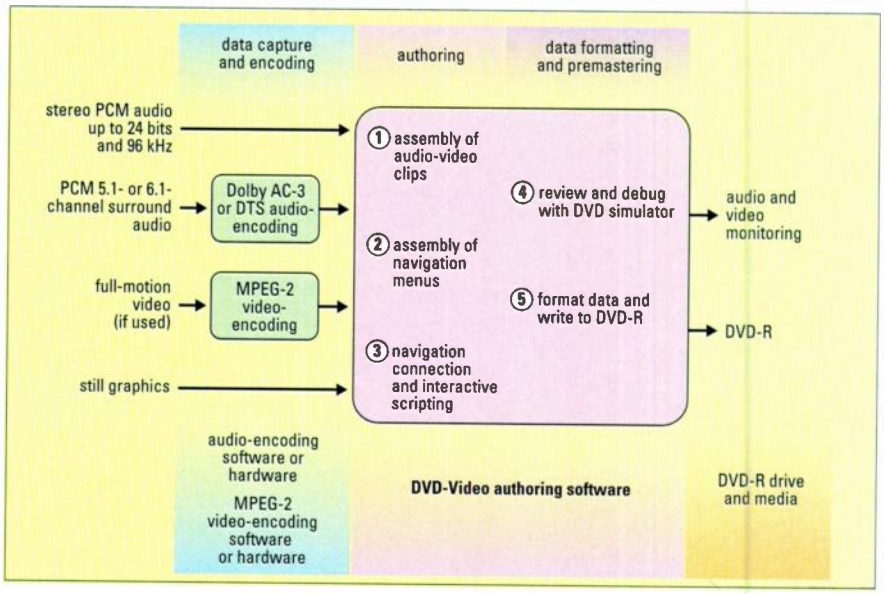

FIG. 7: This diagram shows the process of DVD-Video production and the hardware and software tools required. DVD-Video authoring software packages usually include DVD-simulation and data-formatting tools. Encoding may be included but is often purchased separately.

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DOLBY AC-3 AND DTS

If you always wanted your music to be heard in multiple channels, now's your chance. Multichannel surround may be the coolest aspect of DVD for musicians, and DVD-Video is the format that has turned discrete multichannel playback capability from an exotic thrill to a viable release format for music.

In DVD-Video, multichannel surround audio (5.1 or 6.1) must be data-compressed into Dolby AC-3 or DTS formats. Data compression reduces the bandwidth and file size required for multichannel audio, allowing video and surround audio content to fit in the same program. Every DVD player will play tracks in Dolby AC-3, but only the minority can play back DTS. In addition, encoding and authoring tools for AC-3 are much more common and affordable than the products that support DTS.

If you are going to do multichannel surround work on DVD and you're not going to wait for friendlier DVD-Audio software prices, you will need a way to encode multichannel audio into AC-3 format. You will also need decoding capability for monitoring.

Many titles that use discrete surround audio have a stereo version of the same material for playback on systems not set up for multichannel surround. AC-3 provides for automatic mixdown of its five full-bandwidth channels into one stereo pair, but often results are not optimal.

Numerous musicians and producers prefer the sound of DTS compression. DTS uses higher bit rates for the same number of channels, which enhances fidelity. Because DTS not a format that players are required to support, titles that have a DTS surround track usually also carry an AC-3 version of the same material. Alternate stereo PCM tracks are included in many cases.

Unfortunately, most low-cost DVD authoring packages do not support DTS audio. You may have to go to the expensive professional packages to get full DTS capability for DVD-Video.

If you plan to create multichannel surround content in AC-3 or DTS, familiarize yourself with your tools, encoding's effect on sound quality, and the options and settings of your encoding software or hardware. Pay attention to levels and to bit rates. Data-compressed audio can sound really good—if you work at it.

Here's an AC-3 tip: for any given configuration, select the next higher bit rate from the one Dolby recommends. If you are doing 5.1, Dolby recommends 384 thousand bits per second (kbps), but comparative listening will convince you that 448 kbps (the next higher rate) sounds better in the higher frequencies.

DECODE YOURSELF

Another feature to look for in a DVD authoring package is monitoring capability for discrete surround sound. Few of the available packages that include hardware and software can directly decode AC-3 5.1 or DTS audio to multiple channels. Most systems that use hardware for decoding and video monitoring are able to output AC-3 as an S/PDIF bit stream that can be decoded externally. DTS output capability is less common. In either case, an external decoder, such as a consumer receiver with Dolby and DTS capability, is required.

If you want to release multichannel surround titles but don't care about using DVD's other visual and interactive features, another option that can save you money is available. You can encode audio into DTS and burn it in CD-Audio format. The resulting discs play superbly on DTS-capable DVD systems and on CD players connected digitally to a DTS decoder. If you have a CD burner and

DVD REFERENCES

Delve further into the worlds of DVD and DVD-recordable technology with these references.

BOOKS

DVD Demystified, 2nd ed.
By Jim Taylor (McGraw-Hill, 2001; $49.95)
This is the original (and only) general reference to DVD available to the general public. The second edition includes information about DVD production methods and DVD-Audio that is not found in the original. If you are serious about DVD, you need this book.

DVD Specifications
Available from DVD Forum (www.dvdforum.org; $5,000).
The complete arsenal of DVD specs is available for a mere $5,000 and the signing of a *really* stiff nondisclosure agreement. Its several hundred pages of incredibly dense information are not for the faint of heart.

WEB SITES

DVD FAQ
(www.dvddemystified.com/dvdfaq.html)
Jim Taylor's DVD FAQ is a rich source of information. The data overlaps with that presented in his book *DVD Demystified,* but it is subject to frequent updates.

DVDMadeEasy
(www.dvdmadeeasy.com)
Mark Johnson, one of the most knowledgeable and experienced DVD producers, has aimed his site directly at those who are producing DVD content. Free membership gives you access to a range of articles and forums.

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multichannel content, the only additional tool required is a DTS software encoder.

DVD-VIDEO ADVANTAGES

Besides its advanced audio capabilities, DVD-Video offers cool features for interactive entertainment. Whether you are involved with visual production or not, the picture capabilities of DVD-Video may be an avenue for collaboration and a way to finance your gear and software with commercial video work.

DVD also provides an option for multiple parallel video streams called *camera angles* (the alternate streams can be anything you like, not just different views of the same thing). Viewers can select the streams or incorporate an interactive program to select for them.

For example, once play begins, you can have your title randomly select one of the DVD's eight alternate audio versions of a music piece and one of nine alternate video or computer graphic realizations to accompany it. That yields 72 ways a listener might experience a single piece.

In addition, DVD-Video can put simple graphic images on the screen over video or stills; as many as 32 alternate graphic streams can be available to the viewer. In commercial DVD titles, that overlay capability is used mostly for subtitles, but the same mechanism can be used for other, more artistic, purposes. DVD-Video authoring programs vary widely in how they support DVD subtitling. If you are interested in more elaborate and creative uses, be sure to check the features available when shopping for your authoring package.

DVD-Video uses graphic menu screens for navigation, and navigation schemes can be arbitrarily complex. DVD menu screens can consist of video or animation (with or without audio). Screens can also connect by way of animated transition sequences.

DVD-Video lets you put graphic navigation buttons on the screen as the main content plays, not just in a dedicated navigation menu. That can be an excellent way to let viewers jump from track to track at any time. However, not all of the affordable DVD authoring software packages support that function.

In addition, DVD-Video offers a fairly elaborate programming environment for interactivity complete with mathematical functions (including random number generation) and data storage.

DVD AUTHORING SOURCES

The companies listed below make and sell the specialized products discussed in this article. The types of products and (where applicable) the platforms supported are described.

Apple Computer (www.apple.com/dvd and www.apple.com/dvdstudiopro): DVD-Video authoring software (Mac), video- and audio-encoding software (Mac), DVD Web-linking technology.

Audio Cube (www.sascom.com): DVD-Audio authoring software (Win), digital-audio workstations (DAWs; Win).

AuthoringWare (www.authoringware.com): DVD-Video authoring software (Win), DVD-ROM formatting software (Win).

Canopus (www.canopuscorp.com): video editing systems (Win), video- and audio-encoding products (Win).

Gear Software (www.gearsoftware.com): DVD-ROM formatting and writing software (Win).

Heuris (www.heuris.com): video- and audio-encoding software (Mac/Win).

Intec America (www.inteca.com): DVD-Video authoring software (Win), DVD-ROM formatting software (Win).

Interactual (www.interactual.com): DVD Web-linking technology.

Matrox (www.matrox.com): video editing systems (Win), video- and audio-encoding products (Win).

Minnetonka Audio (www.minnetonkaaudio.com): DVD-Audio authoring software (Win), audio-encoding software for AC-3 and DTS (Win), 5.1-audio-production software (Win).

Panasonic (www.panasonic.com): DVD burners.

Pioneer New Media Technologies (www.pioneerprodj.com): DVD burners.

Pinnacle Systems (www.pinnaclesys.com/professionaldivision.asp): DVD-Video authoring software (Win), video editing systems (Win), video- and audio-encoding products (Win).

Prassi (www.prassieurope.com): DVD-ROM formatting and writing software (Mac/Win).

Roxio (www.roxio.com): DVD-ROM formatting and writing software (Mac/Win).

Sadie (www.sadieus.com): DVD-Audio authoring and MLP encoding software (Win), DAWs (Win).

Sonic Solutions (www.sonic.com): DVD-Video authoring software (Mac/Win), DVD-Audio authoring software (Mac),video- and audio-encoding hardware and software (Mac/Win), DVD Web-linking technology, DAWs (Mac), DVD-ROM formatting software (Mac).

SpinWare (www.spinware.net): DVD Web-linking technology.

Spruce Technologies (www.spruce-tech.com): DVD-Video authoring software (Win), video- and audio-encoding hardware (Win), DVD Web-linking technology tools, DVD-ROM formatting software (Win).

Vitec Multimedia (www.vitecmm.com): video- and audio-encoding hardware and software (Win).

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Everything, Everything by Underworld is a good example of what can be done in the DVD-Video format. The concert disc includes audio streams in 5.1 AC-3 and AC-3 stereo, both of which sound quite good. Spoken portions are provided in English, Gaelic, and Japanese.

The viewer has the option of selecting the concert footage or abstract video art on an alternate video angle. The viewer can select individual cuts for play or can define a specific order for the songs. On computer, a Macromedia *Director* presentation offers Web connections and more ways for viewers to interact with sound and picture.

HYBRID APPLICATIONS

For playback on a DVD-ROM–equipped computer, some interesting possibilities exist for combining DVD-Video content with computer-based material. By playing a DVD on a computer, for example, particular scenes and viewer actions can link your browser to corresponding Web sites. That type of interaction can be used to engage viewers more deeply or simply to involve them in online exchanges such as chats or product purchases.

Web-linked DVD has been such an intriguing idea commercially that the largest makers of DVD-Video authoring software incorporate some form of Web-linking capability in their applications, even at the low end. In most cases, creating a Web link entails entering a URL associated with a menu button or index (also called *chapter* or *scene* in DVD-Video) during the authoring process.

The cost to incorporate Web-linking into DVD projects depends on how elaborate you want to get. Even many inexpensive DVD authoring programs provide simple ways to link index points and menu buttons to specific Web addresses. But if you want to create refined Web-linked multimedia experiences, you may need more advanced software tools that allow DVD-playback windows and browser windows to fit together as orderly frames in a customer *skin*.

Web-linked DVD also has compatibility issues because of manufacturer implementation and the myriad configuration possibilities of users' PCs. Web-linked DVD can work for you, but expect a residue of playback problems to accompany any implementation.

DVD PRODUCTION

Now that I've addressed the possibilities of the DVD-Video format, I'll discuss how they're implemented. **Fig. 7** illustrates the process of DVD-Video production and the specialized tools that it requires. The process is essentially the same for DVD-Audio.

Consumer DVD (both DVD-Video and DVD-Audio) is a complicated reproduction medium. To provide all of the available features in a form universally compatible with consumer players, the DVD spec defines specific requirements for media data formats and control structures; it spells out in lavish detail how to weave multielement media streams and fully programmable, interactive random-access control into several billion bytes of intricately interleaved media information and elaborate tables of control information. (The sidebar "DVD References" lists resources with the most complete information available on the DVD spec.)

In this section, I will focus on using the DVD medium to publish content already in existence. I will assume that you already have the means to produce audio content in high-density stereo or multichannel surround form to take advantage of DVD's capabilities, as well as any video content required.

Although the majority of audio and video content is generally created prior to DVD authoring, certain common graphic elements are needed specifically for DVD. Those may be as simple as the single still graphic used to accompany audio in the DVD-Video format, but they often include any number of navigation menus and still images.

Still graphics for DVD menus are commonly created using standard graphics programs such as Adobe *Photoshop*. Menu graphics for DVD consist of a background image and a graphic overlay with button selections indicated by highlighted colors.

Generally, graphics can be provided in nearly any still-picture file format, but the picture dimensions are constrained to 720 by 480 pixels for NTSC (North America and Japan) and 720 by 576 for PAL (the rest of the world). JPEGs from digital cameras and so forth can be included easily but must be scaled to those dimensions before being imported into the authoring applications.

DVD-Video can also include animated menus as well as transition sequences. Those short visual sequences can be created using nonlinear editors and animation programs such as Adobe's *Premiere* and *After Effects*. Video, however, must be captured to MPEG-2 before being imported into a DVD project.

CAPTURE AND ENCODING

With the exception of uncompressed PCM audio, all of the audio and video data formats for DVD are data compressed in one of a number of standards. Video for DVD is always compressed with MPEG-2, following specific guidelines on bit rate and picture scaling.

Encoding video may be of little concern to you, but it deserves attention. Commercially, MPEG-2 video encoding is often done using real-time hardware, usually in the form of a single-slot PCI card. High-quality hardware-based video encoders can be expensive. Fortunately, many affordable DVD-Video authoring packages include software-based MPEG-2 encoders suitable for creative and informal use. Although slower than hardware-based encoding, those programs can create loops for motion menus and other short connecting

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material, as well as for encoding primary video content (if you're willing to wait).

To review, multichannel audio for DVD-Video must be compressed using Dolby AC-3 or DTS. Compressing stereo audio content is optional.

Although audio is presented at full resolution in the DVD-Audio format, there is a provision for a form of lossless compression called Meridian Lossless Packing (MLP). Software encoders are available for MLP, but the prices are proportional to the high cost of DVD-Audio authoring software and, as such, are generally not within personal-studio budgets.

ELEMENTS OF AUTHORING

Authoring software for DVD must provide a structure for combining elements that work for DVD, and ways to view the results before they are committed to disc. That is done through DVD *simulation* or *emulation*. The authoring software must also be able to multiplex several gigabytes of multiple audio, video, and graphic streams, and create the elaborate files of tables and points that control navigation. Finally, it should be capable of creating the ISO-9660 and micro-UDF file systems required by the DVD spec and of writing them to disc or tape.

In the authoring phase, DVD authoring software generally provides an environment in which to construct clips of video and audio, which may include multiple audio streams, subtitles in varied languages, and scene-access points. A DVD-Video may include as many as 99 video clips or movies. As noted before, a DVD-Video clip can consist of audio with a single still picture as a placeholder when video is not required.

Most authoring software packages provide a separate editing environment for creating menu screens. It is generally a two-dimensional graphic editor that lets you place graphics, define button target areas, choose highlight colors that indicate selected buttons, and determine the behavior of the menu in response to the DVD-remote controls. DVD menus are sometimes used as viewer-controlled slides. In some titles, the number of individual menu screens reaches into the hundreds, although a dozen or so is more typical. If you are looking at a low-cost DVD authoring program, check for restrictions on the number of menus allowed.

The authoring software must also have a way to define the order in which different elements appear and how menu buttons connect to video clips or other menus. Some authoring packages do this by providing for entry of a command at the end of each video clip and each menu button. Other packages provide a tabular display of navigation connections, with drag-and-drop linking from a *Source* to a *Destination*.

Flowcharts and tabular views have strengths in different situations. Flowcharts make it easy to visualize simple structures but can become overcrowded when project complexity increases. Tabular views are less intuitive for simple work but have scaled up very well to the most difficult and complicated titles. It's worth considering the method of linking used in any authoring package you look at. Even relatively simple DVD titles can have dozens of individual links, and you want to be able to make those connections and review them easily.

Interactive scripting may not be a concern, but mid- to high-priced DVD authoring products support programming in the language defined by the DVD spec. That provides a set of machine-code-like instructions that accept user input, do math functions, store data, and make condition jumps to video clips or menus based on values stored in memory. The biggest limitation to interactive coding, however, is that the memory storage space is extremely limited, with a maximum of 16, 16-bit registers available.

Q.A. VIA SIMULATION

With all of the options available, creating DVD titles can get genuinely complex. Even simple titles have ample room for authoring errors. It's extremely important to see how your project will play before you commit it to disc. DVD-R media are getting more affordable, but not so much that you want to waste materials in order to find problems that could have been easily corrected prior to burning.

Any DVD authoring package worth having provides a means to *simulate* your DVD title during the authoring phase so you can test navigation links and verify that the media and behavior of the disc work as intended. The simulator typically provides debugging information such as the values of internal variables and the player's internal state.

Many packages also provide a way to review a title from hard disk after it has been compiled into the DVD-data format but before it is committed to disc. That is usually called *emulation* and consists essentially of playing the DVD content on hard disk using a standard DVD-player application.

PREMASTERING

Once audio-video clips and navigation menus are configured, connected, and checked by simulation, the data has to be compiled into the specific forms required for DVD playback, as defined by the DVD spec. Most authoring packages compile data to hard disk, creating a complete data set equal in size to the finished DVD. That requires you to have a block of free hard-disk space equal to the size of your project. Some recent authoring systems, however, are capable of formatting as they write to disc, which can save hard-disk space and time.

Most of the compiling time goes toward multiplexing video, audio, and subtitle data into a single composite stream. When a DVD player plays a selection, it reads the multiplexed data from the disc and reassembles it in the player's internal buffer while ignoring data from inactive video, audio, or subtitle streams. Without that elaborate multiplexing scheme, DVD playback wouldn't work.

The second part of the compiling process consists of generating the files (which are tiny compared with the gigabytes of audio and video information) that control the disc's navigation and behavior. Those files are defined down to the bit by the DVD-Video spec and

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are highly elaborate, incorporating information about the disc in forms that can be understood by any player in the world.

Finally, the DVD data structure must be incorporated into a disc image that embodies the ISO-9660/micro-UDF Bridge file system defined for DVD. In most systems, that final formatting operation is performed while data is being written to DVD-R or to DLT tape for mastering and replication.

LET'S GO SHOPPING

Because DVD-Video authoring has been a growing concern for a few years, the software products are comparatively mature. At the same time, the business is in transition from its commercial phase, in which authoring products were purchased by only a relatively small number of professional service providers, to a phase in which desktop musicians can afford them.

As a result, DVD-Video authoring products on the market span a huge range of price and functionality. With little agreement as to what features are most appropriate at a given price point, shopping for DVD authoring software can be daunting.

Selecting the right DVD authoring tool will depend on the applications you have in mind, your budget, your preferred platform (PC or Mac), and your feeling for the style and philosophy of a vendor's offerings. Authoring programs also vary in stability, a quality that doesn't come across in manufacturer's data. Trade notes with people who are using a manufacturer's products before making a decision.

PRODUCT TIERS AND TYPES

The field of DVD production tools is in flux, and manufacturers are rapidly adjusting their products to meet the emerging needs of content producers. In general, software for creating DVD-Video

falls into four general categories. Personal DVD-authoring software is often priced less than $200 and is easy to use, but it is sharply limited in function. Entry-level commercial software has a pro-style user interface—usually with a constrained feature set—and is priced from a few hundred dollars to $1,000.

In the several-thousand-dollar range are the midpriced commercial systems. They are robust products with a wide range of capabilities, though they may lack features used primarily for commercial DVD releases. The optional hardware encoding devices can raise the price even higher. Fully professional DVD production systems usually offer full support of the DVD spec and integrated high-end encoding. Their prices are in the tens of thousands of dollars.

As you may suspect, the product categories can overlap. Because manufacturers position their products differently, basing your purchases on data sheets alone is not recommended. To ensure you make the right selection, ask questions, exchange information with product users, and test the software in a realistic production situation.

Depending on your application and the functions included in the authoring package you select, you might need additional dedicated software or hardware products for video and audio encoding. Although a complete survey of specific products is beyond the scope of this article, the sidebar "DVD Authoring Sources" lists a number of suppliers of DVD-Video and DVD-Audio authoring programs, video- and audio-encoding tools, and DVD data-formatting software. Note that many of a software tool's most important qualities—such as completeness, style of interaction, and scalability—are unlikely to be reflected in the manufacturer's literature.

BURNING DESIRES

The viability of DVD technology in the personal studio is poised to increase dramatically. Although DVD-Audio software and player population are still relatively undeveloped and priced for pro-level budgets, the DVD-Video format offers a wealth of possibilities for musicians. But personal-studio musicians need to select their authoring tools carefully to make sure that the features they need are included.

Musicians are at the threshold of a brave new audio-reproduction world that is equal in importance to the introduction of the CD. DVD technology may seem out of your reach now, but rest assured that it won't be for long.

Gary Hall *is a former technical editor for* **EM.** *He has been working with professional digital-audio and video production gear since the late '70s. He is manager of professional DVD authoring products for Spruce Technologies in San Jose, California.*

We welcome your feedback. E-mail us at emeditorial@intertec.com.

LEARNING THE LEXICON

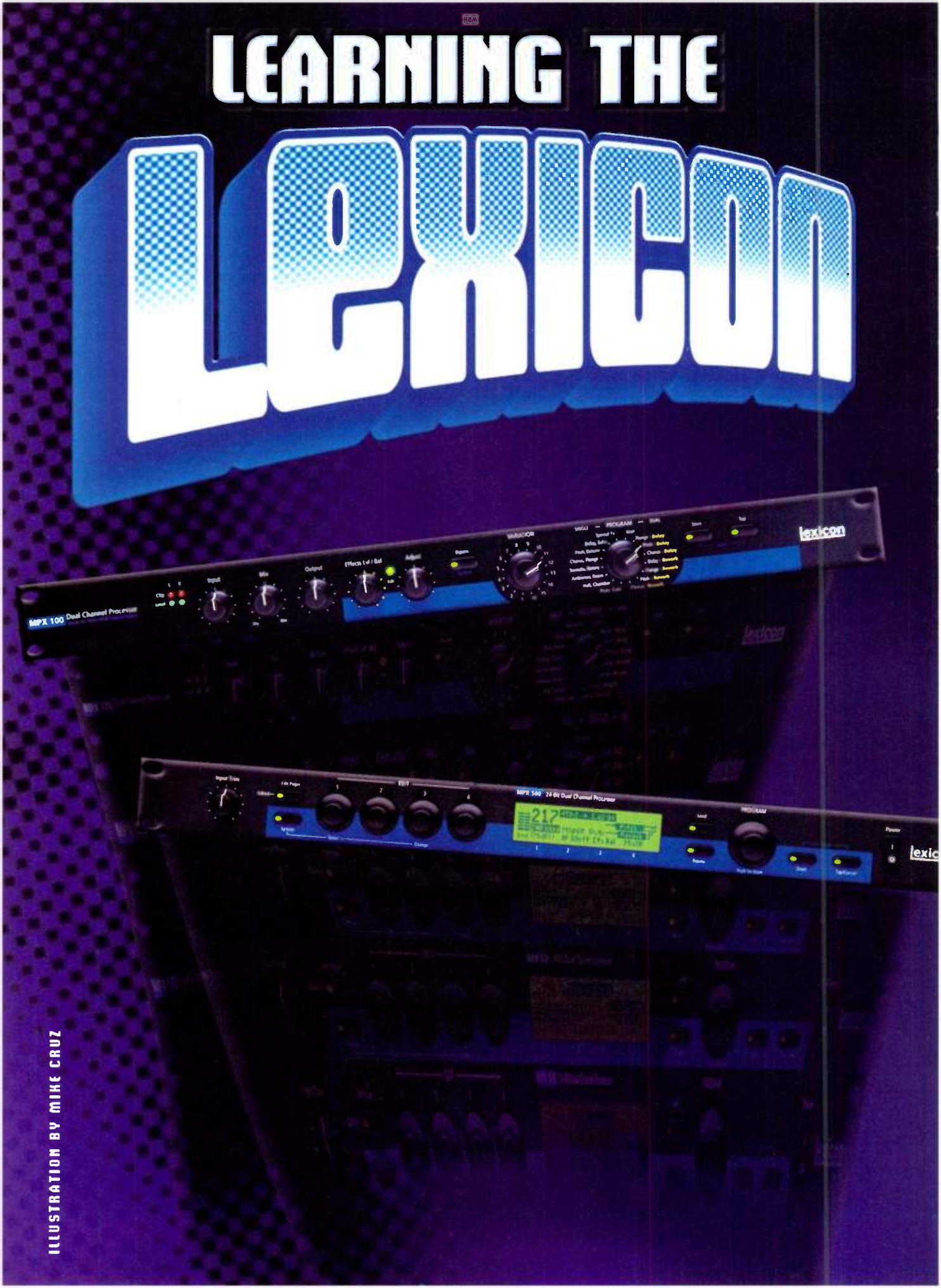

ILLUSTRATION BY MIKE CRUZ

Master CLASS

Secrets of the MPX 100 and MPX 500.

By Michael Cooper

The Lexicon MPX 100 and MPX 500 multi-effects processors are economical alternatives for the budget-conscious engineer in search of Lexicon-quality effects processing. Although the MPX 500 and, to a much lesser extent, the MPX 100 let you edit parameters to dial in custom effects, trailblazing beyond presets can be difficult because of an almost complete lack of documentation about those parameters. Fortunately, a parameter glossary for the MPX series is available at www.lexicon.com in the support downloads area. Also, though the user interface for both units is mostly straightforward, some controls don't always act the way you expect them to act.

Fortunately, none of those idiosyncrasies diminishes the capabilities of either unit; the boxes just need some explaining. In this article, I'll plumb the inner workings of the two popular processors to reveal undocumented features, offer tips on using some of the lesser-known parameters, and dispel some common misconceptions about operating the units. I'll start with the MPX 100 because it is simpler to use and offers much that can also be applied to the MPX 500. For a sneak preview of Lexicon's newest offering, see the sidebar "Features of the New MPX 200."

MPX 100

Though not nearly as programmable as the MPX 500, the MPX 100 offers some nice tweaks for spicing up tracks. Here's a look at some of its reverb algorithms.

It's often tempting to lengthen a track's reverb tail to create a greater sense of depth. But all too often, you get a dense wash of reverb that obliterates detail in the mix and makes everything sound too far away and indistinct. The MPX 100's Live Concert (Chamber variation 11), Vocal 1 and Vocal 2 (Chamber variations 15 and 16, respectively), as well as Vocal Plate (Plate variation 8) offer ways to gain a sense of depth without turning your masterpiece into pea soup. With those programs, the Tap Tempo function sets the delay time for a feedback loop operating on the input signal. The resulting echo feeds the Chamber or Plate algorithm, causing the reverb to repeat. That added spice can be just the ticket for giving a lead vocal, lead guitar, or snare drum the depth you want without sacrificing clarity.

For starters, route your track to the MPX 100, call up one of the previously mentioned programs, and tap in a quarter-note value with the front-panel Tap button. You can also use MIDI or the Audio Tap function to set the tempo. At 100 bpm, you should hear the track's reverb repeat at 600 ms intervals once or twice before it dies off. That gives the effect of the instrument's sound bouncing off walls two football fields away. Talk about depth!

A quarter-note Tap value shouldn't cause clutter as long as you're working with a slow to midtempo song, because the repeats are fixed at such a low level (6 percent feedback level for Live Concert and 12 percent for the other three variations), so the rhythmic effect they provide is subtle. The effect will usually muddle an uptempo tune, however. In fact, the repeating effect can be so elusive that it often can't be detected unless the initial impulse of reverb dies out a little beforehand. First, turn the Adjust knob fully counterclockwise to decrease the reverb's Liveness to its minimum value; then, slowly increase the setting to taste. Liveness is a master control for as many as four parameters, including midfrequency reverb-decay time. With the Liveness/decay time shortened adequately, the reverb repeats can be heard more clearly because they are not competing with an overlapping wash of initial reverb.

LEARNING THE LEXICON

DELAY GRATIFICATION

Using front-panel controls, you can tweak the reverb predelay times for some of the MPX 100's Gate and Plate variations, but not for the Room, Hall, and Chamber programs. (You can, however, tweak predelay settings in the reverb programs by manually entering SysEx messages into a sequencer; for complete instructions about that operation, see "Master Class: Lexicon" at www.emusician.com.)

Fortunately, some variations of the Delay-Reverb dual programs give you front-panel access to the parameter by proxy. The Cascade routing configuration within variations 7 through 10 is your ticket to predelay gratification.

With Cascade routing, left and right inputs feed two stereo effects that are chained together in series (see **Fig. 1**). For Delay-Reverb variations 7 through 10, the MPX 100's Effects Lvl/Bal knob adjusts the amount of delay and dry signal that will be fed to the reverb. When you set the Effects Lvl/Bal knob to the 12 o'clock position for any variations, input to the stereo reverb is derived solely from the output of the stereo delay (see **Fig. 2**). The delay time, which is set with the Tap Tempo function, becomes the reverb's predelay time. You can add impressive depth to lead vocals and sax solos, yet retain clarity, by adding a short predelay to their reverbs. As with other delay-based effects, the predelay time should typically be synchronized with the song's tempo.

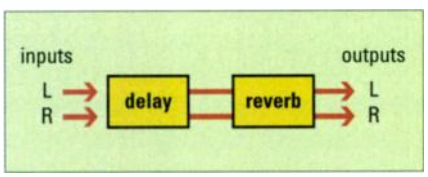

FIG. 1: Cascade routing is employed for variations 7 through 10 of dual programs offered by the MPX 100. The corresponding Delay-Reverb variations route left and right inputs through stereo delay and reverb, chained in series.

You can get dramatic predelayed reverb by setting the MPX 100's Effects Lvl/Bal control to the three o'clock position (still referring to the Delay-Reverb variations 7 through 10). With the control set to three o'clock, the MPX 100 produces instant reverb that's then followed by predelayed reverb (see **Fig. 3**). Again, the predelay time is set with the Tap Tempo function. Set the Adjust knob to produce a medium decay time, and the resulting effect sounds as though you're in an enormous space. The sound reverberates immediately and then seems to bounce off a hard wall at the back of the space to start the reverberation again. The Delay-Reverb variation is similar in principle to the MPX 100's Live Concert, Vocal 1 and Vocal 2, and Vocal Plate, but it is far more intense. It's excellent for use on grandiose, David Gilmour–style guitar solos.

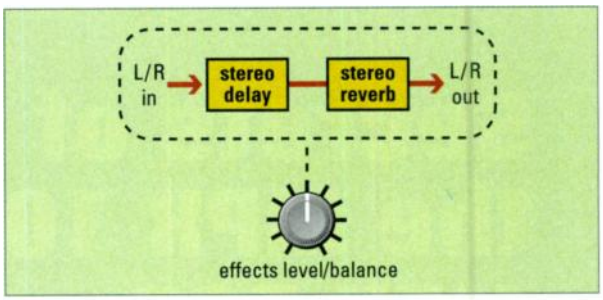

FIG. 2: When the MPX 100's Effects Lvl/Bal knob is set to the 12 o'clock position for Delay-Reverb variations 7, 8, 9, or 10, input to the stereo reverb is derived solely from the stereo delay's output. The delay time set through the Tap Tempo function becomes the reverb's predelay time.

I'M TREMBLING

The MPX 100's Tremolo variations can create excellent stereo-autopan effects. The Adjust knob changes the phase angle (called Sweep in Lexicon parlance) between the left and right output signals for Tremolo variations 4 through 8, thus causing a difference in the perceived width of the stereo image. Though the Adjust knob is continuously variable, it actually switches through four discrete polarity settings instead of smoothly moving through phase angles.

Here's the scoop: the knob starts at a 0 degree L/R phase relationship when set to full counterclockwise (CCW). It then moves to a 90-degree angle at about the 9:30 position, a 180-degree angle just past 12:30, and a 270-degree angle roughly past 3:30. A 0 degree setting creates a mono effect; the stereo image is widest at 180 degrees; and both the 90- and 270-degree settings create a narrower stereo image (and essentially the same effect). In all cases, the Tap Tempo function lets you adjust how fast the image bounces from speaker to speaker. It's usually best to synchronize the bounce to the beat of the music or, for slow-tempo pieces, to some subdivision thereof.

The Sweep parameter is also available for Flange variations 15 and 16. The Adjust knob steps through four static settings for those patches as well.

DIFFUSION CONFUSION

The MPX 100's Chorus variations 5 and 6 assign a diffusion function to the Adjust knob. Diffusion uses an allpass digital filter to simulate the effect of a sound bouncing off an acoustic diffuser. That is, it smears the sound so that discrete slapback echoes are more difficult to hear. Each echo is repeated in several iterations that have different amounts of amplitude and phase. As you turn up the Adjust knob in the Chorus variations, the Chorus algorithm's six delayed voices sound increasingly less discrete and the sound becomes more "gauzy." If you're shooting for a softer-sounding Chorus effect, crank the Adjust knob for those variations.

If you want a modulation effect with extra oomph, check out the Chorus or Flange variations that assign the resonance parameter to the Adjust knob. Resonance causes the Chorus or Flange delay lines to feed back on themselves. The Adjust knob is a bipolar control for the program variations. Turning the knob clockwise from the 12 o'clock position introduces positive feedback into

the algorithm's delay lines, and turning the knob counterclockwise introduces negative feedback. As you turn the Adjust knob farther in either direction, a greater portion of the signal feeds back upon itself. Positive and negative feedback cause phase cancellations, resulting in notches (comb filtering) in the effect's frequency response. Because Chorus and Flange modulate their delay times, the notches are also modulated. The result is a sweep that sounds great on instruments, such as organ and electric guitar, that produce sustained tones.

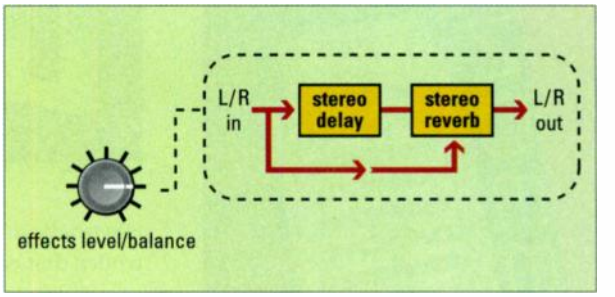

FIG. 3: When the MPX 100's Effects Lvl/Bal control is set to the three o'clock position for Delay-Reverb variations 7, 8, 9, or 10, input to the stereo reverb is derived from the stereo delay's input (dry signal) and output.

MPX 500

Now I'll switch gears and dive into the MPX 500. A quick stroll through the Edit Pages of the processor confirms exactly how powerful—and occasionally confusing—the unit's editing capabilities are. Unfortunately, the near absence of documentation for parameters handicaps engineers eager to exploit the user-friendly interface to its fullest. Furthermore, some terminology used for the parameters is inconsistent with that of the MPX 100—and even for program variations within the MPX 500 itself. Thankfully, a few pointers easily clarify the disparities.

Note that the following tips apply to version 1.04 firmware. See the sidebar "What's New with Version 2" for a rundown of the additional functionality the new firmware will bring to the MPX 500.

GLOBAL WARNING

Flange variations 75 and 77 control the Speed parameter using Edit knobs 1 (Adjust) and 2 (a soft knob on Edit page 1). Note that the Adjust knob's function is labeled—somewhat confusingly—Rate. The knobs control how fast the delays modulate between their extreme values. However, the knobs' respective scales are arbitrary (that is, without a unit value) and not related, so it would be fruitless to try to find an equivalent point for both scales or to infer millisecond or percentage values from their readouts.

Remember that the Adjust knob is

LEARNING THE LEXICON

essentially a convenient program controller that can modify one or more parameters simultaneously. For Flange variations 75 and 77, it provides a link to the Speed control (Edit knob 2) only (as opposed to programs for which the Adjust knob controls several parameters simultaneously), and its range is set to what Lexicon engineers thought would be optimal for the parameter. The range for the Speed parameter, set by Edit knob 2, is more extensive. For example, you can set the modulation speed with the Adjust knob to *x* and increment its value further with Edit knob 2 (Speed) to *x*+10. However, if you change the Adjust knob again, the Speed parameter's value will instantly increase or decrease from *x* and not from *x*+10.

RATE CHANGE

On many digital delay lines (DDLs), the speed or rate parameter controls how fast the delay time sweeps over the range set by the width/depth control; typically, the range varies from approximately 0.1 to 10 Hz (that is, as many as ten modulation cycles per second). Changing the width/depth control does not change the frequency with which the DDL modulates across the range. Thus, a greater width/depth value causes the same speed/rate setting to modulate over a greater distance during the same elapsed time, effectively increasing the linear speed of travel. If the delay time must modulate further at the same frequency, it must move faster to do so.

The MPX 500 works differently. When you set its Speed parameter for a Flange or Chorus variation, you are fixing the modulation at a more or less constant speed. The Chorus variations actually modulate in pseudorandom fashion versus the constant, low-frequency-oscillator–based action provided by the Flange variations. The speed is unaffected by adjustments to the Sweep parameter. The Sweep parameter for the variations is equivalent to a DDL's width/depth parameter; it determines how far the modulating delay time will stray at its extremes, expressed in milliseconds difference from the delay tap's base setting. Therefore, increasing the Sweep value results in a slower rate, because

WHAT'S NEW WITH VERSION 2

Version 2 software ($119.95; now shipping) for the MPX 500 extends the unit's capabilities by adding a dedicated 2-channel compressor, new metering parameters, improved ambience, and additional RAM memory locations for storing user presets.

The new compressor is available on all presets and is always placed in front of the effect(s) in the wet portion of the signal path. Dedicated compressor-only presets are also provided. The compressor can function as a stereo processor or as a single-channel compressor with the unused channel serving as a sidechain input. Available compression ratios are 1:1 (off), 2:1, 3:1, 4:1, 5:1, and 10:1. Threshold is adjustable from 0 dBFS (digital saturation) to –32 dBFS. Edited compressor parameter settings can be applied on a program-by-program basis or globally with a new System parameter called Compressor Mode.

Gain reduction is indicated by a descending bar between the two input-level meters and is calibrated in 2 dB increments. Version 2 also provides 0, –6, –18, and –32 dB calibration marks for the input-level meters for easier level setting.

The number of factory presets has grown to 255 (from 240), and the User Bank has increased to 64 programs from 30 in version 1.x. Version 2 recognizes MIDI SysEx dumps performed with a version 1–loaded MPX 500.

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Although not nearly as programmable as the MPX 500, the MPX 100 does allow for some surprisingly deep tweaks from front-panel controls alone.

the modulation takes longer to go the increased distance at its essentially fixed speed. To keep the MPX 500's cyclical modulation rate roughly the same, you must readjust the Speed inversely to the Sweep parameter's changing value.

Don't confuse the MPX 500's Sweep parameter with the MPX 100's. The 500's Sweep provides control of Flange and Chorus modulation widths; the 100's Sweep adjusts the phase-angle difference between left and right output signals for several Flange and Tremolo variations. For the MPX 500's six-voice Chorus variations, Speed 1 and Sweep 1 simultaneously control the left channel's three voices, and Speed 2 and Sweep 2 control the right channel's three voices.

There's one more cryptic parameter to discuss for the MPX 500 Chorus variations: Spread. Spread is a master delay control that adjusts the difference between the shortest and longest delay times for the chorus algorithm's six voices. Cranking up the Spread value results in a more reverberant sound as delay times increase and the delay taps are spaced farther apart. Keep Spread set to a low value if you're shooting for a tighter, more focused sound.

PLAYING TAPS

The MPX 500's Flange variations provide yet another enigmatic parameter that is important to understand. Most manufacturers use the term *depth* (in regard to flanging) to refer to how much the delay time in the signal's out-of-phase portion modulates away from the base value. For the MPX 500's Flange variations, however, the Depth parameter determines the relative amplitude of both channels' modulated taps with respect to their fixed taps.

A value of ±100 percent denotes modulated tap amplitudes equal to that of the fixed taps ("+" being positive polarity and "–" being inverted). Because closely spaced occurrences of a sound and its modulated iteration create the greatest destructive interference when they are at equal amplitudes, you get the deepest comb-filtering effects from the MPX 500 by setting the Adjust knob to ±100 percent Depth. A 0 percent Depth setting results in no flanging but nevertheless provides an excellent stereo effect on strummed acoustic guitar (in mono) and keyboard comp tracks.

HEAVEN'S GATE

The MPX 500's editing facilities allow you to create a variety of gated-reverb sounds. Two key parameters that work hand in hand with the Gate variations are Shape and Spread. Neither parameter

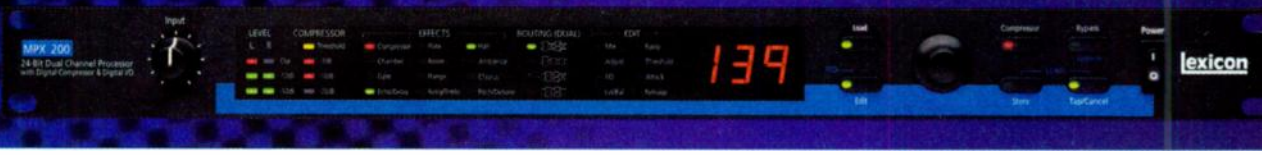
FEATURES OF THE NEW MPX 200

Like the MPX 500, Lexicon's new MPX 200 multi-effects processor ($399; now shipping) is a true stereo-effects processor that features 24-bit A/D and D/A converters and S/PDIF I/O. Whereas the MPX 500 supports 44.1 and 48 kHz sampling rates, the MPX 200 is strictly a 44.1 kHz box (like the MPX 100).

Powered by Lexicon's proprietary Lexichip, the 1U rack-mountable MPX 200 provides 240 factory presets and 64 user RAM locations. The effects algorithms are reminiscent of those found in the MPX 100 and 500; they include Ambience, Plate, Chamber, and Inverse Reverbs as well as Tremolo, Rotary, Chorus, Flange, Pitch Shifting, Detune, 5.5-second Delay, and Echo programs. As with an MPX 500 running version 2 software, the MPX 200 provides a digital compressor for its programs so that you can run two effects and compression simultaneously. As many as eight parameters (four for the compressor) can be edited in each program with front-panel controls.

Other aspects of the MPX 200's feature set should also sound familiar to MPX 100 and 500 users—for example, Dual Stereo (parallel), Cascade, Mono Split, and Dual Mono routing configurations. MIDI control includes Program Change, Bulk Dump, and a Learn mode for assigning front-panel parameters to MIDI messages. You can lock delay times and modulation rates to MIDI Clock or a Tap Tempo function. The latter is controllable from an audio-input trigger, a front-panel Tap button, a dual footswitch, an external MIDI controller, or a MIDI Program Change.

Other amenities include unbalanced ¼-inch inputs that can accept line or direct-instrument input; unbalanced ¼-inch TRS outputs that deliver line-level signals or headphone output (left channel only); a software-selectable MIDI Out/Thru port; Cue program mode; bypass; and a built-in power supply.



does much unless the other is at a healthy level (at least 20 to 30 percent of its maximum setting).

Shape determines the amplitude profile of the gated reverb (how fast the amplitude of the reverb's delay taps will rise over time). Low-value Shape settings cause an almost instantaneous buildup—much the way a real plate reverb performs during its initial stage of excitation. High Shape values, on the other hand, cause an inverse effect in which the reverb's amplitude rises relatively slowly. Dial in a very high value, and the sound mimics a reverb tail played backward on a tape recorder. Remember those?

The Spread parameter's setting determines how quickly the reverb's density builds up. Low settings cause the density of reflections to build up quickly, making the reverb behave like a small chamber; high settings cause a slow buildup of density, similar to the effect of a large hall. For a dramatic but controlled inverse gated-snare sound, try dialing in a medium-long Shape setting (perhaps around 145) and a low Spread setting (roughly 88). If you set the Spread too high with a generous Shape value, the sound will generally become too diffuse to maintain a tight groove. Try lowering the Diffusion parameter to about 48 percent for a coarser, more aggressive sound.

Users beware: some of the terminology used for parameters on the MPX 500 is inconsistent with that used for the MPX 100.

Also try experimenting with the gate's High Slope and Low Slope parameters. Positive-value slopes increase the amplitude of the reverb's reflections over time but limit their effect on high or low frequencies, depending on which slope parameter you're tweaking. Setting Low Slope to a higher value than High Slope generally gives drum tracks more weight. Start with a Low Slope setting of +8 and a High Slope setting of +3 and tweak to taste.

MUTE OUTPUT

Hopefully this article will help you improve your effects-editing chops. Tap the inner power of the MPX 100 and 500, and the new sounds you'll Shape are bound to Sweep you off your feet.

Michael Cooper *does not live on a Slope. He is the owner of Michael Cooper Recording, located in beautiful Sisters, Oregon.*

We welcome your feedback. E-mail us at emeditorial@intertec.com.

Desktop, Tabletop, or Laptop?

What should your next system be?

By Zack Price

USB, PC Card (PCMCIA), and FireWire devices, with their interconnectivity and ease of use, have clearly had a tremendous impact on the computer-music marketplace. What may not be so apparent, however, is the extent to which those technologies have called into question the model of the traditional desktop system as the only viable option for computer-based musicians. Smaller, less expensive, and quieter tabletop models connected to USB and FireWire peripherals can often perform well enough to meet many musicians' needs without internal expandability. Laptops are becoming nearly as powerful as desktop systems and offer the advantage of portability. Combine a laptop with USB, FireWire, and PC Card devices, and you often have the equivalent of a good desktop.

DAVE EMBER

Furthermore, computer companies are being encouraged to move away from the traditional desktop model altogether. Intel's Legacy Removal Roadmap is a plan to systematically remove or replace traditional computer technologies with better alternatives (see **Fig. 1**). Its ultimate goal is the complete removal of user-accessible internal devices. Apple is already traveling down that path with its iMacs and Cubes, and even its desktop Power Mac G4 models have jettisoned much of legacy technology's baggage, unlike their PC counterparts (see **Fig. 2**).

With all that technological change in the air, computer-based musicians may have to reconsider what kind of a setup they need for a properly functioning computer-music system. But that isn't a task for the distant future; it's one of more immediate concern because it will certainly affect how

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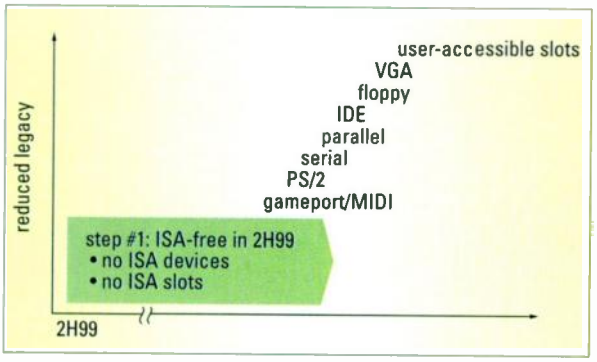


FIG. 1: Intel's Legacy Removal Roadmap is a plan designed to systematically replace outdated computer technologies with better alternatives. Its ultimate objective is the complete elimination of any user-accessible internal devices.

musicians shop for their next systems. For starters, they must determine which computer will best serve their needs: desktop, tabletop, or laptop.

DESK SET

With roomy multislot cases, desktop computers are by far the most expandable in terms of devices and interfacing formats. For example, you can install PCI cards for a variety of purposes, such as interfacing for digital audio and SCSI. You can even take advantage of peripherals normally designed for laptop computers by adding a PCI–to–PC Card adapter to a desktop computer. In addition, most desktop systems now include USB ports, and an increasing number of systems boast FireWire ports as well. Even if a desktop computer doesn't provide FireWire or USB ports, you can easily install a PCI card to add those options.

Moreover, the typical desktop computer is housed in a case that can hold and power several internal peripherals, such as hard drives and CD-RW drives. Because internal devices generally cost less than their external counterparts, a desktop computer can save you money when it comes to expanding your system with new peripherals.

Desktops are the only systems that provide the potential for dual-monitor support, which lets you extend your screen view horizontally or display multiple windows across two monitors. Desktops are also the only systems that offer the potential for dual-processor support. That will become more important as musicians using high-end computers incorporate software—such as Cakewalk's *Sonar* digital-audio sequencer, newer versions of Steinberg's *Cubase VST* and Emagic's *Logic Audio*, and Sonic Foundry's *Sound Forge*—that takes advantage of dual processors for improved performance.

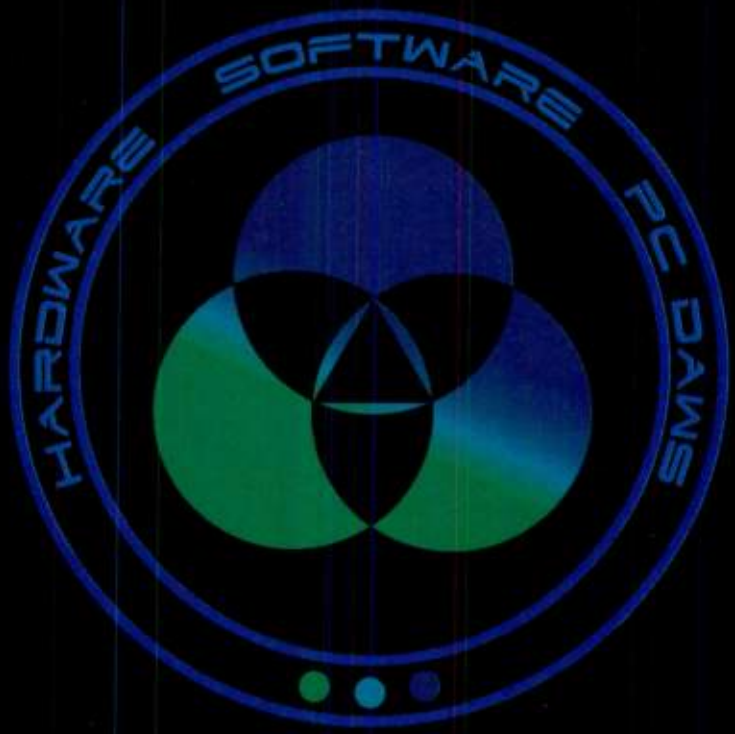
On the other hand, desktop computers have some major drawbacks. Their expandability can be as much a minus as a plus. For example, even with the Plug and Play capabilities in Windows, it can be difficult to determine whether you have enough system resources to add a device or whether a new device can actually function with the available system resources.

Also, Windows-based desktop systems are still loaded with legacy technology that few computer-based musicians need. For example, many new motherboards include at least one ISA slot, despite the near universality of PCI cards. Although USB mice, keyboards, modems, and printers are widely available, most desktop computer motherboards include separate PS/2, keyboard, serial, and parallel ports. Those unnecessary connections take up a good portion of the system resources, not to mention physical space that could be used for other purposes. You can go into the BIOS setup and disable most ports to create an internally legacy-free computer; even so, the physical connections, which are part of the motherboard's cost, are still present.

Desktop computers are also notorious for the noise they can make—a serious disadvantage in a music-studio environment. Eliminating troublesome fan and drive noise can be difficult and expensive. It may involve something as simple as positioning the CPU under

COURTESY OF APPLE

FIG. 2: Apple's product line demonstrates how it has developed computers for desktop, tabletop, and laptop use with a minimum of legacy technology. Clockwise from top left are the Power Mac G4 Cube, the Power Mac G4 desktop, the Titanium PowerBook G4 laptop, and the iMac DV tabletop.



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the desk to help minimize the noise, or it may require more drastic action, such as enclosing the CPU in an equipment closet or a specially built cabinet.

Desktop systems are difficult to transport too. They are heavy and bulky, even when housed in a rack-mount case. Furthermore, you must consider the extra burden of taking along a monitor, which usually has no rack-mount housing. A keyboard, mouse, and mouse pad must also be accounted for. In the past, lack of transportability meant that you couldn't easily use your most powerful computer in a remote location. One solution is to use a device such as a modular digital multitrack (MDM), but that requires the expense of additional interfacing capabilities with the computer and extra time to transfer audio material from one medium to another once you're back at the studio.

ON THE TABLE

Tabletop systems—such as the Sony VAIO Slimtop LCD, Compaq iPaq Desktop, and Apple Power Mac G4 Cube—offer several advantages over other computers, and they're often the least expensive (see **Fig. 3**). Most tabletop models generate little or no noise, and they typically have a smaller footprint than desktop computers, which can be important if you're working in a limited space. What's more, tabletop computers often use the same processors that single-processor desktop systems do, so you don't have to sacrifice power for compactness.

On the other hand, tabletop computers are not as internally expandable as desktop systems. That will become less of an issue as FireWire and USB peripherals begin to dominate the market for add-ons. Even so, external peripherals have two important disadvantages. First, as mentioned previously, external peripherals are often more expensive than their internal equivalents because the case and sometimes a dedicated power supply add to the unit's cost. Second, external peripherals bring the potential for increased fan and drive noise, which could negate the advantage of a noiseless system—part of a tabletop model's appeal to computer-based musicians. On the positive side, it may be easier to house the offending external devices in a small enclosed environment than it would be to segregate a noisy desktop computer in a soundproof cabinet.

Computer-based musicians may find it difficult to choose the right tabletop system for their needs because so many companies are configuring different tabletop systems for low-cost markets. On the PC side, system design is often compromised because too many manufacturers are unwilling to eliminate legacy options from their systems or incorporate the best new technologies. For example, Compaq's iPaq Desktop comes in legacy and legacy-free models, but neither includes FireWire ports. Gateway's Essential 800c model includes five USB ports but no FireWire connection. Sony's VAIO Slimtop LCD includes two FireWire ports, but one is a 4-pin connection.

Apple is the most legacy-free of all manufacturers. It now includes USB and FireWire ports in all of its iMacs and iMac DVs. The more powerful Cube, with its G4 processor (the iMacs use a G3), also boasts FireWire and USB ports, though the Cube doesn't include an integrated monitor as the iMacs do.

LAP OF LUXURY

Many musicians feel that a laptop is really the only computer they need for music production, and that opinion is becoming more popular. Laptops are portable and, to a large degree, self-contained systems. With a laptop, you don't have to worry about external keyboards, pointing devices, or a separate monitor. What's more, laptops can run on batteries for limited periods of time, which makes them well suited to remote recording or music-production projects, and some models offer an optional CD-RW drive. Best of all, laptops are extremely quiet.

The expansion capabilities of laptop computers are constantly improving. Every laptop sold today has at least one USB port. The new Apple Titanium PowerBook G4 and Sony VAIO laptops also include FireWire ports. Nearly every laptop computer, with the exception of Apple iBooks, contains at least one PC Card slot, and many models supply two. That essentially offers most laptop users the same expansion capabilities found in desktop systems. For example, you could add a PC Card multichannel audio card to your laptop system. If you don't have a FireWire port, you could easily add a PC Card–to–FireWire adapter, which would let you add a fast external FireWire drive to the system. It's even possible to add PCI slots to laptops with a PC Card adapter and a tower case from Magma.

Laptops are not without their disadvantages, though. First, they are the most expensive computers to buy initially and to expand later. For instance,

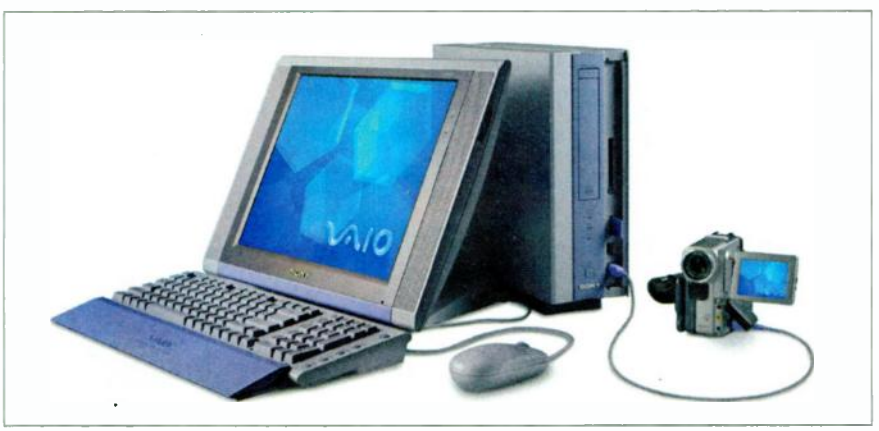

FIG. 3: The Sony VAIO Slimtop LCD is one of the few tabletop systems with USB, FireWire, and PC Card connections as standard equipment. Even so, it still includes PS/2 connections for mouse and keyboard.

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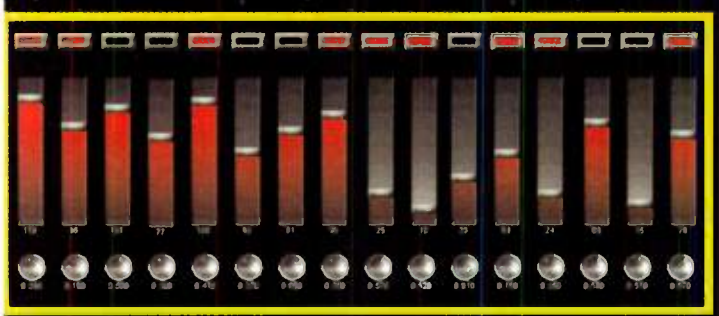

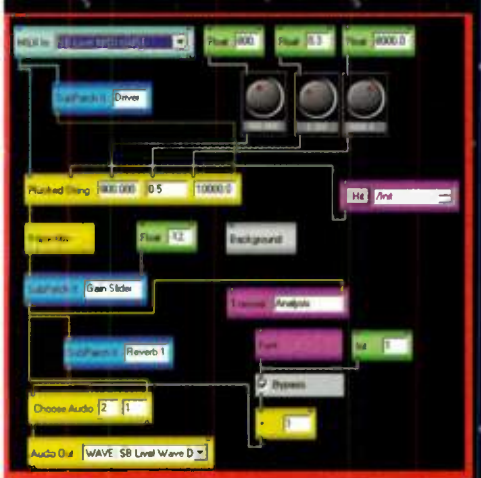

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expanding memory or upgrading an internal hard drive often costs twice as much as it does with a desktop system. You usually can't upgrade the processor or add internal devices as you can with a desktop computer.

In addition, a laptop's display often constitutes half of the replacement cost of the unit itself, which is further troubling considering that the monitor is often the weakest link in a laptop system. Monitor failure is mainly due to bending and warping of the screen that results from improper handling. The risk is serious enough that insurance brokers market separate policies for laptop monitors.

Laptop monitors also have smaller displays than most desktop systems do. However, keep two things in mind. First, people usually sit closer to laptop monitors than they do to desktop or tabletop systems; that can offset the discrepancy in size. Second, laptop monitors are getting larger. A case in point is Apple's new Titanium PowerBook, which has a 15-inch viewing area, as do several current PC models.

LINGERING ISSUES

If you transfer hardware and software from an older system to a new one, you may experience some compatibility problems. Mac users should read "Desktop Musician: Surviving the Upgrade Path" in the March 2001 issue to examine some solutions to potential pitfalls.

PC users have several issues of their own. For example, despite the advantages of FireWire, many PC systems are not yet packaged with built-in FireWire ports. Even though adding a FireWire port to a system is relatively inexpensive (about $80 for a PC Card FireWire adapter and even less for a PCI FireWire card), doing so takes up a PCI or PC Card slot as well as system resources. Although that's less of an issue for desktop systems with several PCI slots, it may be a serious concern for laptop users with only one PC Card slot. Moreover, it may not be an option at all for tabletop users, depending on their system's expansion capabilities.

If you do purchase a PC system with a built-in FireWire port, make sure it's a 6-pin port—two such ports are preferable. Some systems, such as Sony's VAIO Slimtop LCD, have one 4-pin and one 6-pin FireWire port. Four-pin ports, which are intended mainly for digital video and still cameras, don't supply the power needed by most FireWire devices, such as hard drives and audio interfaces. Most digital cameras will work with 6-pin ports and will often include a 6-pin–to–4-pin adapter cable.

One final PC issue is hardware copy protection. Steinberg and Emagic use dongles for copy protection; Steinberg uses the parallel port, and Emagic uses a 9-pin serial port. Although both companies use USB copy-protection keys on Mac systems, neither company plans to use USB dongles on PC systems in the near future. That may be a problem for laptop users who want to use *Logic Audio*, because an increasing number of laptops no longer include serial ports.

WHO NEEDS WHAT?

USB, FireWire, and PC Cards have already done much to influence the types of devices we add to our systems. Increasingly, those interconnection standards will blur the lines of demarcation among desktop, tabletop, and laptop systems. Will that trend ultimately sound the death knell for traditional desktop computers? I don't think it will anytime soon, but that fate seems to be looming if the Legacy Removal Roadmap is to be believed. (For more on the future of USB and FireWire, see the sidebar, "Bozos on the Bus.")

BOZOS ON THE BUS

Now is a time of major transition and uncertainty in the computer market. With a speed of 480 Mbps, USB 2.0 is 20 times faster than USB 1.1, and its speed rivals FireWire's. Although USB 2.0 is available on some PCs, Microsoft will not support it in its upcoming release of Windows XP, despite the partnerships of many major PC manufacturers to develop USB 2.0. Microsoft's decision could put a damper on upcoming USB 2.0 developments, such as potentially faster USB audio devices. On the other hand, those companies could use their combined influence to force Microsoft to support the standard later.

Microsoft's decision directly affects not only the future development of USB 2.0 but also the new Card Bay protocol developed by the PCMCIA Manufacturers Association. Card Bay is a new PC Card that uses the high-speed serial bus protocol of USB 2.0 or FireWire rather than the parallel bus of PCI. Card Bay developers focus on wireless communications and memory applications, but where that standard will lead in the digital-content–creation market remains to be seen. Card Bay is at an early enough stage that ultimately it could be based exclusively on FireWire. Many Card Bay developers, however, also have a strong interest in USB 2.0. That could retard the development of portable Card Bay devices or create a new standard that will divide resources between Apple and PC manufacturers, because their underlying technologies compete.

FireWire2, with an 800 Mbps transfer rate that is double the current FireWire standard's, is also due by the end of 2001 or early 2002. However, no company whose systems include built-in FireWire ports plans to upgrade its firmware to support FireWire2. That means users will have to buy another PCI card or PC Card to upgrade—if they can.

Does all that mean users will also need to get new FireWire or USB devices right away? Fortunately, no. The new standards will be backward compatible with all current USB and FireWire devices.

Regardless, desktops are not in danger of dying out soon, because they are the only systems that provide dual-monitor and dual-processor support. Those features are must-haves for power users running digital-audio sequencing programs with host-based effects plug-ins and virtual instruments. Likewise, those wishing to use hardware-based audio systems—such as Ensoniq's Paris, Digidesign's Pro Tools, or even DSP-based software-synth PCI cards such as Korg's OASYS or Creamware's Pulsar—will want to stay with desktop systems. (Note that some products, such as Symbolic Sound's Kyma System, offer desktop and laptop interfaces.)

But not everyone needs, wants, or can afford that kind of power. Tabletop systems are ideally suited for those who don't need a top-of-the-line system but still want a computer that will handle their production needs well into the future, without costing too much in the present.

Laptops are the ideal option for those who don't need megabuck power systems but do need powerful portability. Laptops can also be a vital link between high-end desktop installations and field work, and if both systems are configured properly, they can even share devices. That can more than offset a laptop's initial high price. Laptop computers can serve as complete workstations in their own right, competing well with tabletop systems and some desktops.

Ultimately, many users will want to use both stationary and portable systems. USB, FireWire, and PC Cards help make that goal easier and more cost-effective. Although those interconnecting technologies have helped blur the line separating desktops, tabletops, and laptops, they haven't erased that line just yet.

Zack Price, *after years of creating MS-DOS file names and deciphering vanity license plates, is now busily developing his principles-of-limited-information theory.*

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Decibels Demystified, Part 2

Bringing theory into the real world.

By Scott Wilkinson

During the past 15 years, many fundamental music-technology concepts have been explained in "Square One" (originally titled "From the Top"). In 1997 EM *technical editor Scott Wilkinson combined many of those columns into a comprehensive primer titled* Anatomy of a Home Studio: How Everything Really Works, from Microphones to MIDI, *published by EMBooks, an imprint of Artistpro.com (www.artistpro.com).*

KARYN KRAFT

Our readership has continued to grow, and new readers shouldn't be left behind. Rather than try to reinvent the wheel, we will periodically reprint excerpts from the book as "Square One Classics." These articles will clarify the essential, unchanging concepts that make it possible to be an electronic musician.

In the past two issues, I've presented the underlying ideas necessary to understand decibels. Now that those concepts have been discussed, it's time to dig into information that is more practical and that relates directly to audio equipment.

There are several standard reference values to which power and voltage are compared using decibels (see the table "The Decibel Zoo"). Unfortunately, that leads to much confusion. Remember that all voltage in audio equipment is based on alternating current and measured using the root mean square (RMS) method.

As mentioned last month, power-referenced decibels are used for circuits that draw a significant amount of current from the voltage source. In the following equations, the amount of power being used as a reference is represented by P_0, and the amount of power being measured is P_1. If the measured power is equal to the reference power ($P_1 = P_0$),

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The Decibel Zoo

Decibel Type	Standard Reference (0 dB)
dBm	1 mW
dBu	0.775 VRMS
dBV	1 VRMS

the difference is 0 dB. In other words, 0 dB is the *reference level.* (Recall from last month, if $a = 10^b$, then $b = \log a$.)

$$10 \log (P_1/P_0) = 10 \log 1 = 10 \times 0 = 0 \text{ dB}$$

If the measured power is twice the reference value ($P_1 = 2P_0$), the difference is about 3 dB.

$$10 \log (P_1/P_0) = 10 \log (2P_0/P_0) = 10 \log 2 = 10 \times 0.301 = 3.01 \text{ dB}$$

If the measured power is ten times the reference value ($P_1 = 10P_0$), the difference is 10 dB.

$$10 \log (P_1/P_0) = 10 \log (10P_0/P_0) = 10 \log 10 = 10 \times 1 = 10 \text{ dB}$$

The most common power-referenced decibels are denoted dBm, and the reference power value (P_0) is 1 milliwatt (mW), or 0.001W. In other words,

$$0 \text{ dBm} = 1 \text{ mW}$$

That type of decibel is handy when talking about small but significant power values such as those that exist in most professional audio equipment. In fact, dBm is typically used to specify the nominal signal level in professional gear.

HIGH-VOLTAGE DECIBELS

Voltage-referenced decibels are used when a circuit draws negligible current from the voltage source (that is, when the impedance is high and the load is small). That applies to most consumer and semipro gear, including synthesizers. The reference level is still 0 dB; however, if the measured voltage is twice the reference value ($V_1 = 2V_0$), the difference is 6 dB, not 3 dB as in power-referenced decibels.

$$20 \log (V_1/V_0) = 20 \log (2V_0/V_0) = 20 \log 2 = 20 \times 0.301 = 6.02 \text{ dB}$$

If the measured voltage is ten times the reference value ($V_1 = 10V_0$), the difference is 20 dB.

$$20 \log (V_1/V_0) = 20 \log (10V_0/V_0) = 20 \log 10 = 20 \times 1 = 20 \text{ dB}$$

One common voltage-referenced decibel is denoted dBu. The *u* stands for unloaded and refers to the very small load that high-impedance circuits present to the voltage source. The reference voltage for dBu is 0.775V. In other words,

$$0 \text{ dBu} = 0.775\text{V}$$

Perhaps the most common voltage-referenced decibel is denoted dBV, for which the reference voltage is 1V. In other words,

$$0 \text{ dBV} = 1\text{V}$$

That type of decibel is generally used to measure the signal level in consumer and semipro gear. (See the table "dBV Versus dBm/dBu" to compare decibel types.)

You might occasionally come across a similar decibel designation, dBv, which is completely equivalent to dBu. Don't let the *v* fool you; it is not the same as that in dBV. The dBv decibel is not used much today.

V, L, AND G

Among the many terms tossed around when discussing audio systems, perhaps the most misused are *volume, level,* and *gain.* All three words have something to do with the amplitude of an AC electrical signal, and they also relate to decibels, but their precise meaning is not clear to the many people who use them with reckless abandon.

People often use *volume* to describe acoustic sound intensity or the amplitude of an AC electrical signal. Technically speaking, however, volume is defined as power, and it is typically applied to the output of a power amplifier. If you turn up the volume, you are increasing the power output in watts.

The word *level* is often used in conjunction with voltage or power values, as in "the power level is so many watts" or "the voltage level is so many volts." However, level is defined as the magnitude of a quantity with respect to a particular reference value. (Sound familiar?) As a result, the word is correctly used only in conjunction with decibels. For example, the audio-signal level in professional audio equipment is expressed in dBm, which is referenced to 1 mW.

Gain is defined in several ways, which doesn't help matters. Unless otherwise specified, it usually refers to the change in a signal's power and is measured in decibels. In that case, gain has no standard reference value. Instead, the gain compares the signal's power values before and after the change. For example, if a signal's power increases by a factor of two, the gain is 3 dB.

dBV Versus dBm/dBu

dBV	Volts RMS	dBm (into 600Ω) or dBu
+6.00	2.000	+8.2
+4.00	1.600	+6.2
+1.78	1.228	+4.0
0.00	1.000	+2.2
–2.20	0.775	0.0
–6.00	0.500	–3.8
–8.20	0.388	–6.0
–10.00	0.316	–7.8
–12.00	0.250	–9.8
–12.20	0.245	–10.0
–20.00	0.100	–17.8

RAVE REVIEWS

The Røde NTK Launches With Rave Reviews

"In every situation, both the NT1000 and NTK had lower self noise than either U87."

"With these mics, RODE has beaten the low-cost Sino-capsule market at their own game."

- Ty Ford

Ty Ford – Mix Magazine
The complete test report is available at www.mixonline.com and in the June 2001 issue of MIX magazine.

"...mellow tube tone, but with ultra low noise."

"These microphones are standard-setters that the entire industry would do well to study."

- Bruce Richardson

Bruce Richardson – ProRec Recording Magazine
The complete review is available at www.prorec.com

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IT'S ALL RELATIVE

The concept of gain brings up another application of decibels: they are often used to compare two voltage or power values without respect to a standard reference level. When decibels are used to relate two arbitrary values in that way, they are expressed in dB without a modifier (such as *m* or *V*) because they use no standard reference. That approach is typically used to describe the change in a signal that is altered by adjusting a control. For example, you might manipulate an equalizer control to reduce the level of a frequency band by 3 dB.

In addition, it doesn't matter whether power or voltage values are compared; the number of decibels remains the same in either case. If you change the power flowing through any circuit with a given impedance, the voltage also changes but by a different factor than the change in power. The factor by which the power changes is the square of the factor by which the voltage changes. For example, if the power increases by a factor of four, the voltage increases by a factor of two (the square root of four). That is due to the fact that power is proportional to the square of the voltage, as revealed in Joule's law:

$$P = K \times V \times I$$
$$= K \times V^2/Z$$

Remember that K is a constant that depends on the reactance of the circuit, and it can be ignored for these purposes. Of course, V is voltage, I is current, and Z is impedance.

PRACTICAL EXAMPLES

It's time to look at a few practical examples. You've probably seen *frequency-response specifications*, which identify the range of frequencies that a piece of audio gear can effectively pass from its input to its output at a given gain. For example, a piece of gear might have a frequency response of 50 Hz to 18 kHz, ±3 dB. That means that all frequencies between 50 Hz and 18 kHz will pass from the input to the output with no more than 6 dB of variation in gain (3 dB above the input level and 3 dB below) from one frequency to another.

Equalizers include one or more boost/cut controls that amplify or attenuate different ranges, or bands, of frequencies. For example, many EQs boost or cut the frequencies in each band by ±12 dB. At maximum boost (+12 dB), the signal's power in that frequency band is increased by a factor of 16, and the voltage is increased by a factor of 4.

Another characteristic of most audio gear is the *signal-to-noise ratio* (which is often abbreviated S/N). S/N is the difference in decibels between the nominal signal level and the noise floor of the equipment. For example, in many analog tape decks, the noise floor is 45 to 65 dB below the nominal signal level, which corresponds to 0 on the tape deck's volume unit (VU) meters, so S/N = 45 to 65 dB.

Among the most misused audio terms are *volume, level,* and *gain.*

You can record signals at a level as much as 5 dB above the nominal level on an analog tape deck, which determines the dynamic range of the deck. By definition, *dynamic range* is the difference in decibels between the maximum undistorted signal level and the noise floor. In the example from the previous paragraph, the dynamic range is 50 to 70 dB.

Decibels are critical to understanding and effectively using audio equipment. Now that you have a basic understanding of decibels, you should be able to make the most of your studio and the signals that flow through it.

Scott Wilkinson *has never met an electrical decibel he didn't like.*

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Distribution Roundtable

Three industry experts provide an insider's view of music distribution.

By Michael A. Aczon

The distribution of musical recordings is one of the least understood yet most important components of the music industry. Even the best recordings of great songs won't make it to the public without a distributor. In an effort to demystify the process and strategies of music distribution, **EM** gathered three industry executives for a roundtable discussion. These three pros bring to the conversation different perspectives of the distribution business: the independent artist/label view, the ever-changing digital distribution view, and the major-label view.

JACK DESROSCHER

The first panelist is Kofy Brown, an Oakland, California, musician and songwriter and a co-owner of indie label Simba Music Records. She is also a consultant for San Francisco–based TRC Distribution. The second, Ron Sobel, is a Los Angeles entertainment attorney in private practice, specializing in music publishing, technology and new media, and the digital distribution of intellectual property. Sobel worked at ASCAP from 1986 to 2000, most recently as vice president of creative affairs. He also is a faculty instructor in the Music Industries Studies program at California State Polytechnic University, Pomona; serves on the California Copyright Conference's board of directors; and is a frequent lecturer and speaker about intellectual property issues. Rounding out the panel is Jennifer Otter, who works on the front lines of the music industry as West Coast marketing director for Interscope, Geffen, and A&M Records, which are all distributed through the world's largest music distributor, Universal Music and Video Distribution (UMVD). Otter previously worked for UMVD and had

"We Had A #1 Hit Because We Joined TAXI"

If you told me that one day I'd co-write the #1 Country song in America, I probably wouldn't have believed you.

My name is Erik Hickenlooper. My writing partner, Jim Funk and I wrote the Kenny Rogers hit, 'Buy Me A Rose.'

We aren't professional songwriters with a string of hits under our belts. Just a couple of ordinary guys who love to write and record our own songs. We live in small towns in Utah, and we both have day jobs.

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stints with Sony Music Distribution and Polygram Distribution. She is based in San Francisco but works in 20 western states.

How would you describe music distribution and how it fits into the big picture of the music industry?

Sobel: Distribution, in its simplest form, is the business and mechanics of getting recorded material into the marketplace. If the costs to record and promote a record are high, you have to distribute and sell a huge number of records to recoup the investment. If, on the other hand, recording and promotion costs are kept small, the sales and distribution network can be more manageable and therefore more profitable.

Brown: In the big picture, distribution is like the veins of the music industry. It's how retail outlets get product. Basically, the record company makes a product—for example, a compact disc. Then it uses its own distribution department or an outside distribution company to make sure the CD gets to as many places as possible. Independent distributors like TRC have relationships through sales representatives to get CDs out to retail chains and mom-and-pop stores. Our label staff actually goes to some of the local San Francisco Bay Area independent stores ourselves, and we distribute or sell our CDs direct.

Otter: Distribution is key for a record to be successful in the worlds of both major and indie labels. Without a strong distribution team, records are literally not in stores. UMVD distributes a lot of the key labels in the world of major labels. Along with making sure that each label's products are in stores, many times representatives from the distribution team are the only people that bands have contact with while on the road. While most label personnel are located in Los Angeles and New York, UMVD has people in the field all over the United States. Those people not only physically check stock but also get new and breaking information about artists and projects to countless record retail accounts. The UMVD field staff—usually directed by each label's staff—is also largely responsible for making sure that the artists have visibility in the marketplace in such places as local stores and venues where the bands are playing, and in helping place local advertisements for the bands.

Clearly there are basic similarities in distribution for majors and indies. Are there any differences in their philosophies or approaches?

Brown: The biggest thing that makes majors and independents different is the resources. For example, a major distributor like Sony can distribute a CD almost anywhere in the world. That's why music by a major-label artist like Lauryn Hill can be promoted and purchased from Zimbabwe to New Zealand to Peru to Gary, Indiana, simultaneously. Sony has the power and money resources and the personnel to get and promote their product almost everywhere.

Otter: Although I have only really worked inside of the major-label and major-distribution system, I see both strengths and weaknesses in it. The best thing, in my opinion, about a major distributor is the sheer number of people employed by it who are theoretically there to help work our records. Also, the money is there for advertising and support for implementing marketing plans created by the record label.

However, with that also come many people whose drive and motivation is the bottom line and not necessarily the music and artistry of the projects at hand. Many artists slip through the cracks in the major-label system due to an extremely heavy workload, lack of enthusiasm of the staff, and the cliché of "too many chefs in the kitchen," as well as the major-label egos and politics that can be involved. In my relationships with the players in the indie world, there seems to be an overall greater sense of purpose, drive, and passion; however, there is a lot less money, clout, and resources in many cases.

Sobel: All recording artists want their records in the marketplace, but it is a very crowded and competitive marketplace. We now have two kinds of records: traditional, physical CDs, and

nonphysical digital-music files. The major labels have been very successful at selling physical CDs, but they have little experience with selling or distributing digital-music files. The costs to distribute digital-music files are minuscule compared to the costs of traditional, physical distribution. There will always be marketing and promotional costs to consider, but the fact that artists now have an opportunity to put their music in the marketplace without incurring manufacturing, shipping, packaging, physical distribution, and inventory expenses provides an alternative method of building and reaching an audience. Although we are still in the infancy of digital distribution—and of working out the licensing and monetization aspects of that new distribution option—the promise of access to a global marketplace through digital distribution should be seen by all of us in the creative community as a healthy and positive addition to our promotion options.

Distribution seems to be limited by the geographic region. In today's global economy, how can artists use a distribution network to get their music heard by the widest audience?

Brown: You're right about the borders. We have used our domestic distributor to generate interest abroad, and we've used other methods. By gigging abroad, I create a demand for my records in other parts of the world. My company then utilizes the indie distributors in those countries, including the Netherlands, England, Japan, and Canada. We aggressively sought out different markets in the world to sell to. It makes sense for an independent artist and label to go with distributors that are familiar with each region.

Sobel: In much the same way that some indie labels have a physical sphere of regional influence, some digital distribution outlets have an analogous sphere of "cybercommunity" influence. Where traditional distribution channels may have exposure and sales in a two- or three-state physical region, some Internet music sites have exposure and sales to different audiences, different markets, and different continents, which simply broadens the ability of an artist to reach an audience.

Otter: UMVD is a global company. In my experience at Interscope, Geffen, and A&M, we take each artist individually and try to make that project work in specific breakout markets. We definitely share information and ideas with our colleagues around the country; if something works in one market, we will try to implement it in another.

Brown: Indie labels have to be very resourceful and use the available technology like the Internet to get our product all over the world. We can get our product out by posting MP3s on different sites on the Web. We can use outlets such as Amazon.com or CDnow.com—there are thousands of outlets on the Internet that can be very useful in getting traditional

distribution. If you start creating a big buzz on the Internet, eventually that overflows to the record stores, and then they call the label asking how to purchase the product that people have started requesting. It's like the snowball theory when done correctly.

This is all okay in theory, but readers are probably interested in how to initially get their products into a distribution network. How does an artist or a label get started? What is the process of submission or consideration for independents looking for distribution partners?

Brown: For an independent distribution company like TRC, all you need to do is find out the name of a buyer and then call, write, or e-mail him or her and pitch your product. First, you should make sure it fits the genre of the distributor you are talking to, so in [our] case, it's hip-hop, dance, or urban only. If you are into rock, punk, jazz, gospel, or any other type of music, you should search out a distributor that sells that type of music. Second, you should have a marketing plan or some type of sales history to show the distributor that your product will sell.

Sobel: Digital distribution partners should be seen as just another link in the chain of exposure, marketing, sales, touring, and merchandising endeavors. There are several reputable digital distribution outlets—MP3.com, ArtistDirect, and eMusic, among others—and there are new and emerging companies evolving on a daily basis. Each company offers unique opportunities according to different contractual obligations. I encourage artists to contact several potential digital distribution outlets to determine which of them offers the most appropriate array of services at reasonable terms. A key distinction between traditional label deals and digital deals is the requirement for exclusivity. Nearly every traditional label will require an exclusive arrangement, whereas most digital partners operate on a much more flexible, nonexclusive basis. That offers smart artists many opportunities to market their music.

Brown: Remember that if the distributor decides to pick up your product, you should realize that their main function is to get your product to the retail outlets, not make people buy it! The most common thing I hear from indie labels is "Why isn't my product selling?" It's because you—the label—probably didn't do anything to promote it. It's your job to make sure people come into the store and buy it. It is the distributor's job to make sure the product is in the store, available to be purchased. Also make sure your CD has all the mandatory things such as a UPC bar code on it and make sure it is shrink-wrapped. Those two little things often get left off indie records.

Otter: Honestly, as a marketing director, I'm not responsible for the A&R aspects of [the] labels we end up distributing. That's another facet of a major label: it's departmentalized. That is a reality of the major-label game; because there are so many projects happening at one time, we have to specialize duties, responsibilities, and expertise.

Many artists are doing it themselves these days. What can artists and labels do to enhance their chances of an ongoing, mutually beneficial relationship with a distributor?

Brown: To me, the biggest thing is forming a relationship with the sales reps at the distribution company. Go to your distributor and meet the people in person. Do a performance or special show if possible for the company. Making your product mean something to someone is one of the biggest ways to get the distributor to push your product. Also, establish a relationship with the retail buyers so you can let the distributor know you're also working the record.

Sobel: As in any successful partnership, both the artist or label and the digital distributor must contribute to the venture. Aggressive and creative marketing strategies are very effective on the Internet. One such strategy is *viral marketing*, which is basically Internet word of mouth. In an Internet-connected environment where fans have long e-mail lists of friends, it is very easy to spread the word about a new product, band, song, or show quickly because an e-mail sent to a list of friends is easily sent to another's

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list of friends. The compounding phenomenon of 1 begets 2, 2 beget 4, 4 beget 16, and so on spreads rapidly, much like a virus. That has proven to be an effective and inexpensive means of promotion and marketing.

Another Internet marketing concept is *data mining,* or using information that is volunteered by the consumer to the artist or Web-site host. If a fan voluntarily provides data such as age, gender, zip code, or music preferences, the smart artist can use that information to market and promote more effectively.

Then there are other things the artist can do, such as maintain an e-mail connection with the audience—for example, notifying them of special promotions, discounts on CD purchases, and the like—and taking advantage of the entire spectrum of Internet and Web site exposure, including news, live versions of songs, newer songs, chat pages, photos, and videos on an artist's Web site. Those techniques all offer a broader, richer experience for the fan and a new opportunity for the artist to market or sell merchandise, and they can stimulate exposure and sales in ways that a traditional brick-and-mortar store cannot. Furthermore, structuring joint venture opportunities, such as tours, merchandising, advertising co-ops, and marketing campaigns, can be effective for gaining exposure, which leads to building relationships with an audience, which leads to commerce.

Otter: I have been on the road with Weezer in the past weeks, doing a lot of in-store signings and performances. For a new or developing project or artist, those sorts of events are ideal for making new fans and reconnecting with old, dedicated fans. For a band that is trying to establish a fan base, it is key that they play as many shows as they can and go out into the audience afterward and introduce themselves to any fans or potential fans. Getting and maintaining a strong base are important for launching and sustaining any longevity of career in this business. Management, both for established acts and up-and-comers, needs to recognize and reward people for being faithful to a band over a span of time.

I think whether it is a meet and greet, when fans get to go backstage and meet an artist; an in-store event; or even an industry dinner with a band, if bands or artists are cool, you are going to work that much harder for them. I have had many record retailers and distribution people fall in love with a band or artist after they get to spend some time with them. That one-on-one contact really makes people feel like they are a part of the project, whether that contact is breaking bread with Weezer or having them sign their new CD for you. It is really a powerful example of how important music is to our culture.

There has been a lot of talk in the industry over the last several years about the death of retail sales due to the Internet. Are you seeing such a downturn? What are your thoughts on this trend and on the future of the coexistence of traditional distribution and digital distribution?

Sobel: I think heralding the death of retail sales is a bit premature. Digital distribution won't erase retail sales in the short term. On the contrary, exposure that a band achieves on the Internet often leads to sales of their records at retail outlets. As digital distribution matures, however, it is likely that computer-savvy consumers will find that purchasing music through digital distribution channels, including streaming, downloading, and subscription, will be more convenient and rewarding than purchasing a traditional CD. Digital distribution of music from an artist to a fan will soon provide efficiencies, enhancements, and a connectedness that a traditional sale cannot.

Brown: I think that retail sales have slowed down a bit due to the Internet, but I think it's mostly because of the outrageous prices that CDs sell for now—$17 to $18! I know plenty of people who just won't go out and buy music the way they used to because it costs so much.

Sobel: The technology currently exists to distribute, monitor, account, and monetize music over the Internet. The obstacles, however, involve the complex migration of licensing protocols together

with the history the labels have in controlling the physical distribution of records. As we come to understand that music is not so much about controlling the manufactured containers—records—as it is about monetizing the artistic creations—songs—we will also learn how to take advantage of digital distribution to reward and incentivize music as a service and not as a product.

Brown: I think traditional distribution will always be around because it's so great to go out to a record store, sift through records or CDs, and find gems. That will always be the case, but as technology grows and becomes easier to use, I do think more people will be getting their music via the Internet in some way, shape, or form.

Otter: The dealings on this are moving so fast and are happening so high up in the corporate ladder, I can't adequately address it on behalf of my labels. However, I spend a majority of my money shopping for records in retail stores. People in and out of the industry are always totally boggled by why I, given my job, would have to buy music. The answer is that I love music more than anything in the world, and there is no way that I get even a fraction of all the stuff I want from work. There are few pleasures that I prefer to spending a foggy San Francisco afternoon digging through the bins of Amoeba [Records] on Haight Street. Whether it is an obscure indie release that is just brilliant, a B-side single, or some scratched vinyl that reminds me of playing records on my first Fisher Price record player, there is far too much music and there are too many genres for me to ever feel that my collection is complete, or that my musical education is even close to being complete.

DELIVER THE GOODS

As the panelists point out, distribution is a complicated matter because it is the point at which many aspects of the industry come together: artists, fans, labels, promotion and marketing, and actual delivery of the product. The ever-evolving world of digital distribution provides some new alternatives to the traditional model and is yet another factor to consider when planning the distribution of your music.

Ultimately, however, the members of the music-buying public make the final decision regarding what they want to buy, and what they want are great songs that are performed well. So be sure your understanding of distribution and the delivery of your music is backed up with musical goods that deliver.

EM *contributor* **Michael A. Aczon** *is spending the summer conserving electricity in his Richmond, California, home by playing his 12-string acoustic guitar with his family as they sing Beatles songs together.*

We welcome your feedback. E-mail us at emeditorial@intertec.com.

REVIEWS

KORG

KARMA

This maroon monster takes the "work" out of workstation.

By David Battino

After unleashing the Triton proX, winner of the 2000 EM Editors' Choice award for keyboard synthesizer, Korg probably could have coasted for a few years. The obvious next step would have been to play the specs game, repackaging the Triton technology with more oscillators or sample ROM and a snazzy new name.

Instead, Korg tripled the Triton's CPU power but left the proven audio engine, devoting the additional mojo to a sophisticated MIDI processor that redefines how the synth interacts with its player. There's also good news for those who haven't been able to afford a Triton: Korg shaved $750 off of the new instrument's retail price by trimming some features many musicians won't miss.

The result is a monster of a keyboard

FIG. 1: A descendent of Korg's popular Triton series of workstations, the Karma incorporates an innovative MIDI performance processor that interacts with the player in real time.

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FIG. 2: The Karma's back panel has three MIDI ports, three jacks for footswitches and pedals, and two pairs of analog audio outputs. The instrument uses an external power supply.

called Karma. Playing it reminds me why I got into electronic music: the Karma provides that magical combination of instant gratification and enormous potential that makes you want to jam until your fingers fall off.

If you've seen the Karma and dismissed it as a mondo arpeggiator or a hip auto-accompaniment keyboard, you're wrong. Arpeggiators simply spit out sequences of notes, whereas the Karma shapes those notes in real time to reflect what you're playing, altering tempo, Velocity, filtering, and more. For example, the Karma's Magic Flute Combi generates trails of pulsating, arpeggiated echoes from each note you play in the top three octaves of the keyboard. When you change the chord in the bottom two octaves, the flute echoes automatically transpose to fit. Flick the joystick, and a percolating guitar arpeggio in the lower region transforms into a strum.

Auto-accompaniment keyboards also alter their prerecorded riffs in response to chord changes, though generally just by making simple transpositions or riff substitutions. The Karma can trigger riffs too, but they can be altered in real time by MIDI or set to evolve automatically. The latter option makes the Karma similar to algorithmic software such as SoundTrek's *Jammer* or PG Music's *Band-in-a-Box*, except that Karma doesn't make you input chord progressions first.

PRODUCT SUMMARY

Korg
Karma
keyboard workstation
$2,250

FEATURES	4.0
SOUND QUALITY	4.5
EASE OF USE	3.5
VALUE	5.0

RATING PRODUCTS FROM 1 TO 5

PROS: Excellent, dynamic sounds. Astonishing interactivity. Expandable.

CONS: Cramped, confusing display. Exceeding sequencer's memory limit erases data. Dense manuals. No digital-audio output.

Manufacturer
Korg USA
tel. (516) 333-9100
e-mail product_support@korgusa.com
Web www.korg.com

KARMA SUTRA

Although it looks reddish in many photos, the Karma is actually an attractive pinkish purple (see **Fig. 1**). The center section is made of brushed aluminum, and the end caps are plastic. A plastic door at the top left pops open to reveal two sockets for Korg's growing range of EXB-PCM sample-ROM expansion cards ($240 each). The door feels flimsy, but you probably won't be opening it often. Nonetheless, the door makes adding expansion cards easier than with the Triton. Compared with the Triton, though, the Karma's back panel is short one pair of assignable audio outputs (see **Fig. 2**).

A slot on the underside of the Karma accepts the EXB-MOSS card ($600), a physical-modeling synthesizer board derived from the Korg Z1. Except for the KARMA Real-time Controls section (eight knobs and three switches that control the MIDI processor), the rest of the knobs and switches are functionally equivalent to those on the Triton, though more of them have assignable functions. The Karma also includes four illuminated Chord Trigger buttons.

If you've used Korg workstations in the past dozen years, you'll recognize the Karma's logical, menu-driven screen layout. Unfortunately, the instrument comes with four densely written manuals, which, in combination with an often cryptic display, make learning to use the Karma slower than necessary. However, Korg posted searchable PDFs of the manuals on its Web site, and the Karma user-group site has many helpful tips (see the table "Online Karma").

The Karma easily loaded the Triton patches and songs I downloaded from Korg's Web site and transferred to disk. (In Korg's nomenclature, patches can be one- or two-oscillator Programs or multi-Program Combinations [Combis] that contain as many as eight Programs arranged as splits, layers, or multitimbral sequencer templates.)

Loading Triton patches revealed how much the Karma's real-time MIDI processor enhances its sound. All the Triton patches come up with a generic arpeggiator preset, whereas Karma's versions of the same patches are complex, dynamic symphonies of sound that twist and evolve under your fingertips.

TRITON TRUE?

Before I get into the nitty-gritty of what makes the Karma unique, it's important to describe the differences between the new instrument and its progenitor, the Triton. (See the January 2000 issue or visit www.emusician.com for a Triton review.) The relative importance of the Karma's missing features versus the power of the new MIDI-processing capabilities depends on your needs as a musician.

Sampling. The Triton offers stereo sampling, and its audio inputs can be used for real-time signal processing. The Karma provides no sampling or sample importing. Because so many music styles depend on sampling, I wish the Karma had a flash RAM slot and could import samples from a computer.

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Outputs. The Triton has six analog outputs to the Karma's four. But with the Karma's flexible routing and high-quality effects, two fewer outputs are not that much of a disadvantage. (The effects are identical to those on the Triton.)

Interfacing. The Triton has a serial MIDI interface to a Mac or PC and the option to install a SCSI port; the Karma has neither. However, without sampling capabilities, the Karma would gain negligible benefit from SCSI.

Display. The Triton's touch-sensitive display is 320 by 240 pixels, whereas the Karma uses the same 240-by-64 screen as the Triton-Rack. The smaller display is frustratingly cramped and cryptic; some letters are only 3 by 4 pixels. Unlike the Triton-Rack, the Karma has navigation buttons that are so distant from its data-increment buttons that you have to use both hands to make adjustments.

Keyboard. The Triton is available in 88-, 76-, and 61-key versions (as well as a rack-mount model), but the Karma comes only in a 61-key configuration. The Triton's Yamaha action is crisper than the Fatar action on the Karma. I thought that would bother me, but I became used to the Karma keys quickly. However, the Karma's Aftertouch is a bit squishy.

Power supply. The Triton's power supply is internal; the Karma has a line lump.

Ribbon. The Triton has a ribbon controller, and the Karma has a boatload of performance knobs and switches, giving it the advantage.

Arpeggiators. The Triton has dual polyphonic arpeggiators. The Karma has the vastly more powerful MIDI-processing technology called Kay Algorithmic Real-time Music Architecture (KARMA).

FIG. 4: The animated Note Activity screen shows the name and notes of the chord you're playing as well as any new notes generated by the four KARMA processors.

GIMME A KAY

Korg licensed KARMA from musician and programmer Stephen Kay, who has been refining the software for seven years; he's won six patents so far. Kay is also the creator of some brilliant factory demos for Korg synths dating back to the O1/W. He developed KARMA to assist in his own compositions.

At the heart of KARMA are 1,190 Generated Effects (GEs), algorithms that transform the notes you play—or changes you make to a knob, a joystick, or another MIDI controller—into new musical gestures. For example, if you play a three-note chord with the Spanish Gtr C6-> Program, you hear it arpeggiated over two octaves. Move one finger to a new note, and depending on the note's Velocity relative to the previous Velocity value, the new arpeggio plays faster or slower, which is quite expressive. Release the chord, and the arpeggio slows down and fades away.

If you play some notes in the keyboard's top octave (above C6), their pitches are ignored, but each new key press advances the arpeggio pattern by one note. I spent hours playing the Program. While your left hand grabs simple block chords, your right is free to control timing and Velocity; the result is less thinking and more expression.

The real magic comes when you apply Karma's other controllers to the sound. Each GE has more than 400 parameters, as many as 16 of which are mapped to the Karma's hardware controllers (see **Fig. 3**). In the Spanish Gtr Program, available parameters include Swing Percentage, Note Duration, Note Randomize, and Clock Advance. A Scene button lets you store two sets of knob-and-switch configurations per Program and flip between them. So far, I've been describing Scene 2 of Spanish Gtr; in Scene 1, Clock Advance is disabled, so playing chords produces a strum rather than an arpeggio. Those control capabilities are in addition to the familiar Triton knobs for filter cutoff and other sound shaping.

The eight knobs are laid out in two rows of four, but the corresponding onscreen knobs are laid out in two columns of four. That arrangement took some getting used to. On certain GEs, some knobs are configured to switch among a small number of values; however, the display doesn't indicate how many values are in the list, which makes it tricky to dial in precise settings. For example, Knob 3 might call up four snare patterns, but you will have to experiment to discover which of them is active at the 12 o'clock position. I wish it were possible to name the controller assignments myself; during performance, "Dive Bomb Amount" might jog my memory faster than "Bend End %."

FIG. 3: The KARMA Real-time Controls screen shows which Generated Effects (GE) parameters are mapped to the Karma's eight knobs and two buttons in the current Program.

GE BRINGS GOOD THINGS

I mentioned some of what an arpeggio GE can do, but 14 additional categories of GEs include Keyboard, Bell/Mallet, Acoustic Mono, Ethnic, Guitar, Bass,

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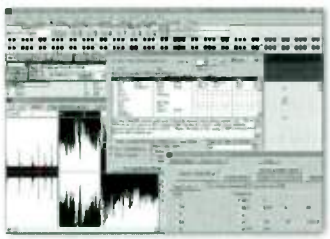

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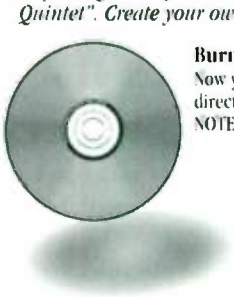

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Synth, Pad Motion, Sound Effect (SE), Gated, and Drum Pattern. Because they're hooked into the synth engine, the GEs can control pitch bend, LFO depth, envelopes, filtering, and more. The idea is to produce idiomatically correct instrumental parts, and generally, the GEs succeed. Adding KARMA to the normally tame Harmonica Program produces fuzzed-out scoops and tonguing effects. In the Marimba Vel/AT Program, high Velocities trigger mallet rolls, with Aftertouch controlling their tempo and volume.

You can run as many as four GEs in a Combi or song, making the Karma really come alive. Some Combis are so rhythmically dense that they play themselves, emulating jazz trios and progressive-rock jams. I mapped a footswitch to toggle KARMA on and off so I could catch my breath. On other Combis, the accompaniments are more subdued. I happily played David Gilmour–esque solos on the New Breed of Gtr Combi while a KARMA-generated drummer improvised a backbeat and tom fills. Incidentally, several Karma factory patches are so loud that they distort internally. Lowering the volume slider will fix that during performance; for a permanent repair, lower the Level slider on the Performance Edit screen and resave the patch.

When it comes to animated synth pads, the Karma is a behemoth. Dial up the /\Gods Bathtub/\ Combi, walk your fingers up and down the Chord Trigger buttons, and you'll see what I mean. No synth since the Wavestation has caught my ear that way. The Wavestation stood out in a mix—often too much—because of its percolating textures, but the Karma makes sounds that evolve timbrally and harmonically.

You might wonder what one-finger chord buttons are doing on a professional synth. The four Chord Triggers have some surprisingly useful applications. Each button can store a chord with as many as eight notes. You can enter the notes all at once or individually, which means that you can capture spread-out harmonies that would be impossible to play otherwise.

Korg provided appropriate chords for most Programs and Combis, which makes auditioning sounds a snap. Many preset chords feature luscious harmonies. Whenever I found one, I called up the Note Activity screen, revealing the chord's name and the notes for an instant music-theory lesson (see **Fig. 4**).

The Chord Triggers are also handy for soloing, firing off difficult chord progressions, and preserving interesting harmonies you stumble across while improvising. By pressing the Latch button, you can free up your left hand to operate the knobs and joystick while your right hand wails.

KARMA 'N GET IT

For exclusive Karma demos and royalty-free samples produced by KARMA creator Stephen Kay, visit **EM** at www.emusician.com.

Karma Specifications

Polyphony	62-note in single-oscillator mode; 31-note in double-oscillator mode
Multitimbral Parts	16
ROM/User RAM Programs	256 (GM2)/640 (768 with EXB-MOSS option installed)
ROM/User RAM Combis	0/768
Drum Kits	64
Sound ROM	32 MB (425 multisamples + 413 drum samples)
Filters	4-pole resonant lowpass; 2-pole combination lowpass/highpass
Effects Processing	(5) insert effects (102 types); (2) master effects (89 types); (1) stereo master 3-band EQ
MIDI Effects	(1,190) KARMA GEs, expandable
Sequencer	(16) tracks; (200,000) events; (200) songs; (150) preset/(100) user Patterns per song; 192 ppqn resolution; RPPR function
Keyboard	61-key; transmits Velocity, Channel Pressure
Controllers	(4) dual-function knobs; (2) switches; (1) joystick; (1) slider; (8) KARMA knobs; (2) KARMA buttons; (4) Chord Triggers; (1) Scene 1/2 button; (1) Latch button; (1) Tempo knob
Audio Outputs	(4) ¼" unbalanced TS; (1) ¼" stereo headphone
Additional Ports	MIDI In, Out, Thru; (1) damper pedal; (1) assignable footswitch; (1) assignable footpedal
Storage	3.5" floppy drive
Dimensions	43.3" (L) × 4.7" (H) × 12.6" (D)
Weight	22 lbs.

BEYOND SEQUENCING

While playing the Karma, I repeatedly happened upon fortunate sonic accidents, not to mention licks no human could play. Luckily, the built-in 16-track sequencer makes capturing and developing such moments reasonably convenient. You can copy a Combi to a song with four clicks, setting up eight tracks with the proper sounds and effects. (Strangely, copying a single Program to a song requires dozens of keystrokes.) When you punch Record, the sequencer memorizes the notes and control data that you and KARMA generate. Even spiraling harp glissandi show up in the event list as editable notes.

Recording multiple GEs (such as a drum pattern, guitar strum, and bass line to accompany your soloing) requires you to arm multiple tracks. There's a hidden danger, though, because enabling the Multitrack Recording mode arms all 16 tracks. The Karma's sequencer then divides its available memory by 16 and then again by 2 to allow for the Undo buffer. In this case,

the 200,000 available MIDI events are suddenly reduced to just 6,250 per track. Because KARMA generates so much MIDI data, you can easily max out the memory after 32 bars or so. If that happens, everything you've played since you last hit the Record button is erased without warning. Even though previously recorded data remains intact, the threat of unexpectedly losing a take in progress is a major annoyance. I wish that the sequencer displayed a real-time memory meter and saved recordings in progress.

The work-around is to determine which tracks need to record data and then disable the rest. A slicker method is to turn the Local Control parameter off and loop the Karma's MIDI output through an external sequencer. The returning MIDI data then triggers the KARMA effects, and only the notes you play and Control Changes (CC) you make are recorded in the external sequencer. To capture the whole shebang in the external sequencer

Online Karma

Here are some of the best places to experience the Karma on the Web.

TITLE	URL	FEATURES
Karma Discussion Group	http://groups.yahoo.com/group/korgkarma	Lively Karma forum with tutorials by Stephen Kay.
Karma Flash Demo	www.korg.de/karma/index.html	Music clips; Karma close-ups from Korg Germany.
Karma Lab	www.karma-lab.com	Stephen Kay's site, bursting with MP3s and background details.
Karma Radio	www.mp3.com/stations/karmaradio	Streaming and downloadable music by Karma Discussion Group members.
Korg USA	www.korg.com	Streaming video; downloadable software, MP3s, and manuals.
Tritonhaven	www.tritonhaven.com	Triton resources, including Karma-compatible patches.

for detailed editing, leave the Local Control parameter on.

You can do some fairly deep editing in Karma's sequencer, which is identical to the Triton's (with a less informative screen). You can transpose pitch and scale the Velocities of ranges of notes (a handy feature for remapping drum parts), quantize with variable intensity (though not with swing), create CC ramps, and more. A Pattern feature allows you to record single-track performances and quickly insert them at different sections in the song; Korg supplies 150 preset Patterns. The innovative Real-time Pattern Play/Recording (RPPR) feature lets you trigger Patterns from the keyboard as a sequence plays.

THE BEST IS YET TO KARMA

After devoting seven years to KARMA, Stephen Kay isn't about to give up. He and Korg are discussing the possibility of releasing software that will let Karma users create new GEs. (The synth has memory to store more GEs, but it will require an OS update to load them.)

Kay also hopes to release a standalone software version of KARMA (see **Fig. 5**), though it's hard to imagine how it will integrate as tightly with a generic MIDI setup as with the Karma keyboard. "It helps to have a flexible system like the Triton sound engine, in which many things, such as the filter settings and various parameters of the insert effects, are controllable via MIDI," Kay says. "It also helps having an international team of programmers spending more than a year creating all the GEs and Combis."

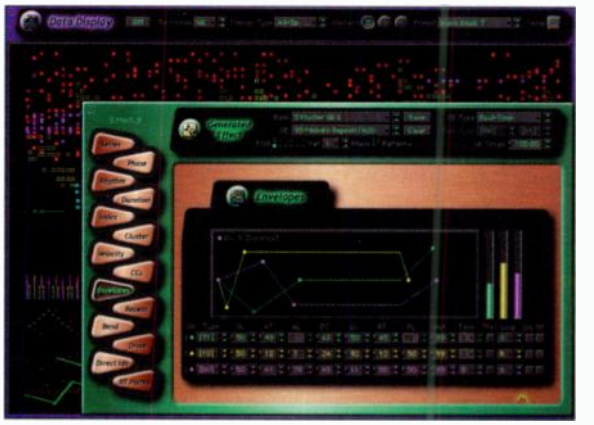

FIG. 5: The KARMA software used by Korg's voicing team to create the synthesizer's GEs is being considered as a standalone product.

I suggested that a standalone version might be tighter if it included a software synth or ran on Korg's OASYS sound card, and Kay was receptive. "I have many plans for KARMA," he says. "I'm already working on new features."

Keep your eye on Korg's Web site for downloadable Karma OS updates. Users of Karma OS 1.0.2 or earlier should grab the latest version (currently 1.0.4), which fixes a sustain-pedal issue that eats up polyphony. Updating the OS is

easy; just download three files, transfer them to three floppy disks, and feed the disks to the Karma sequentially.

IS IT CHEATING?

I've heard the Karma described as "a beer commercial in a box." I've also seen some discussions online about Karma leading to the "death of musicianship." I've come to believe the opposite is true. Yes, it is easy to get impressive-sounding results right away, but unless you make some effort, they'll start to sound stale pretty quickly. The Karma is meant to be played. You need to dive in and wield those knobs to bring out its (and your) true personality.

I have read hundreds of posts from Karma owners, doubters, and cravers. Some have rejected the Karma because it doesn't have Triton features such as sampling and an internal power supply or because they didn't grasp that KARMA is far more than a fancy arpeggiator. The happiest ones seem to be those who just let KARMA wash over them, building on its collaborative suggestions. One enthusiast wrote, "It's as if I had another musician to jam with who came up with some cool, original ideas."

Admittedly, the Karma has a few problems. As a workstation, it comes up a bit short; you'll need to add a computer or hard-disk recorder to create productions with vocals or instrumental overdubs. When I ran the Karma in tandem with my sampler, it added a whole new dimension of realism and character. However, if you have even basic keyboard skills, if you've been frustrated by the obstacles you need to overcome to record your ideas, or if you don't mind getting a platter of new ideas delivered every time you punch up a preset, the Karma is worth a close listen.

I predict that thousands of open-minded musicians will be scooping up Karmas. If you make the effort to master KARMA's real-time controllers, you'll be rewarded with an evocative yet personal sound.

By the time you read this, **David Battino** *should be putting the finishing touches on* **EM***'s 2002* Desktop Music Production Guide, *which storms the beaches on October 4.*

SONIC FOUNDRY

VEGAS AUDIO 2.0 (WIN)

Place your bets:

Vegas *is a winner.*

By Allan Metts

After dominating the stereo audio-editor market for many years with its *Sound Forge* program, Sonic Foundry has caught the attention of studio owners everywhere with the release of its multitrack editor, *Vegas Audio* 2.0. Formerly known as *Vegas Pro, Vegas Audio* 2.0 features an intuitive, easy-to-use interface; a powerful recording and editing environment; and support for many types of media within the same project file.

In addition to *Vegas Audio* 2.0, Sonic Foundry now offers *Vegas Video* 2.0 and *Vegas Audio LE* 2.0. Whereas *Vegas Audio* provides comprehensive audio capabilities and a single video track (along with some video-editing tools), *Vegas Video* includes *Vegas Audio* and an extensive feature set for complex digital-video editing. The features include specialized video effects, filters and generators, compositing of multiple video signals, and advanced transition effects. (See the Sonic Foundry Web site for a comparison of the versions.) *Vegas Audio LE* is a streamlined product at a reduced cost that provides eight audio tracks and basic audio-editing capabilities. It also supports still images and includes a video reference track but no video editing.

I'll look at *Vegas Audio* 2.0 in this review. (See the February 2000 issue for a review of its predecessor, *Vegas Pro* 1.0a.) I'll start with some *Vegas* basics but will focus primarily on the software's new and improved features.

VEGAS VACATION

Vegas Audio is available as a Web download or in a boxed CD-ROM version. (Sonic Foundry puts product updates and links to supporting libraries, such as Microsoft's DirectX, on its Web site.) I installed from the CD-ROM and had no trouble setting up.

If you download the software, you can use *Vegas Audio* for seven days, and then you must register it. There are several painless ways to register, and you can choose options to protect your privacy. You can even register without providing any personal information. If mandatory registration keeps piracy down and prices low, I'm all for it.

Vegas Audio opens to an uncluttered, modern-looking interface (see **Fig. 1**). It has two status bars, a customizable toolbar, a time display, a scrubbing tool, and transport controls. The remainder of the main window consists of an area for working with tracks and an area for docking windows.

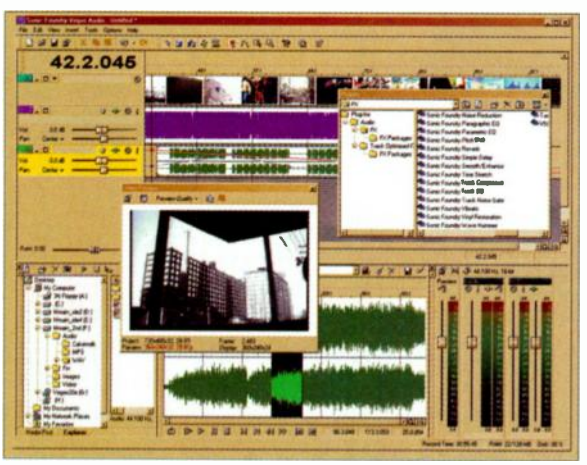

FIG. 1: *Vegas Audio* offers an intuitive and powerful user interface. Pop-up menus, dockable windows, and extensive drag-and-drop support make the program a joy to use.

The *Vegas Audio* user interface is remarkably customizable. You can move things around to an amazing degree and resize nearly every boundary. You can drag ten program windows to the docking area, position them anywhere on the display, or remove them from the screen. You can even relocate the time display that appears by default in the upper-left corner of the screen, but interestingly, you can't move the transport controls.

Minimum System Requirements

Vegas Audio

Pentium II/200; 32 MB RAM; Windows 98SE/ME/NT 4.0/2000

The docking area is quite flexible. Drop a window onto it, and the window resizes to fill the surrounding space. Drop another one in the same spot, and a tab control appears that lets you switch between the two open windows. If you have a window open and put another window in a different spot, the docking area splits in two, complete with a border that can move to change the relative size of the two window panes. What's more, the second window pane can accept additional windows, which creates an additional set of tab controls. You can continue adding tabbed and split windows until you run out of things to add.

WINDOW-SHOPPING

Given that flexibility, you might wonder what the windows are for. Among the most important is the Explorer window, which is used to select and preview the media files on your system, and the Trimmer window, in which you perform edits on your audio Events. (The term *Event* refers to a media file or portion of one on disk. Because Events are just pointers to the media file, you can safely manipulate and edit them without affecting the original.) There's also the Mixer window—for controlling the audio on each *Vegas* bus, the assignable effects, or the entire project—and the Video Preview window, in which you can see what the video portion of your project will look like when you render it. The Plug-In Chooser window provides access to your system's DirectX plug-ins, and the Edit Details window displays a tabular listing of every Event in your Project. Those windows aren't new to version 2.0, so I won't cover them.

Vegas's Explorer window gives you access to the media files on your system, but sometimes you want to see just the

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files in the current project. For that purpose, *Vegas* provides the Media Pool window (see **Fig. 2**). The screen shows how many times each file in the project is used and where it is stored on disk. You can remove or replace media files in the Media Pool, sort the files by attribute, and browse the folder that contains the files. You can also preview files, insert them into tracks, or open them in the Trimmer window.

The Media Pool also shows file attributes that aren't visible in the Explorer window. For example, you can see the sampling rate and bit depth of audio files or the field order and pixel-aspect ratio of video files. Some settings can be altered—if you want to view the images using different dimensions, for example. There are also fields for comments or other text entries. Those get stored with your *Vegas* project, not with the media file, which means you can use different comments with a file if it appears in multiple *Vegas* projects.

TICKTOCK

Vegas now includes a built-in metronome to help you stay in tempo during recording. You can use the default metronome sounds built into the program, or you can specify your own audio files for the accented and unaccented beat. Unfortunately, only one time signature and tempo can be specified per project. If your music drops into 3/4 time or accelerates to the end, your metronome and measure/beat displays will get off-kilter. For my material, I really needed the ability to specify a tempo and time signature map.

Once you record your tracks (or build them from audio files on your hard drive), you'll probably want to set up your mix automation before you render the final product. You do that with envelopes.

Vegas Audio offers two kinds of envelopes: Event and Track. Event envelopes control the volume of an Event throughout its duration and are always exactly the same length as the Event itself. You can drag Event envelopes with your mouse to set the overall volume of the Event and to create fade-ins and fade-outs. If you like, *Vegas* can automatically use the Event envelopes to create crossfades when two Events overlap.

FIG. 3: The Pan/Crop window lets you size, crop, and rotate video Events. You can even animate your settings with the built-in keyframe controller.

Event envelopes are handy, but they cannot simulate the complex fader moves that you would execute in a typical mixdown session. That's where Track envelopes come in. Track envelopes can span multiple Events in a Track and can control volume and panning. You add nodes to the Track envelope anywhere you wish and then move those nodes to the volume or pan setting you desire. *Vegas Audio* executes the volume and pan changes as your piece plays by interpolating between the node points. The changes between nodes can take place in a linear fashion, or they can accelerate or decelerate.

New to version 2.0 is the ability to copy and paste envelopes between tracks. Also new is the Lock Envelopes feature. When envelope locking is switched on, each node stays attached to the Event. If you move the Event, the rest of the Envelope adjusts accordingly. So if you drop the gain when your singer belts out that high C, you can ensure that the gain change always occurs in the right place, even if you shift the passage forward or backward in time.

VIDEO IN VEGAS

Vegas Audio includes one type of envelope that is used for editing video. That envelope controls the opacity of a video Event. (*Vegas Video* offers envelopes for fancy effects such as video velocity and fade to color.) Opacity determines how well you can see whatever is beneath the event you're editing. An event with 0 percent opacity doesn't show at all, whereas one with 100 percent opacity completely obscures a video event below it in a video Track. If you set a video Event to 50 percent opacity and drop it on top of another video Event, both images are equally visible.

Using opacity Event envelopes, you can create video fade-ins and fade-outs just as you do with audio Events. By default, *Vegas Audio* automatically creates video crossfades when two Events overlap.

Vegas Audio can import AVI and QuickTime movies, but you're not limited to moving pictures—*Vegas* also imports a number of still-image formats, such as JPEG, Windows Bitmap (BMP), Targa (TGA), GIF, and Portable Network Graphics (PNG). Photography is a hobby of mine, and I was able to easily create a montage of my favorite images (with an original song accompanying

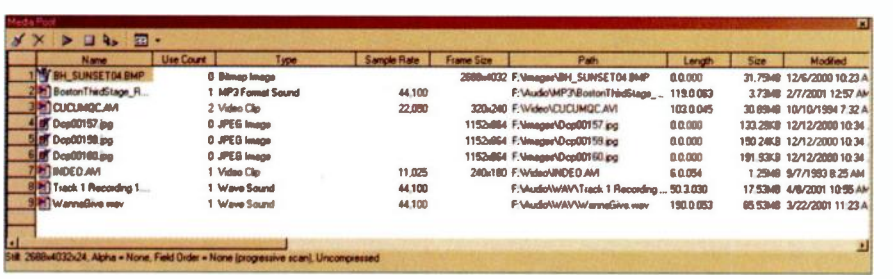
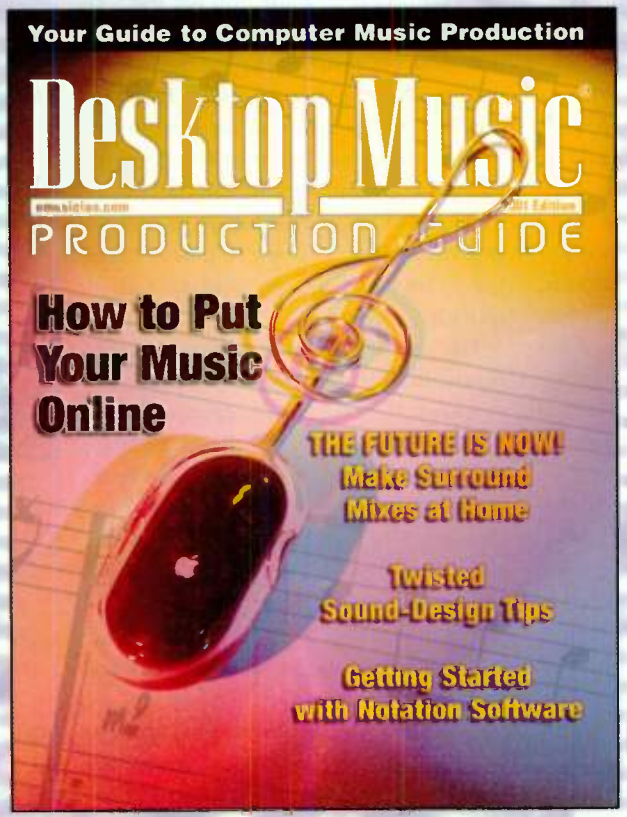


FIG. 2: The Media Pool window is new in *Vegas Audio* 2.0. You can see the media files in use by your Project and gain access to common settings and operations. Notice the variety of media types that can coexist in one work session.

Electronic Musician presents the 2001



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the pictures). You can specify how long each still image appears, and you can define the transition between each one. Transitions are limited to cuts, fades, and crossfades, however—you need *Vegas Video* if you want something more elaborate.

Entire video Events or just portions can be cut, copied, and pasted. For example, you can extract the middle of a video Event and paste it at the end. When you do, you end up with three Events instead of one: the extracted portion, the portion that preceded it, and the portion that followed it. If you want those three Events combined for future editing operations, simply group them together. Once you create a *Vegas* Group, any movements or edits take place on the Group as a whole.

It's no coincidence that video- and audio-editing operations are similar—*Vegas Audio* uses the same paradigm for both types of Events. That factor contributes to the program's intuitiveness and ease of use.

IT SLICES, IT DICES

Additional video edits are possible using an Event's Pan/Crop window (see **Fig. 3**). That window provides a representation of the video Event and offers a frame through which you view it. To conceptualize the viewing frame, think about watching a movie through a rectangular hole in a piece of cardboard. If you hold the cardboard up high, you see the top portion of the movie. If you enlarge the hole, you see more of the movie.

The size of a video Event is fixed in the Pan/Crop window. You can make the image appear larger or smaller (for viewing convenience), but an AVI file at 320-by-240-pixel resolution is always represented as 320 by 240 pixels. So if you zoom in, the image pixelates rather quickly.

The size of the viewing frame is a different matter, however. Shrink it, and you crop the image (the cropped area appears black). Enable the Stretch to Fill Frame option, and you can zoom in or out by making the frame larger or smaller. You can pan the frame left, right, up, or down, and you can also rotate the frame around any center point. Turn the frame upside down, and you invert the image that appears onscreen.

A number of positioning aids appear on the Pan/Crop window. You can restrict frame movements to horizontal or vertical directions, and you can lock the frame's aspect ratio. You can snap the frame to a grid (the grid size is user-definable), and you can force all of the sizing to occur around the center of the frame. If you like, you can distort the aspect ratio of the source material to create stretched or squished video.

But wait: there's more. You can save presets with your favorite settings, and you can make the viewing frame move as time passes. By moving the frame across an image of text—for example, the credits for your video—the text will appear to scroll across the screen. By varying the size, position, and rotation of the frame, you can create a number of zooming, panning, spinning, and spotlighting effects.

To animate those settings, use the keyframe controller at the bottom of the Pan/Crop window. Keyframes are specific points in your movie to which you've assigned a set of size, position, and rotation settings. *Vegas* smoothly transitions between the settings of two keyframes, so if the image is right side up at one keyframe and upside down at the next, you'll see the image rotate during playback. You can specify rotations greater than 360 degrees, and the image will spin multiple times. The controller presents the Event you're working on as a horizontal bar and provides controls to add, remove, and move among the keyframes.

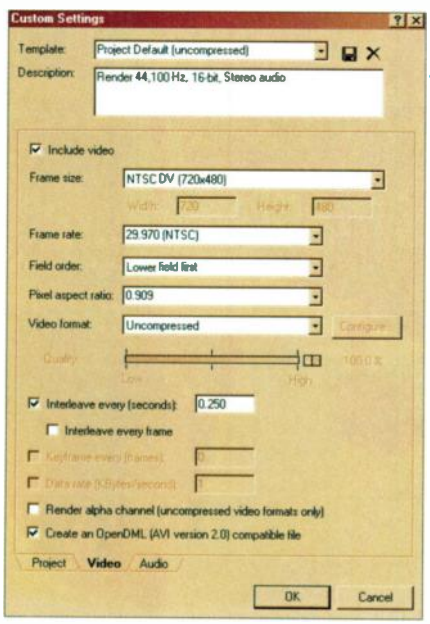

FIG. 4: When it's time to render your project to its final form, you have plenty of choices. This shows the specifics of a project's video portion.

PRODUCT SUMMARY

Sonic Foundry
Vegas Audio 2.0 (Win)
multitrack audio editor
$399.95

FEATURES	4.0
EASE OF USE	4.5
DOCUMENTATION	5.0
VALUE	3.5

RATING PRODUCTS FROM 1 TO 5

PROS: Intuitive user interface. Capable video editing. Excellent documentation. Numerous DirectX effects included.

CONS: Only one tempo/time signature setting. No on-the-fly punch in. No MIDI-based controller automation.

Manufacturer
Sonic Foundry
tel. (800) 577-6642 or (608) 256-3133
e-mail customerservice@sonicfoundry.com
Web www.sonicfoundry.com

VEGAS EFFECTS

Vegas Audio provides excellent support for DirectX effects. Any number of DirectX effects can be chained together and applied to Tracks or output buses. You can also create Assignable FX sends. In more familiar terms, Track effects correspond to channel insert effects, effects on buses are equivalent to master channel effects, and Assignable FX are the same as effects sends.

Although those options are not new to *Vegas Audio* 2.0, previous versions allowed only a limited number of Track Optimized effects to be used. Now you can use an unlimited number of DirectX effects, as many as the limits of your computer allow.

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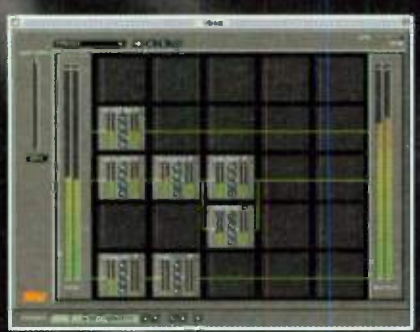

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Also new to version 2.0 is the ability to apply non-real-time destructive effects to any Event, which saves CPU power during playback. *Destructive* is a bit of a misnomer, because *Vegas* saves the processed audio in a different file by default. Destructive effects are applied only to entire Events. To process a smaller region, you have to break your Event into pieces.

Vegas Audio ships with three Sonic Foundry effects packages, which are also sold separately under the names *XFX 1*, *XFX 2*, and *XFX 3*. If you have no DirectX effects installed on your system, you'll suddenly find yourself with a rather capable set when you install *Vegas*. Included among the 18 total are common effects such as delay, reverb, chorus, and pitch shifting and some not-so-common ones such as amplitude modulation, vibrato, Gapper/Snipper, and a smoother/enhancer.

There is much to love and nothing to hate about *Vegas Audio* 2.0.

Also included are parametric, paragraphic, and graphic EQs and three types of dynamics processors: a noise gate as well as graphic and multiband compressor/limiter/gates. Overall, I had all the effects I needed for a typical work session, and the quality of the effects was good. The reverbs and choruses aren't the silkiest I've heard, but they're usable nonetheless.

Several tools stretch or compress the length of your audio. One appears as a DirectX effect, but my favorite is what Sonic Foundry calls Rubber Audio, which is in the Event Properties page. The tool already knows the length of your Event, so you simply specify the new time and indicate whether the pitch should be altered. That was useful when I needed to change the length of an audio Event to match that of a video Event. You can also press the Control key on your keyboard and drag an Event to make it fit a new time, which is handy for beat matching and for ensuring that audio events stay lined up.

VIVA VEGAS

Once your project plays back just the way you want, render it to its final form. *Vegas Audio* supports a variety of common and not-so-common audio and video formats. New to version 2.0 is support for RealAudio 8, RealVideo 8, Windows Media 7, QuickTime 4.0, and OpenDML AVI. With each rendering operation, you can specify appropriate settings such as the video frame rate and resolution and the audio sampling frequency (see **Fig. 4**). You can even create Edit Decision Lists (EDLs) for use with other video applications.

There is much to love and nothing to hate about *Vegas Audio* 2.0. The user experience is impeccable, and the documentation is thorough. The product is packaged with a separate tutorial CD, a print manual, online help, and a PDF version of the manual. I appreciated having a print manual that I could read anywhere, but I quickly found myself using the PDF manual more than anything else. The PDF file has an index and a table of contents, and it's extensively hyperlinked. I could usually discover what I wanted to know within seconds.

EM's review of *Vegas Pro* 1.0a noted several omissions, including MIDI-based controller automation, MIDI Machine Control, and the ability to manually punch in after playback had started. Unfortunately, none of those features made it into the new version.

But all in all, *Vegas Audio* 2.0 is a wonderful program with powerful recording and editing capabilities. I like the fact that a complete set of effects is included, and I was pleasantly surprised by the hefty dose of video-editing capabilities (especially for a product called *Vegas Audio*). Wanna have some fun? Head to *Vegas*!

Allan Metts *is an Atlanta-based musician, software and systems designer, and consultant.*

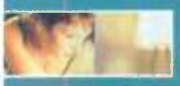
broadjam

Artist: Katrina Carlson
Genre: Pop

Song: I Know You By Heart
LO-FI MP3 | HI-FI MP3 | REAL AUDIO

Artist: Kodac Harrison
Genre: Blues

Song: Love Turned On The Light
LO-FI MP3 | HI-FI MP3 | REAL AUDIO



Artist: Faye
Genre: Alternative

Song: What's Right
LO-FI MP3 | HI-FI MP3 | REAL AUDIO

Artist: Bill Epps
Genre: R & B

Song: Sign On In
LO-FI MP3 | HI-FI MP3 | RE

Artist: Derrick Procell
Genre: Country

Song: Same Plan
LO-FI MP3 | HI-FI MP3

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TC-HELICON

VOICEPRISM

The future of vocal processing has arrived.

By Mark Nelson

In recent years, movie stars have increasingly shared the limelight with computer-generated animation and special effects—some so subtle that they go completely unnoticed by the casual viewer. In crowd scenes, for example, virtual extras have to an extent replaced their flesh-and-blood counterparts. Technology is edging closer to creating an artificial actor that can fool the unsuspecting observer. A comparable feat is underway on the audio front. Indeed, it's only a matter of time until you'll be able to dial up virtual singers as easily as some people can generate realistic room simulations.

Every now and then, a product comes along that provides a glimpse of that bold future. TC-Helicon's VoicePrism is such a product. It takes artificial harmony generation to a new level and offers a taste of the direction in which vocal recording and processing seem inevitably to be heading.

Harmony processors have been around for quite a while; most are based on technologies pioneered by Canada's IVL Technology. The VoicePrism is the first offering from a joint venture between IVL and TC Electronic. What sets the unit apart from the crowd are unprecedented "humanizing" control and stunningly realistic results.

STRAIGHT UP

Designed for studio and stage, the VoicePrism is a full-function solo voice processor with a mic preamp, equalizer, effects, and dynamics processing in addition to an intelligent four-voice harmony processor. A huge amount of processing power resides inside the attractive 2-rackspace box, yet getting up and running is as simple as plugging in a mic and twisting a knob (see **Fig. 1**). An onboard demo can save you the embarrassment of singing in front of the sales staff at your local music store.

The knobs and switches feel reassuringly solid. I particularly like the ergonomic slant-front design. Also, kudos to the designer who thought to recess the display panel out of harm's way; it's a small detail, but my road rack is full of gear with scratched faceplates. Moving the screen back a quarter of an inch does make a difference.

Signals enter the VoicePrism through either a front-panel XLR mic jack (with switchable 48V phantom power) or a balanced ¼-inch TRS input on the rear (see **Fig. 2**). An auxiliary input lets you use your favorite outboard gear along with the VoicePrism's full complement of internal effects. The rear panel also provides a pair of ¼-inch TRS analog outputs; an S/PDIF digital output; MIDI In, Out, and Thru jacks; a jack for an optional footswitch; and an IEC receptacle for the power cord (no wall wart here).

FIRST TAKE

Patience has never been my strong suit; even before the delivery truck had backed out of my driveway, I'd torn open the carton, set the unit on my desk, and grabbed a mic. A tip in the well-written *Quick Start Manual* alerted me to a nifty feature: the five Browser buttons interact with the large data wheel to constrain selections to a particular mode—one of the four harmony types or effects without harmonies. Finding just the right Preset among the 128 choices is a snap.

I began by scrolling through lead-vocal Presets. Most combine some degree of compression and EQ along with reverb and time-based effects such as chorus or delay. They sounded far too processed for my taste, but a few deft tweaks quickly yielded more satisfactory results.

Because I was still in a hurried frame of mind, I decided to forego close inspection and jump right into the harmonies. I learned that the Presets can be overwritten and that factory settings can be recalled at any time.

I have to admit that I'm seriously deficient at singing harmonies. So I grabbed my guitar and dialed up a VoicePrism Preset called Country Tune. Based on a

PRODUCT SUMMARY

TC-Helicon
VoicePrism
vocal processor
$1,299

FEATURES	4.5
EASE OF USE	4.0
AUDIO QUALITY	4.0
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Extremely easy to use. Lots of control. Realistic-sounding harmonies. Two effects blocks. Independently moving harmony lines through MIDI. 24-bit digital output.

CONS: No independent outputs for lead and harmony vocals. Only two bands of EQ. Front-panel gain knobs don't fully mute lead vocal or effects levels.

Manufacturer
TC-Helicon/TC Electronic (distributor)
tel. (805) 373-1828
e-mail info@tcelectronic.com
Web www.tc-helicon.tc

FIG. 1: The VoicePrism is a dedicated vocal processor that provides intelligent four-part harmony, dynamics and effects processing, and MIDI chord recognition. Humanizing features let you specify the gender characteristics of each harmony voice with formant-corrected pitch shifting.

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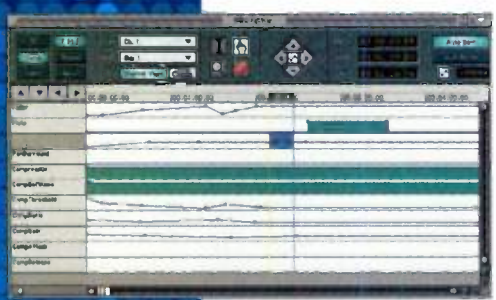

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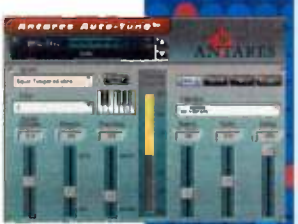

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user-defined scale, it synthesizes male and female harmonies voiced a sixth below and a third above the lead voice. For added realism, each voice is delayed slightly relative to the lead, and each has detuning and vibrato settings.

I belted out a couple of country standards, some old-time gospel, and even a close-harmony chestnut by the Carter Family. The VoicePrism tracked every vocal nuance, filling my headphones with three distinct singers. I wouldn't hesitate to use the Preset live or on a demo just as it is, right out of the box. Brothers and sisters, I am convinced.

I spent the remainder of the afternoon scrolling through Presets, fiddling with parameters, and singing every song I know. Although she doesn't sing, my wife even joined in, realizing a lifelong dream of becoming a Motown backup singer. I haven't had so much fun with a piece of studio gear in ages.

FINDING YOUR VOICE

Did I mention the VoicePrism is easy to use? Let me say it again: the designers got it right. The faceplate is split roughly in two, with real-time functions to the right of the data wheel and editing functions to the left.

Four center-detented knobs provide hands-on control for lead and harmony volume, effects level, and input gain. Surprisingly, turning the knobs all the way down doesn't completely cut off the signals. Although a handy button bypasses the harmonies, muting the lead-voice send requires navigating inside the Mix page.

FIG. 2: VoicePrism's rear panel provides ¼-inch TRS balanced line and auxiliary inputs and a switch to change input sensitivity from +4 dBu to –10 dBV. Also included are a pair of ¼-inch TRS balanced analog outputs, an S/PDIF output, three MIDI ports, and a control jack that works with one- or three-button footswitches. An expansion port accepts the optional VoiceCraft expansion card.

A large bright meter next to the power switch displays input and output levels. Two rows of function buttons run directly above the level knobs. Each button clicks solidly and lights up when pressed, so you won't get lost. I particularly enjoy having the mic/line and phantom-power switches within easy reach.

▼

I haven't had so much fun with a piece of gear in ages.

When you select a Preset, the backlit LCD clearly shows signal routing, harmony type, key, effects type and routing, and various editable parameters (see **Fig. 3**). Twisting any of the four context-sensitive soft knobs changes relevant parameters in real time; a press brings up a menu with more selections. Clever little cartoonish icons, from a hefty bearded bass singer to tiny babies, identify characteristics for harmony voices. There's even an alien with an antenna—the icon for some weird sci-fi effects.

The functions are clearly marked and laid out in a logical manner. If you get lost, everything is explained in the short user manual. The VoicePrism features a dedicated Help button that gives you access to various context-sensitive information screens. There you'll even find the e-mail address for tech support burned into memory.

O SOLO MIO

The VoicePrism is essentially two units: a channel strip/vocal processor and a harmony machine. I tested the channel strip first, beginning with the preamp. For that test, I bypassed everything but the preamp and tracked vocals directly to disk. I then repeated the test with a Mackie CR1604-VLZ mixer and a dbx 386 dual-tube preamp. The VoicePrism certainly held its own; in fact, I preferred it to the dbx for some voices. I also had a chance at another studio to compare the VoicePrism preamp with vintage API preamps and with those in an SSL board. Those tests confirmed, not surprisingly, that the VoicePrism preamp is not as pristine as certain high-end preamps, but it will get the job done and then some.

The VoicePrism's dynamics processing

VoicePrism Specifications

Audio Inputs	(1) balanced XLR (mic); (1) ¼" balanced TRS (line); (1) ¼" balanced TRS (aux)
Audio Outputs	(2) ¼" TRS; S/PDIF coaxial
Control Ports	MIDI In, Out, Thru; (1) ¼" TRS footswitch
Sampling Resolution	24-bit, 44.1 kHz
Frequency Response (analog)	±0.8 dB @ 10 Hz–12 kHz; –2 dB @ 20 kHz
Total Harmonic Distortion (analog input)	0.0026% @ 1 kHz (A-weighted)
Dynamic Range (analog)	100 dBA
Harmony Types	Shift (Smooth, Stepped); Scale (Smooth, Stepped); Chordal; Notes/Manual
Vocal Processing	thickening; compression; noise gate; (2) EQ blocks
Effects Processing	chorus; flanger; delay; reverb
Display	128 × 64 pixel backlit LCD
Dimensions	2U × 8.2" (D)
Weight	7.8 lbs.

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and EQ could be better. The software compressor lacks subtlety and control; except for the 1.5:1 setting, ratios are variable only by whole numbers. In addition, the base settings are not intuitive: patching the compressor into the signal chain calls up a default threshold of –60 dB with no gain reduction. After a couple of rude surprises, I learned to jump ahead a page to check the settings first and then return to assign the lead or harmonies or both to the compressor.

Equalization is limited to two single blocks, each comprising two variable highpass filters (one with variable cut/boost), two variable lowpass filters (one with variable cut/boost), and one bandpass filter (with variable Q). That is sufficient for most applications, but the limiting factor is that the two bands can be assigned to only two places simultaneously. That is, you can assign the two bands to either the lead or harmony, or you can assign only one band to each. (You can also assign either or both EQ bands to the aux input.) Vocal thickening and a noise gate are available on the lead and harmony voices at all times.

In general, the VoicePrism's channel-strip aspects are better suited to the stage than to the studio. (An upgrade is available that is supposed to greatly improve the EQ and compression; however, I tested only the stock unit.) Fortunately, the VoicePrism's aux input lets you patch in your own compressor or equalizer, which significantly enhances the unit's value (see the sidebar "Upgrade Path").

FIG. 3: Effects Routing and Harmony modes are shown in the main Preset screens. Cartoonish icons identify the gender characteristics for the four harmony voices. You can gain access to real-time parameters with four soft knobs just below the display.

SINGING IN THE CHOIR

The VoicePrism shines as a harmony processor; it simply blows away anything else that I have heard. Shift, Scale, Chordal, and Notes/Manual modes are four distinct harmony-generation methods that cover just about any situation. Shift and Scale modes are further divided into Smooth mode, in which harmonies follow subtle pitch variations of the lead voice, and Stepped mode, in which harmonies are pitch corrected.

Shift mode creates harmonies at fixed intervals above, below, or simultaneously above and below the lead voice, much like an old-fashioned pitch shifter. Scale mode allows you to specify the key and scale of the harmonies in the Setup menu, so you can create wonderful harmonies in parallel thirds and sixths. Chordal mode ascertains the root and chord type from real-time data the VoicePrism receives when you play a chord on a MIDI instrument. Either of the two Notes/Manual modes lets you control the exact pitch of your harmonies through MIDI.

I first used the Stepped Shift mode to correct the pitch of a wavering harmony vocal; a few minutes of tweaking saved the track. Attempts to transpose a performance by more than a few semitones sometimes yielded telltale warbling and other artifacts, depending on the quality of the vocal input and the amount of transposition. A good source voice provided the most realistic results, possibly because of a skillful singer's unwavering pitch. (I've noticed the same correlation using other pitch-correction hardware and software.) Messing around with vocal formants and effects in Shift mode yielded some outrageous sounds totally unlike anything I have heard before.

Continuing my search for the ultimate in pitch correction, I jumped over to Stepped Scale mode and muted all but a single voice. That mode worked even better than Stepped Shift; rather than transposing the track, only out-of-tune notes were affected. I also used the mode to thicken the chorus for a Scottish singer's demo, blending close-harmony clones with the real singer's voice for a much bigger sound. Although Scale mode works best with simple diatonic material, it yields some interesting possibilities using alternative scales.

In Smooth Scale mode, the harmonies retain the original voice's slight pitch inconsistencies for a more natural-sounding harmony. Chordal mode creates harmonies with as many as four parts from chords entered manually or through MIDI. Most common major, minor, dominant, and diminished chords are supported along with a generous handful of suspensions. The harmonies follow a song's changes in a realistic manner. The unit even recognized my faltering attempts at keyboard playing, quickly generating the appropriate chord type from only one or two notes. Once I had the hang of it, I used my synth workstation to sequence three slightly different choruses for an R&B song. *Badda-bing!*

Chordal mode features a handy Step

UPGRADE PATH

TC-Helicon recently announced two new products for the VoicePrism that incorporate human-voice–modeling technology. The VoicePrismPlus Human Voice Modeling Formant Processor adds head and chest resonance, breathiness, rasp, growl, modeled vibrato, and vocal inflection to the lead-voice input. The VoiceCraft expansion card essentially upgrades the VoicePrism to the same specifications as the VoicePrismPlus and also provides higher-quality compression and EQ, better effects processing, and 24-bit S/PDIF and AES/EBU ins and outs.

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(* Logic and Cakewalk in preparation)

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BANISH MUNCHKINS

What is it that enables listeners to instantly differentiate between singers, even when they're singing the same note? The answer is vocal formants, which are the identifying resonant characteristics unique to each person's vocal tract. A singer's formants are affected by several factors, including size of the head, layout of the vocal cords, and length of the throat; even bone density plays a part. Formants emphasize certain fixed-frequency bands, regardless of a note's pitch; that's why you sound like yourself throughout your vocal range.

Formants come into play any time you pitch-shift a human voice. Simply transposing the voice up or down also transposes the formants, resulting in "munchkinization" or other unnatural effects. Intelligent harmonizers such as the VoicePrism take the behavior of formants into account so as to provide more natural-sounding pitched effects.

Altering formant characteristics is the trick behind gender-bending effects too. Now you can turn a lithe female alto into a cigar-chewing male quartet. Isn't science a wonderful thing?

function that allows you to progress through a sequence of chord changes (50 songs with 50 steps per song) using an optional footswitch for MIDI-free live or studio use. I picked up my guitar to test the feature and came up with a dandy campfire sing-along right there in my studio.

The Notes/Manual modes provide the ultimate in realism, generating as many as four independently moving harmonies from incoming MIDI data. Data can be received on a single channel or, for even greater control, on four adjacent channels. Setting the Chordal mode to Momentary in the Utility menu's Preferences page constrains harmonies to the duration of MIDI notes. Using that powerful feature, I generated harmonies that came and went at different parts of a song—a single voice for some lines and an entire chorus for others. To better mimic real vocals, I could even stagger the releases of individual singers.

VOICE CONTROL

Each voice within a harmony Preset responds independently to a variety of parameters, including timing, Scoop (the typical vocalist's habit of bending up to a note), vibrato, tuning, level, panning, and effects level. The humanizing functions are many and deep, and almost every editable function is accessible through MIDI messages.

The VoicePrism lets you adjust gender settings in the various harmony modes. A simple twist of a knob modifies a variety of formant-based parameters, creating male and female voices (see the sidebar "Banish Munchkins"). Results can be startling—with no effort at all, I transformed a tenor into a credible bass that fooled some pretty demanding ears. Upon learning he'd been deceived, the producer said, "I wish I'd had that on my last project!"

Sometimes achieving the most realistic effect was counterintuitive. The same tenor's voice sounded unnatural when shifted using any of the female settings, yet I dialed in formants based on a well-known male singer and *voilà:* instant Barbra Streisand. Who knew?

VOCAL EFFECTS

The two independent effects blocks provide the usual vocal sweeteners. FX 1 is dedicated to chorus, flanger, and a nice selection of mono and stereo delays. FX 2 provides delays and a variety of reverbs ranging from Tight Studio Reverb to Arena. I wish there were algorithms for plates and spring-type reverbs—two vocal staples. Both effects blocks accept sends from the lead voice, harmony voices, and the aux input; in addition, the output from FX 1 may be routed to FX 2. Opportunities abound for customizing effects and for saving patches as part of a Preset.

Considering all the VoicePrism does, the quality of the effects is quite high. Reverbs are nice and rich, though just a tad grainy in the tails. I really enjoyed the analog-sounding Mono Tape Delay; with a little slap back, vocal thickening, and compression, you, too, can rule.

The ability to tie the delays to tempo would be nice, but you can't have everything. Although it isn't the VoicePrism's intended use, the unit could also serve nicely as a second multi-effects box, in a pinch. Just for the record, though, the VoicePrism does not share its effects architecture with TC Electronic's popular G-Force processors.

VOICE OF APPROVAL

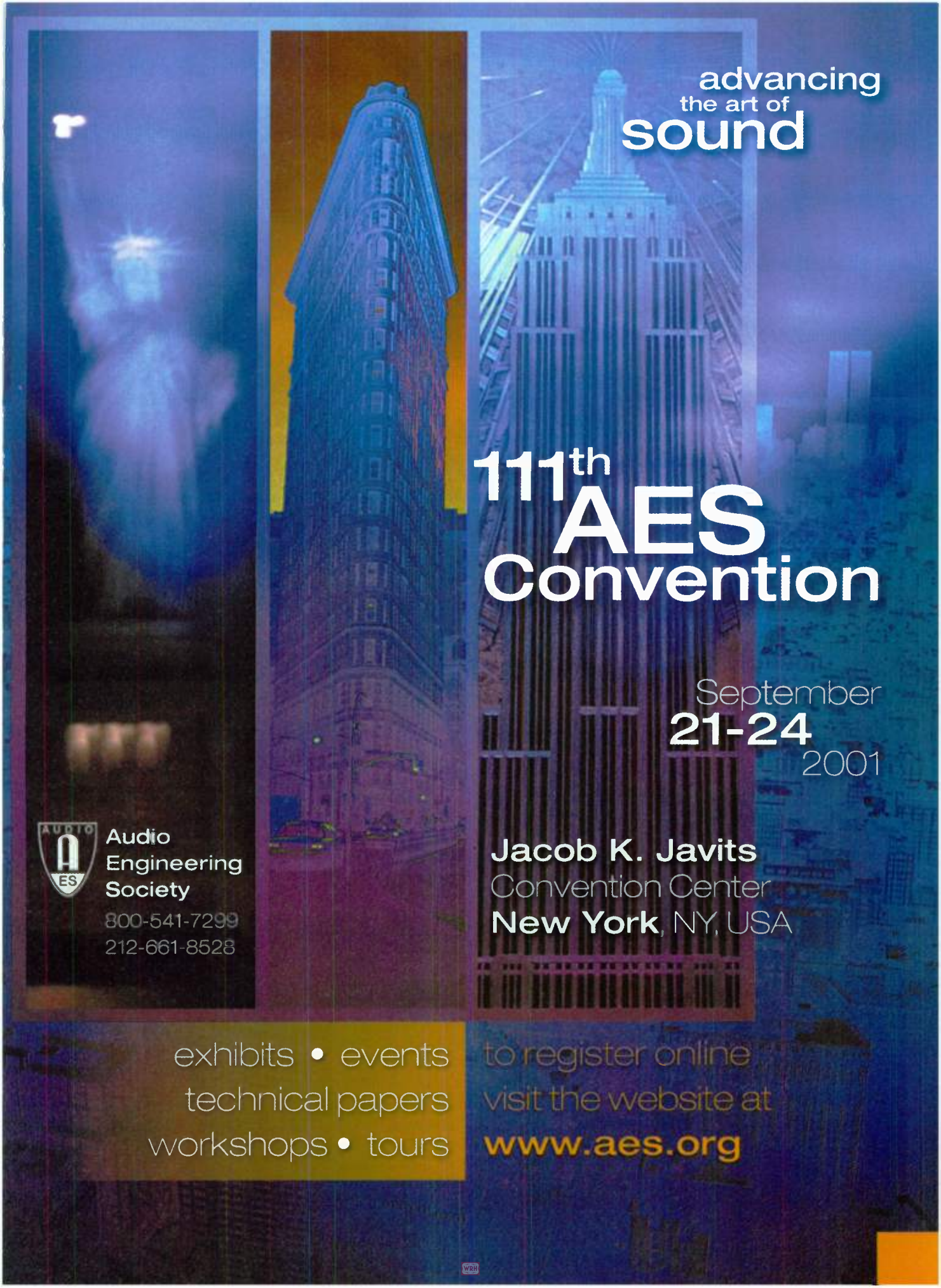
I like the TC-Helicon VoicePrism a lot. Combining functionality that normally requires a rack full of gear with state-of-the-art harmony generation into a single unit is quite an achievement. The VoicePrism is a ball to use right out of the box, and the more you get inside and tweak, the better it sounds.

Most of my recording work involves acoustic music and relatively natural-sounding vocals, and the VoicePrism proved itself useful in those demanding applications. But given its ability to create unique vocal effects, I recommend it for remixing and other forward-looking applications. If you want a sound that no one else has (yet), the VoicePrism is a good place to start.

I'm not sold on the EQ and dynamics, and I don't think the harmonies always ring 100 percent true. The results depend largely on the source, and great singers definitely produce the most realistic harmonies.

Of course, artificial harmony is not everyone's cup of chai, but if you already use or need a vocal harmony processor, check out the VoicePrism. It's truly one great piece of gear.

Mark Nelson *sang in high school until his band asked him to stop. He lives and records in southern Oregon's Applegate Valley, where his voice won't disturb the neighbors.* *Thanks to A Wing and a Prayer Productions for help with the review.*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A . R . T .

TUBE MP STUDIO

Warm up your sound with this tiny well-featured monster.

By Alex Artaud

A few years back, Applied Research and Technology (A.R.T.) introduced the Tube MP, an inexpensive single-channel tube mic preamp. The stompbox-size unit quickly gained a solid reputation with musicians and engineers for its versatility and clear, warm tone. Now A.R.T. has unveiled an enhanced version of the Tube MP called the Tube MP Studio ($159), and it's quite an impressive little box.

RUNS IN THE FAMILY

The MP Studio looks identical to its precursor except that the newer unit has a VU meter. The unit's electronics are housed in an all-steel chassis with a flat-black finish. The construction is rugged, so taking the unit on the road isn't a problem.

The A.R.T. Tube MP Studio, an enhanced version of the original Tube MP, offers a new limiting feature and a VU meter.

Like the MP, the MP Studio provides continuously variable input- and output-level knobs and button switches for +20 dB gain, 48V phantom power, and phase reverse (actually, polarity reverse). The +20 dB gain switch lets you select between +6 to +40 dB and +26 to +60 dB overall gain, making the MP Studio useful for a wide range of signals. The gain switch is remarkably quiet, with no nasty clicks or dramatic increase in noise floor.

Also like its forebear, the MP Studio offers XLR and ¼-inch input and output jacks. The multiple I/O adds considerably to the unit's versatility and, in combination with the ability to handle wide-ranging input levels, lets you use the MP Studio as a DI device (for electric basses, guitars, or whatever) and a mic preamp. In addition, the XLR and ¼-inch inputs can be used simultaneously to sum signals, though the ¼-inch input will be attenuated slightly.

The MP Studio's other new feature is an Output Protection Limiter (OPL), which basically does what it says. Available from a fourth push-button switch labeled OPL, the dedicated circuitry has been included to monitor and control peak signal levels. When it is engaged, the limiter executes a fast attack and slow release on peak-level sounds. The feature is helpful when recording sources with unpredictable dynamic content—especially to digital media—and it saves you the hassle of bringing along a dedicated limiter for location recording. With OPL engaged and the output cranked up all the way, the MP Studio outputs 0 dBu at the ¼-inch jack and +6 dBu at the XLR jack.

The MP Studio's VU meter is accurate and a reliable visual indicator of how hard the unit's 12AX7a tube is running. The 0 mark on the VU meter indicates +6 dBu at the ¼-inch output and +12 dBu at the XLR output. With OPL in the pathway, the VU meter indicates the attenuated signal.

PRODUCT SUMMARY

A.R.T.
Tube MP Studio
tube-microphone preamp
$159

FEATURES	3.5
AUDIO QUALITY	4.0
EASE OF USE	4.0
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Warm, clear sound. Low noise floor. Rugged construction. Versatile. Portable. Inexpensive. Provides polarity reverse, phantom power, and peak limiter.

CONS: Wall-wart power supply. No power switch. No ground-lift switch for DI applications.

Manufacturer
Applied Research and Technology
tel. (716) 436-2720
e-mail cserve@artproaudio.com
Web www.artproaudio.com

Directly below the VU meter is an LED that glows green when power is applied and remains green with lower-level signals. If OPL is not in use, the LED turns red to indicate clipping. However, the occasional flashes of red didn't result in unpleasant distortion. The LED works as a good reference for calibration (after your ears, of course); a constantly lit red LED means the signal level needs to be reduced. With OPL engaged, the LED glows red when the limiter circuitry senses that the signal is about to clip and thus begins reducing gain. The MP Studio is powered by a 9 VAC wall wart.

OPERATION PREAMP

I put the Tube MP Studio through its paces as a mic preamp first, testing it with microphones ranging from an AKG C 1000 to a Neumann U 87. My emphasis was on studio applications—overdubs of acoustic guitar, flute, vocals, and percussion, for example.

In general, the MP Studio added roundness to the tone of instruments, specifically compared with the standard (not XDR) console preamps on my analog Mackie mixer. (That comparison is

admittedly somewhat incongruous, but it is helpful, as many readers are familiar with Mackie preamps.) Conga drums, acoustic guitar, flute, and vocals recorded with the MP Studio sounded more natural and felt more present by comparison, both when soloed and in the mix.

To get a broader perspective about how the MP Studio rates, I also compared it with a high-end, Class A tube-mic preamp that cost nearly ten times as much. (First-rate tube preamps typically cost more than $1,000 per channel.) I recorded my voice, various hand percussion instruments, and acoustic guitar into a Digidesign Pro Tools rig and compared the results. Impressively, the MP Studio held its own in terms of warmth, tone roundness, and quietness; however, it couldn't deliver the same level of dimensionality or sense of space to the sound.

The MP Studio's main circuitry is identical to its predecessor's, so I focused mostly on the OPL circuitry, the more-significant new feature. I was interested to hear how the OPL acts with different instruments, particularly those with fast attacks, such as claves, shakers, and conga drums. I cranked up the MP Studio's input levels so as to hit the preamp hard and then listened for the action of the limiter. Impressively, its response was very fast and transparent, with no noticeable artifacts.

I also tested the OPL on acoustic guitar and accordion, again keeping the levels high. The action of the limiter was more pronounced, evidently because of the broader frequency range and longer sustain times of those instruments. Specifically, with OPL engaged, the lows became attenuated slightly more than mids and highs. However, that observation needs to be kept in perspective. In general, peak limiters should be used only when necessary—when tracking a percussion instrument or unruly vocal on the fly, for example—and then sparingly. You probably wouldn't be slamming the inputs as hard as I was, either.

Occasional flashes of red didn't result in unpleasant distortion.

GO DIRECT, YOUNG MAN

I also tested the MP Studio as a direct box with electric bass and electric guitar. On bass, the MP Studio provided a sound fatter than and superior to what you would get from going directly into your average console—I was able to dial in a solid round tone without resorting to the EQ I normally reach for when recording bass through my board. My Strat, too, sounded better through the MP Studio. The unit generated a combination of solid tone and warm colors that the Mackie couldn't deliver.

Overdriving the inputs of the MP Studio didn't yield usable results for me, though the coloration from overdriving may appeal to others. But I did tend to set levels pretty hot (with OPL disengaged), using the VU meter as a visual indicator and generally flirting with the flashing red overdrive indicator. Although I didn't find OPL necessary for most bass and guitar DI applications, I switched it in occasionally to get a feel for its action, and generally, it was transparent.

NEW AND IMPROVED

The A.R.T. Tube MP Studio microphone preamp and DI is a welcome upgrade to the company's popular Tube MP. The addition of the OPL peak-limiting circuitry extends the unit's range of applications, providing a set-it-and-forget-it option so you can focus on the music and not worry about overshooting signals. It's a feature that might have kicked up the price of the unit substantially, so A.R.T. is doing musicians and engineers a real favor by including it for only a few extra dollars. The added VU meter is also a nice extra and an accurate one at that.

The only features I missed were a power switch and a ground-lift switch for direct-box functions, but those are minor quibbles. Overall, I was impressed by the sound, construction, and feature set of the Tube MP Studio. The unit sounded noticeably better than midlevel stock console preamps and even compared well to a high-end unit that costs significantly more. Also, it appears to be made for the long haul: I left the unit on for more than 24 hours once, and it not only worked just fine afterward but also remained surprisingly cool. Come to think of it, that's an apt description for this handy little box—surprisingly cool!

Alex Artaud *is a musician and studio owner living in the San Francisco Bay Area.*

Tube MP Studio Specifications

Amplifier Type	tube hybrid
Input Connectors	(1) ¼" unbalanced; (1) balanced XLR
Output Connectors	(1) ¼" unbalanced; (1) balanced XLR
Gain Control Range	+6 dB to +40 dB, switchable to +26 dB to +60 dB
Maximum Input Level	+22 dBu (¼"); +14 dBu (XLR)
Maximum Output Level	+22 dBu (¼"); +28 dBu (XLR)
Frequency Response	10 Hz–30 kHz (±0.5 dB)
Dynamic Range	>100 dB @ 20 Hz–20 kHz (typical)
Equivalent Input Noise	–129 dBu (XLR to XLR)
Total Harmonic Distortion	<0.1% (typical)
Signal-to-Noise Ratio	>100 dB
Phantom Power	48V DC
Tube	hand-selected 12AX7a dual triode
Metering	VU
Power Supply	9 VAC wall wart
Dimensions	5.5" (W) × 5" (H) × 2" (D)
Weight	1.5 lbs.

METRIC HALO

CHANNELSTRIP 1.2.2 (MAC)

Three high-quality processors in a single plug-in.

By Michael Cooper

Desktop musicians have long enjoyed the expanded capabilities that plug-ins have brought to their host applications. Unfortunately, many plug-ins are little more than one-trick ponies offering a single processor in one window. Consequently, a well-stocked suite of plug-ins forces you to switch constantly among windows to adjust each plug-in's parameters. Metric Halo's *ChannelStrip*, on the other hand, mitigates that problem by providing a sophisticated, high-quality parametric Equalizer, Compressor, and Gate in one efficiently designed window with plenty of controls, meters, and interactive graphs. *ChannelStrip* is available as an MAS, RTAS, AS, or TDM plug-in.

I reviewed the MAS version of *ChannelStrip* 1.2.2 using Mark of the Unicorn's *Digital Performer* 2.7.2 and *AudioDesk* 1.01. The other versions offer the same functions and capabilities, which allows you to exchange settings between platforms. If you're hoping to use *ChannelStrip* for mixing with a digital-audio workstation (DAW), use the fastest system possible; my aging Power Mac clone (a Power Computing PowerCenter 132 with a 300 MHz G3 upgrade card) started getting sluggish with six *ChannelStrip*s running at once.

According to *Digital Performer*'s Performance monitor, *ChannelStrip* uses at least 50 percent more CPU resources than a 6-band Waves *Renaissance* EQ, which can also be a hog. That's no wonder, because *ChannelStrip* employs 64-bit processing throughout its sections, which accounts for the high-quality filtering. The signal is dithered to a 32-bit floating point (fixed point in the TDM version) at the plug-in's exit. Metric Halo offers a lite version of *ChannelStrip* that demands less CPU power but offers many of the same functions (see the sidebar, "ChannelStrip/SP").

Minimum System Requirements

ChannelStrip

G3; 64 MB RAM; OS 7.5.3

CONTROL PANEL

ChannelStrip's graphical user interface is fast as well as flexible. The processing blocks' control sections are organized on the left side of the window; interactive graphs showing the action of each processor are provided on the right (see Fig. 1). Typical Macintosh conventions are employed to adjust a host of virtual knobs and buttons and to save or load presets. (You can also copy presets and use them in other projects.) Additionally, you can Command-drag knobs to make fine adjustments or Option-click on them to reset to the default values. Pop-up menus in the Equalizer section speed up filter selection, and you can also enter values directly into the data fields.

In many cases, *ChannelStrip* lets you adjust parameters with more than one control. For example, you can adjust the Compressor's threshold with a knob in th e Compressor section or by dragging a small green triangle above the Compressor's input-level meter. In a similar manner, you can change the EQ's frequencies, boost/cut amounts, and bandwidths with dedicated knobs or by dragging control points in the EQ Transfer Function graph.

Separate graphs for the Compressor and Gate show the effects of the parameter settings. A small red indicator is superimposed on each graph. It shows the instantaneous input and output levels in real time, which provides helpful feedback about the processor's dynamic response. If you need to reclaim a bit more screen space, you can hide the Compressor, Gate, and EQ graphs as well as the accompanying sidechain graphs, with a single click. You can also change *ChannelStrip*'s background color to suit your desktop decor.

ChannelStrip offers peak-reading input-level meters (one each for the Gate, Compressor, and EQ sections) and a set of stereo output-level meters. The tricolor output meters indicate peak, RMS, and VU levels and include clip indicators you can reset. The plug-in's component parts—including EQ bands and sidechain filters—have dedicated bypass buttons. A master bypass

FIG. 1: Controls and metering for *ChannelStrip*'s processing blocks are organized on the left side of the window. On the right side, interactive graphs depict the action of each processor and offer additional parameter control points that you can drag to edit settings.

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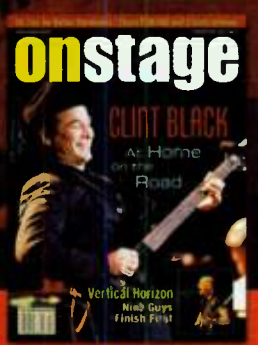

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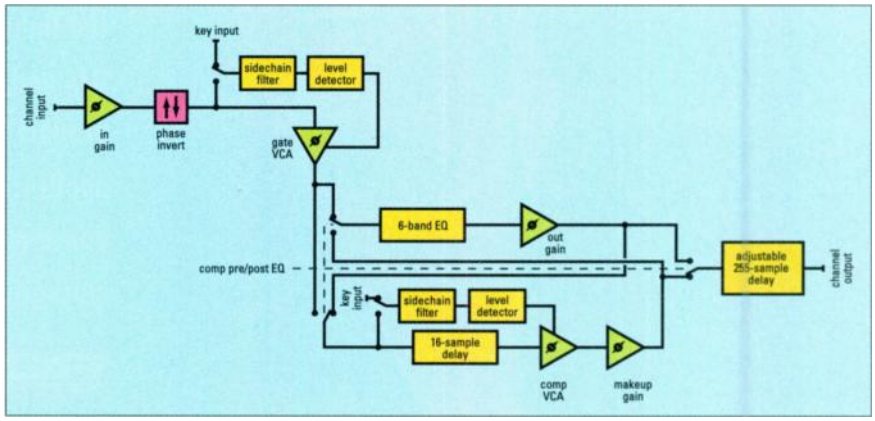

FIG. 2: *ChannelStrip*'s versatile design incorporates three processing sections with flexible sidechain gating functions.

button is provided for the EQ section and for the plug-in as a whole. *ChannelStrip*'s only fader serves as an output-level gain control for the EQ section. The Compressor section includes an output-level knob, and because compression or EQ is always placed at the end of the signal chain, you are sure to have control of the plug-in's master output level.

Overall, *ChannelStrip*'s interface is well designed and easy to use. It does, however, have a few deficiencies. The gain-reduction meters for the Gate and Compressor could use better resolution. They share the same coarse scale as their respective input-level meters. Although the control knobs have numerical readouts, the meters do not, which sometimes makes it hard to fine-tune settings.

GO WITH THE FLOW

The signal enters *ChannelStrip* at the input gain section, which consists of a gain control knob (±24 dB) and a numerical readout, followed by a polarity inversion switch (see **Fig. 2**).

An expander/gate with a fixed 1:2 ratio is next in line. You can adjust attack times from an ultrafast 2 µs to 100 ms, and you can select release times from 5 ms to 5 seconds. In addition, the gate features a sidechain that can use the channel signal (the audio patched through the plug-in's audio path) or a bus signal as the source. When the channel signal is the source, a single-band sidechain filter with six filter types can be activated for frequency-sensitive applications, such as removing narrow-band bleed from mic signals. Those filters are the same types found in the dedicated EQ section.

When a bus signal is the source, the gate's action can be made to key off an unrelated track. For example, I used a

PRODUCT SUMMARY

Metric Halo
ChannelStrip 1.2.2 (Mac)
signal-processing plug-in
$345 (RTAS/AS or MAS)
$699 (TDM/RTAS/AS)

FEATURES	4.5
EASE OF USE	4.5
AUDIO QUALITY	4.0
VALUE	5.0

RATING PRODUCTS FROM 1 TO 5

PROS: Outstanding EQ. Above-average Gate and Compressor. Excellent selection of sidechain filters. Flexible and sophisticated functionality. Fast and intuitive user interface.

CONS: CPU hog. Gate lacks Ratio, Range, and Hold controls and a key-listen function. Compressor dulls sound slightly at high ratios and with deep gain-reduction levels. Gain-reduction meters need numerical readouts and better resolution.

Manufacturer
Metric Halo
tel. (888) 638-4527 or (845) 831-8600
e-mail in-foo@mhlabs.com
Web www.mhlabs.com

kick-drum track to key a gate that was processing a bass-guitar track, which caused the gate to allow bass notes through only on kick-drum beats. That technique works very well for arrangements in which the bass closely tracks the kick drum; it really tightens up the performance.

Overall, the inclusion of a sidechain greatly increases the effectiveness of *ChannelStrip*'s Gate. The choice of filter types available to the sidechain surpasses any such feature set I've seen in analog units. Nevertheless, the lack of Range, Hold, and Ratio controls and a key-listen function make the Gate less capable than the best analog models.

ChannelStrip's soft-knee-type Compressor section usually follows the Gate, but it is also possible to switch the Compressor so that it is post-EQ in the signal path. Wide-ranging Threshold, Ratio (as much as 1,000:1), Attack, and Release controls are provided. Because *ChannelStrip* delays the channel signal by 16 samples (or 8 samples in the TDM version) relative to the detector signal, the Compressor has "look-ahead" capability that provides it with instantaneous attack response when the Attack knob is set to zero. An output Gain control (with numerical readout) is supplemented by an Auto Gain function that automatically applies makeup gain to compressed signals. In addition, the Compressor features the same—though independent—sidechain functions as the Gate section, enabling de-essing and ducking.

ChannelStrip lets you choose among three compressor "character" settings: Smooth, Warm, and Fast. Those settings provide varying degrees of compression smoothing as well as control of fast transients. The Smooth setting offers the lowest distortion levels with few artifacts but only modest transient control. The Fast setting grabs transients more quickly but can introduce more waveform distortion. Warm is an intermediate setting, and it's the one I found to be generally most useful.

ChannelStrip's 6-band EQ section typically follows the Compressor, though you can place it before the Compressor with a button click. Dedicated boost and cut, frequency, and bandwidth controls are provided for each of the six bands, and each band can use any of six filter types. The Peaking/Parametric filter has a bell-shape curve with a center frequency continuously variable from 20 Hz to 20 kHz. It offers ±24 dB boost and cut and a 0.1- to 2.5-octave adjustable bandwidth. The 12 dB per octave High Cut and Low Cut filters have corner frequencies that are continuously variable from 20 Hz to 20 kHz. The High Shelf and Low Shelf filters offer +12/–24 dB boost/cut; the 6 dB per octave Bandpass filter provides 0.1- to 2.5-octave adjustable bandwidth and a 20 Hz to 20 kHz continuously variable center frequency.

The same filter types are available for

H H B

PORTADISC MDP500

This MiniDisc recorder boasts professional I/O.

By Rudy Trubitt

I use a DAT recorder for field recording, but I'm not especially fond of the format. Although generally reliable, DAT recorders have been known to eat tape, which is why I always make sure my team packs more than one recorder. "If you care, carry a spare" has become my mantra.

But what else is there besides DAT? I toyed with the idea of setting up a laptop computer as my field recorder—until I remembered how often my computer crashes at home. I also considered the question of what might happen to a laptop on the shores of a glacial lake or in the crush of a crowded subway.

My solution for the past few years has been to carry a consumer Sharp portable MiniDisc (MD) recorder as a backup (and occasionally primary) recorder. With a professional front end such as the Denecke AD-20 mic preamp and A/D combo, the MiniDisc format can sound good. That wasn't always the case—when introduced by Sony in 1991, MiniDisc's ATRAC data compression was criticized by audio reviewers and largely dismissed. Since then, however, much progress has been made. Indeed, at this point, I can't reliably tell an MD copy from the linear pulse-code modulation (PCM) original.

Still, the limitations of consumer portable MD recorders are painfully obvious: tiny input jacks, poor metering, awkward level adjustments, noisy mic preamps, no digital outputs, and so on. You can get around some of the limitations by buttressing consumer gear with pro-audio peripherals, but doing so leads to a bag full of gadgets and a rat's nest of cables.

Until recently, the only professional MD recorder available was the Marantz PMD650. Fortunately, those seeking an all-in-one solution now have another viable choice: HHB's new Portadisc MDP500 (see **Fig. 1**). I tested the Portadisc in a variety of conditions on two continents, and my initial positive impressions were, for the most part, confirmed.

CHOCK-FULL

The Portadisc is clearly designed by people who know field recording. From its sturdy construction to its prerecord buffer, the unit practically shouts "professional" the moment you take it out of the box. Roughly the size of a medium hardcover book, the purple Portadisc is packed with features: XLR jacks, phantom-power mic inputs, USB support, a switchable limiter, low-cut filters, extensive monitoring options, and even a tiny built-in speaker.

You gain access to the Portadisc's many features through a menu-based interface on the front panel. Four dedicated buttons and three soft keys walk you through a two-line, 24-character backlit LCD (which can be difficult to read in poor lighting).

Using the Portadisc in the field inspires confidence. Small but useful touches abound; crucial controls are optimally placed and operate positively. The record-level and headphone-volume dials can be latched to avoid unintentional adjustments. A nicely designed nylon carrying bag is included, with convenient clear panels for wet weather operation and Velcro openings for secure cable access. My only initial complaint was with the shoulder strap, which was uncomfortable and somewhat unreliable.

INS AND OUTS

The Portadisc offers outstanding flexibility through its array of connectors (see **Fig. 2**). In addition to the balanced XLR mic/line inputs, it also has RCA line-output jacks; a ¼-inch headphone jack; and three digital I/O options: S/PDIF on both Toslink optical and coaxial jacks, and USB. The recorder also has a mini-DIN-plug connector so you can link to a remote transport (optional).

Left and right input sources can be set independently. You can also simultaneously record from one analog input and one channel of a digital source. Mic-input features include phantom power, attenuator, low-cut filter, and limiter. The line input offers a limiter, too, and there's even a built-in microphone for slating takes and a speaker for headphone-free playback.

The Portadisc can exchange digital audio with a factory-USB-equipped Macintosh (with OS 9 or later) or a PC (with Windows 98/ME/2000). When I discovered that the Portadisc had a USB connector, I hoped it would let the computer view and edit track or disc names and permit file-based (rather than real-time) audio transfers. The Portadisc's USB implementation, however, is minimal; the unit appears simply as a sound input or output device (like an external microphone or USB loudspeaker). Nevertheless, if your computer doesn't have S/PDIF or optical I/O, the Portadisc's USB port could save you a few hundred bucks.

POWER TO GO

Power can be the Achilles' heel of a portable electronic device. Happily, though, battery implementation for the Portadisc is solid and reliable. The

FIG. 1: The HHB Portadisc MDP500 MiniDisc recorder boasts several professional features in a compact machine.

Portadisc comes with eight AA nickel-metal-hydride rechargeable cells that fit into a removable tray mounted behind a sliding cover on the unit's back panel. As the batteries deplete, a two-digit "percent remaining" counter keeps you apprised of the battery status. HHB claims about three hours of recording time on a fully charged set. I received a bit less time, but that was using Schoeps microphones, which draw a fair amount of phantom power. A spare battery tray is provided, so if you carry an extra set of AA batteries (which I strongly recommend), you can swap the entire battery pack and be recording again in seconds.

The included AC adapter can power the deck and also can serve as a battery charger. It is conveniently small and can be detached from the AC cord. In addition, it automatically switches to match the line voltage of the country you're in—I used it in New Zealand (220 VAC) without a hitch. "No worries," as they say down under.

AUTO UPDATE

Most disc-based recorders assume a risk not shared by tape-based machines: loss of the take if power is interrupted during recording. That's because, typically, the disc's table of contents (TOC) is updated only after the recording is complete. That isn't just a theoretical possibility—I've lost audio on my consumer MD when an external battery connection came loose during recording.

Fortunately, HHB solved that problem. Even if you are foolhardy enough to remove the Portadisc's internal battery pack while recording, the unit automatically updates the TOC the next time it is turned on, rescuing the final take. That is an extremely nice feature.

FIG. 2: HHB's Portadisc includes a wealth of input and output connectors, including USB for digital-audio transfers to a laptop.

TIME MACHINE

My favorite Portadisc feature is the glorious prerecord buffer. When you put the deck into Pause/Record mode, it begins recording sound to a 6-second RAM buffer. When the buffer fills, the oldest audio is discarded to make room for incoming sounds. When you take the machine out of pause, the contents of the buffer are written to disc, followed by the remainder of the take. In other words, the Portadisc is a time machine that takes you back to the moment when you wish you had started recording but didn't.

That is a wonderful feature when you are recording unpredictable sources such as animal sounds, distant church bells, crowd reactions, building demolitions, and so on. Instead of missing the beginning of those sounds or idly recording in the hope that something interesting might come along, you can relax in Pause mode, secure in the knowledge that when the sound source begins, you will capture all of it.

TROUBLE IN PARADISE

After the mic itself, the microphone preamplifier is typically the element in the recording chain that has the most effect on recording quality. Judging by the Portadisc's sturdy XLR inputs and HHB's professional pedigree, I expected good performance from the Portadisc's mic preamps. To my surprise, the analog electronics were the Portadisc's weakest link.

Some of my field-recording work involves capturing quiet sounds from nature, often recorded from a distance. For premium results, that requires a quiet (not to mention accurate) mic preamp. Though the Portadisc's mic preamps were acceptable for recording close-miked dialog or amplified music, they are noticeably noisy when recording quiet sources.

Even more annoying than the noise level from the preamps is a subtle whine that appears in recordings when the deck's phantom power is engaged. After I discovered that problem on the original review unit, HHB kindly sent another deck for me to test. The second machine was something of an improvement, but it did not entirely resolve the discouraging problem.

METERED OUT

Although the Portadisc's meters are good, they don't always tell the whole story. Metering is derived from the output of the A/D converter, but it is possible to drive the microphone preamp into clipping, even though the meters register levels well below digital zero. In fairness, that only happens when your record-level knob is at the lowest part of its range, but a teensy LED that showed clipping in the mic pre would have been appreciated. Rule of thumb: if your record-level knob is below 4 and the VU meter is running hot, it's a good idea to

Portadisc MDP500 Specifications

Recording Time	80 min. (stereo); 160 min. (mono)
Analog Inputs	(2) balanced XLR mic/line (with +48V phantom power); (2) unbalanced RCA line
Digital I/O	(2) S/PDIF (coaxial and optical Toslink); USB
Headphone Output	¼" TRS
Frequency Response	10 Hz–20 kHz (–0.5 dB)
Signal-to-Noise Ratio (playback)	>89 dB
Dynamic Range (line input)	>96 dB
Total Harmonic Distortion	<0.02% @ 1 kHz (0 dBFS)
Power	12V DC; (8) AA batteries (8 rechargeable nickel-metal-hydride included)
Remote Control Connector	parallel 8-pin mini-DIN
Dimensions	10" (W) × 2.2" (H) × 7.1" (D)
Weight	4.44 lbs.

MDP500

PRODUCT SUMMARY

HHB
Portadisc MDP500
portable MiniDisc recorder
$1,545

FEATURES	5.0
AUDIO QUALITY	2.5
EASE OF USE	4.0
VALUE	3.0

RATING PRODUCTS FROM 1 TO 5

PROS: Glorious prerecord buffer. Outstanding assortment of features. Comprehensive I/O.

CONS: Somewhat noisy analog front end, especially with phantom power engaged. LCD often difficult to read.

Manufacturer
HHB Communications USA
tel. (310) 319-1111
e-mail sales@hhbusa.com
Web www.hhbusa.com

apply the Portadisc's mic attenuator (–15 and –30 dB settings are provided) and crank up the input-level knob.

Speaking of proper level setting, the built-in limiter circuit works as advertised. However, the automatic gain control (AGC) is unreliable—it is easy to drive the A/D into distortion if you speak loudly while eating the mic. Skip the AGC and use the onboard limiter as needed.

NEWSWORTHY DEVICE

The HHB Portadisc MDP500 is well suited to broadcast journalism, electronic news gathering, interview archiving, and similar tasks. However, my interests center on sound design and music recording. Because of its somewhat noisy analog front end (especially when using phantom power), I can't recommend the Portadisc MDP500 for recordings of very quiet sounds. Aside from that, it is a full-feature, professional MiniDisc recorder that is more than qualified for the tasks of capturing real-world sounds and exchanging audio with other digital devices.

Rudy Trubitt *is a writer and sound recordist. He has been writing for* **EM** *since 1990.*

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SE5000Tube Microphone
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Frequency Response: 20Hz to 18kHz
Polar Pattern: cardioid
Sensitivity: >16m V/Pa
Output Impedance: <200 ohm
Output Noise: <18dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: external regulated 115/220 P.S

SE1
Sale $89.00
Type: small diaphragm condenser
Frequency Response: 30Hz to 18kHz
Polar Pattern: cardioid
Sensitivity: 10mV/Pa
Output Impedance: <200 ohm
Output Noise: <18dB typical, A weighted
THD: <0.5% at 134 dB SPL
Power: +48V phantom power

SE1000
Sale $99.00
Type: large diaphragm condenser
Frequency Response: 30Hz to 20kHz
Polar Pattern: cardioid
Sensitivity: >18m V/Pa
Output Impedance: <200 ohm
Output Noise: <17dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: +48V phantom power

SE2000
Sale $129.00
Type: large diaphragm condenser
-10db Pad - lo-cut filter
Frequency Response: 30Hz to 20kHz
Polar Pattern: cardioid
Sensitivity: >18m V/Pa
Output Impedance: <200 ohm
Output Noise: <17dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: +48V phantom power

SE2500
Sale $149.00
Type: large diaphragm condenser
Frequency Response: 30Hz to 18kHz
Polar Pattern: cardioid
Sensitivity: >16m V/Pa
Output Impedance: <200 ohm
Output Noise: <17dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: +48V phantom power

SE3000
Sale $179.00
Type: 1.07" twin diaphragm condenser
Frequency Response: 20Hz to 20kHz
Polar Pattern: cardioid, figure 8, omni
Sensitivity: >18m V/Pa
Output Impedance: <200 ohm
Output Noise: <17dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: +48V phantom power

SE3500
Sale $169.00
Type: 1.07" large diaphragm condenser
Frequ1ency Response: 20Hz to 20kHz
Polar Pattern: cardioid
Sensitivity: >20m V/Pa
Output Impedance: <200 ohm
Output Noise: <15dB typical, A weighted
THD: <0.5% at 120 dB SPL
Power: +48V phantom power

Bayview Pro Audio Line Card

emagic, TC WORKS, PreSonus Audio Electronics, RME Intelligent Audio Solutions, WAVES, DUY, CAD Professional Microphones, ANTARES, ART, RaXXess, NEMESYS, lucid, audio-technica, Bellari, Quiklok, M-AUDIO, DRAWMER, Steinberg North America, Kind of Loud, IBM, Lynx Studio Technology, GENELEC, bias, intel, Fostex, PARIS, t.c. electronic, SPIRIT by Soundcraft, Soundcraft, FMR Audio, dbx, MAGIX, Aardvark, FRONTIER Design Group, Equi=Tech, TERRATEC, SHURE, MOTU, PLEXTOR, digidesign, Avid, MONSTER CABLE, Focusrite, marantz, RØDE Microphones, EGO-SYS, KK AUDIO, SONY, FATAR, JBL Professional, Millennia, AKG, KRK V-Series, AVALON DESIGN — Pure Class A Music Recording Systems, Soundscape Digital Technology, MACKIE., Apogee Digital, echo digital audio, HHB First We Listen, ALESIS, Demeter amplification, SONAR

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SOUND BURST

FX4U 1.2, VOL. 1–3 (VST; WIN)

Quality effects plug-ins that are cheaper by the dozen.

By Zack Price

If you're looking for an easy way to add a pile of VST plug-ins to your desktop system without emptying your bank account, Sound Burst may have the solution. The Italian company's new *Fx4u* collection features a wide range of processing plug-ins with great-looking graphic interfaces. The plug-ins' consistent design makes them easy to use and fun to play with. The collection is divided into three volumes, each providing four plug-ins. You can purchase each volume individually, or you can buy the collection for considerably less than $200.

ROLL CALL

Fx4u, vol. 1 supplies four handy plug-ins: *Master Chorus, Screamer, Sync Delay,* and *Retro Filter. Master Chorus* generates as many as ten voices of lush chorusing effects. Presets include a Classic Chorus, a warm and dark Tube Chorus, a Panning Chorus, and two detuned chorus effects. *Master Chorus* also provides separate effects for guitar, electric piano, and strings. I didn't think those instrument-specific chorus settings would make much of a difference, but each one really enhances the character of the instrument it's programmed to work with.

Screamer is a 4-band distortion unit with three distortion drive settings. Unfortunately, the distortion settings don't have names, and the frequency bands aren't labeled.

Sync Delay is a virtual delay unit with left and right output channels that you can synchronize to a specified tempo (see **Fig. 1**). You can also disable the Sync-to-Tempo feature and independently adjust the left and right output channels. Moreover, you can sync the left and right output channels to each other, even when the Sync-to-Tempo button is active. Lowpass and highpass filtering are available.

The fourth effect, *Retro Filter,* has five cryptically labeled filters that you can modify with resonance and modulation parameters. A convenient meter lets you keep an eye on the input level.

Moving to the second *Fx4u* installment, vol. 2 provides *Mega Filter, Metaphaser, Phoner,* and *Granulator. Mega Filter* takes the *Retro Filter* from vol. 1 to a higher level, with ten filters and five cutoff slopes (see **Fig. 2**). Adjustable parameters include cutoff frequency, resonance, bandwidth, LFO rate and depth, and modulation by a basic envelope follower. The Power Resonance setting adds resonance and extra drive to any audio that passes through it; it's the best choice for squawking, spiky effects.

Metaphaser is a basic phase shifter with as many as 16 stages of phasing. In addition to the usual depth, rate, and feedback knobs, you can tailor its sound with stereo imaging and filter parameters.

The *Phoner* plug-in creates telephone-voice EQ effects and includes an adjustable noise generator, FM Distortion, and Drive parameters. With those controls, you can also create effects that don't sound like a telephone, such as making music sound as though it were being played too loudly through a tiny transistor radio with bad reception. *Phoner* might not be an effects processor that you use frequently, but it provides an amazing degree of flexibility beyond the simple telephone-voice effect.

Granulator is a simple granular synthesizer that does a fantastic job of resynthesizing the waveform data from audio tracks. *Granulator* takes in adjustable chunks of digital-audio data and spits them out at an adjustable rate or density. By adjusting the Shuffle setting, you can randomly shuffle the chunks around so they don't come out in the same order in which they went in. *Granulator* can adjust the pitch of the output data, randomly alter the output pitch, or combine the two functions.

Fx4u, vol. 3 rounds out the collection with *Extreme Flanger, Protocomp, Quick Gate,* and *Rotovibe. Extreme Flanger* creates a variety of effects ranging from Classic Flanger, Slow Wah Flanger, and Sweeping Flanger to more extreme effects such as Bad Tape and Robotizer.

FIG. 1: The *Sync Delay* plug-in can synchronize its output channels to a specified tempo. The independently adjustable left and right output channels can also sync to each other.

PRODUCT SUMMARY

Sound Burst
Fx4u 1.2, vol. 1–3 (VST; Win)
effects plug-ins
$69.99 per volume; $179.99 for all three

FEATURES	4.0
EASE OF USE	3.0
DOCUMENTATION	1.0
VALUE	4.0

RATING PRODUCTS FROM 1 TO 5

PROS: Good-quality effects. Consistent user interface. Low price.

CONS: No documentation. Unlabeled parameter controls. Plug-ins don't work properly with *WaveLab* 3.0 and *Logic Audio* 4.7

Manufacturer
Sound Burst
tel. 39-011-650-1307
e-mail info@soundburst.com
Web www.soundburst.com

FIG. 2: *Mega Filter* offers ten filter types with a lot of flexibility, including five cutoff slopes.

Extreme Flanger does more than create flanging effects; it also generates vibrato and doubler effects. In fact, of all the Sound Burst plug-ins, *Extreme Flanger* is the most flexible in the effects it can generate.

Sound Burst describes the *Protocomp* plug-in as "the smartest compressor you'll ever need for general use." I wouldn't go that far, but it's easy to use and surprisingly smooth-sounding. *Protocomp* provides knobs for all of the expected parameters as well as three level meters and an envelope follower.

Quick Gate is a noise gate specifically for drum tracks and other sounds with short durations. It was another pleasant surprise, because it did a great job of tightening up some recorded drum tracks. I thought they were fine as they were, but *Quick Gate* made the drum tracks sound even better.

Rotovibe is two effects in one: vibrato and tremolo. When you want a vibrato effect, just minimize the tremolo setting. Likewise, minimize the vibrato to emphasize the tremolo effect. Vibrato and tremolo rates are adjustable, and you can combine the two effects to create some interesting choruslike sounds. *Rotovibe* works best with sustained sounds rather than sounds of short duration, such as percussion hits.

GOBS OF KNOBS

Most parameters in the *Fx4u* plug-ins are controlled with virtual knobs that you adjust by dragging the mouse. In some cases, buttons engage specific parameters; for example, *Sync Delay* has a button to activate Sync-to-Tempo and another button to engage the link between the left and right delay outputs.

As with most VST effects, you can save and load effects settings. In addition, *Master Chorus*, *Mega Filter*, *Phoner*, *Rotovibe*, and *Extreme Flanger* provide nine presets and an additional Custom preset that you can use as a starting point for creating effects. When you alter a parameter in a preset, the preset name automatically changes to Custom. It's a bit disconcerting at first, but the current settings aren't lost.

The ***Fx4u*** plug-ins are monaural, and you can use them as send and insert effects without problems. *Master Chorus*, *Granulator*, *Metaphaser*, *Rotovibe*, and *Extreme Flanger* include a Stereo Image parameter that adjusts the output's perceived stereo width.

NICE, BUT WHAT'S MISSING?

Despite the plug-ins' apparent ease of use, no documentation is included. Even minimal instructions would have made them much easier to use. According to Sound Burst, the company is writing documentation that should be available soon.

I like twiddling knobs as much as the next guy, but I also want to know what I am tweaking and why. Call me curious, but I would like to know the frequency settings for each distortion band in *Screamer* and what the three drive types are. Unfortunately, it's not possible to tell just by looking at the front panel (see **Fig. 3**). Although you can make an educated guess about the parameters in a simple effect such as *Screamer* or *Metaphaser*, it's impossible to fully understand them in more complex plug-ins such as *Retro Filter*. In fact, every effect has at least one setting that needs clarification of function or parameter range.

FIG. 3: Looking at *Screamer*'s front panel offers no clue as to the three drive types or frequency settings for the four distortion bands.

The Sound Burst plug-ins worked with most VST programs I use—Steinberg's *Cubase VST* 5.0 and *Cubasis VST* 2.0, Sonic Syndicate's *Orion Pro* 2.3, and FXpansion's *VST-DX Adapter* 3.0. However, a plug-in that I loaded into the Master Section of Steinberg's *WaveLab* 3.0 took over that program by blocking access to the Master Section window. I could use the plug-in to process audio data, but then I had to exit the program and start over again. Sound Burst says the next version of *Fx4u* will support *WaveLab* 3.0 and Emagic's *Logic Audio* 4.7. (The current version works just fine in *WaveLab* 2.0.)

Minimum System Requirements

Fx4u

Pentium/200; 32 MB RAM; Windows 95/98

The sound quality of each *Fx4u* plug-in is quite good, and the user interface is relatively consistent from one plug-in to the next. The lack of documentation and the *WaveLab* 3.0 problem should be corrected soon—they might even be resolved by the time you read this.

My only other wish is that the plug-ins were MIDI-controllable. However, I own a large number of VST and DirectX plug-ins that aren't MIDI-capable, so I'm used to living without that feature. Nonetheless, I can see myself working with all of the *Fx4u* plug-ins on a regular basis. Check them out and see if they suit your needs too.

Quick Picks

RISING SOFTWARE

Musition 2.0.2.11 (Win)

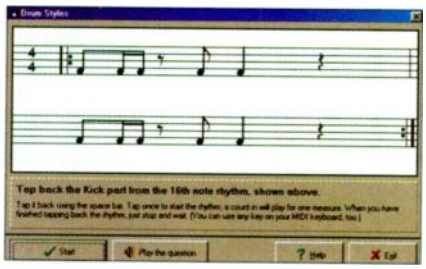
By Thomas Wells

Musition ($119; single user) is a companion to Australia-based Rising Software's computer-assisted ear-training software, *Auralia*. Like *Auralia*, *Musition* has a friendly user interface and is simply organized. The software covers 25 topics in four groups: Note Reading, Terms and Symbols, Key Centers, and Instruments. You gain access to the topics using four large buttons arranged horizontally beneath the Menu and Toolbar.

Topical Exchanges

Clicking on a group button displays the topics it contains, and clicking on a specific subject starts the drill. Each drill begins with a dialog that lets you choose the difficulty of the lesson. The dialog also describes the methods the drill will use and gives directions about how to use the exercise. Use the Toolbar to control volume and tempo, change the difficulty level, and provide a score for the drill.

The Note Reading topic group includes exercises titled Advanced Clefs, Chord Recognition, Meter Recognition, Note Reading, Rhythm Notation, and Rhythm Tapping. Under Terms and Symbols are lessons about Chord Symbols, musical Symbols, Concepts, and Terms (mainly Italian). The Key Centers topic group contains mostly ear-training exercises about Intervals, Chord-Scale Relations that are primarily jazz oriented, Key Signatures, Modulation, Jazz Scales, Scales, Scale Degrees, and Scale Home Keys. The Instruments topic group contains a set of varied lessons: Instrument Range, Instrument Recognition, Instrument Keys, Transposition, Guitar Symbols (tablature), Drum Styles, and Drum Sticking.



***Musition*, from Rising Software, has a sparse interface and displays the current lesson in the center of the screen. Like other lessons, the Drum Styles lesson provides clear instructions and is simple to use.**

In Drum Styles, the student is asked to play one part of an example using the Spacebar while *Musition* plays the other parts. In Drum Sticking, the student performs rhythms with alternate fingers, using the computer keyboard's *F* and *J* keys. Unlike *Auralia*, *Musition* doesn't display the notes that the student plays. It would be helpful if there were more feedback.

Instrumental Success

Although most lessons in *Musition* are generally thorough and straightforward, the Instruments topic group has some problems. For example, lessons in the Instrument Range section can be confusing because they address neither variations such as practical and extreme ranges nor the player's level (high school, professional, and so on). In addition, ranges are given at concert pitch, and the ranges are not always shown in the clefs in which the instrument is usually written. Nomenclature in the Instruments group is also odd. For instance, instruments that are assumed to be in C, such as the viola, are identified as Viola in C.

Notational inaccuracies, though minor, can be confusing to the beginner. For example, the program uses the symbol *16* to indicate a two-octave transposition up, rather than the correct *15* or *15ma*.

In the Transposition topic group, the student is shown a note on the staff at concert pitch—G♯3 for the Contrabassoon, for example—and asked to identify the written pitch necessary to produce that note. Seven pitches are provided as possible answers, but the list of possible answers includes no octave designation. As a result, it isn't clear whether the note you're specifying is above, below, or at concert pitch. Unfortunately, the Help button on that topic provides no information about the instrument.

Instrument Recognition is one of the most enjoyable lessons; *Musition* plays riffs on recorded instruments for the student to identify. It would be preferable if the recordings covered the different registers of the example instruments, because the timbres of some instruments vary significantly through their ranges.

In the Classroom

Like its companion software *Auralia*, *Musition* lets the instructor customize lesson content. Although it's simple to change items such as terminology, chords, concepts, and Italian terms, it's impossible to get to the information about instrumentation, which is where the program needs improvement.

Making up tests with *Musition* is easy. The Tests entry under the Administration menu lets you name a test and decide the topics and levels covered. It also allows you to determine the number of questions in the test and the number of times a topic will replay. The program informs students when they first log in that tests are available and lets them choose which test they want to take.

A nice touch in *Musition* and *Auralia* is the Professor, a virtual teaching associate. The Professor evaluates the percentage of correct answers in students' work and proceeds to suggest that they move to more or less advanced work, depending on whether they attain or fail to meet the level that is established by a lab administrator.

Lab Pack

Musition's administrator's tools make it simple to keep records, examine test results, and create and delete users. *Musition* is easy to use in a lab situation, just as Auralia is. (For lab-pack and blanket-license pricing, refer to Rising Software's Web page.) *Musition* is a generally complete and enjoyable computer-assisted instruction package in music fundamentals and can be useful at many levels of instruction.

Overall EM Rating (1 through 5): 4

Rising Software; tel. (888) 667-7839 or 61-3-9894-4788; e-mail sales@risingsoftware.com; Web www.risingsoftware.com

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SOUND BURST

Classic Synths

By Julian Colbeck

What is a classic synth? The Sequential Circuits Prophet-5, Moog Minimoog, Oberheim OBX, and Roland Jupiter-8 come to mind. Sound Burst alludes to those instruments on *Classic Synths* ($139), a sound library of 2,000 samples for the BitHeadz *Unity DS-1* software sampler. Just how many of the sounds are sampled directly from the sources is quite another matter. As with all good libraries, *Classic Synths'* contents are listed alphabetically rather than by category. However, patch names such as "Analog Aura" and "Mister Glide" don't help users with a specific instrument in mind.

Real or Replica

I loaded the first item listed on the menu, "'70s Pipe," which is a group of five programs constructed from nine samples that collectively occupy 1.34 MB of space. This is a reedy organ; the five programs use some of *Unity's* effects, filter, and envelope parameters to offer fairly radical variations of the initial sound. The looping is clean and accurate, and you can use real-time filtering by assigning the appropriate MIDI Control Change message to an available slider or knob on your controller. However, I couldn't figure out the sample's source. I ventured further through 87 mysterious patches: "Piano," "Kalimba," "Classic Rhodes," "Cryptic Rhodes," "Clavi," "Prophetic Mind," and more. The patches share the familiar timbral qualities of FM synthesis.

I compared some sounds with those of samples that I know were derived from a Fender Rhodes or a Prophet-5, and I examined the waveforms. A number of sounds on the *Classic Synths* CD are perfectly good and well presented in terms of loop points and number of multisamples. However, they are not authentic samples from classic synths. Sound Burst implies a greater degree of authenticity than that without stating it.

Classic Synths has good stuff, nonetheless. I liked the pop sounds of "Z E Piano," with its impressive span of 13 multisamples. "Jete Strings" is equally impressive with its massive (too massive, even) 13-second samples. It was odd that the loops were much shorter than I would expect for samples of this length. "W S Grand Piano" devotes 12 MB of samples to a single program that's deep and powerful, if a little somber.

The alphanumeric listing makes it difficult

Sound Burst's *Classic Synths*, a sound library for BitHeadz's *Unity DS-1* software sampler, offers simulations of popular sounds from keyboards past.

to get a feel for what you get on *Classic Synths* without trawling the entire disc. If you're simply looking for a bunch of new material to load into *Unity DS-1*, that may not be too arduous a task, but for $139, it's quite reasonable to expect better documentation and organization.

The Real Deal

Classic Synths is probably not the sample library to buy if you're looking for banks of classic Prophet-5 and Minimoog patches. For starters, the disc is riddled with piano-style instruments, which are not considered synths by most people. Prophet-like samples such as these seem way too harsh and digital. Sound Burst has done a professional recording job, but I question the direction and presentation of the series.

Overall EM Rating (1 through 5): 2.5

Sound Burst by C.R.I.M.; tel. 39-11-650-1307; e-mail info@soundburst.com; Web www.soundburst.com

NEMESYS MUSIC TECHNOLOGY

Peter Ewers's Symphonic Organ Samples (GigaSampler)

By Zack Price

Peter Ewers's Symphonic Organ Samples ($179) re-creates the historic sound of the grand pipe organ built by Aristide Cavaillé-Coll in 1846 for the Saint Madeleine Cathedral in Paris. Rather than providing numerous individual organ-stop sounds, Ewers offers five excellent GigaSampler Instruments that showcase the most common combinations of stops.

The first Instrument, Symphonic Organ Tutti, beautifully captures the full sound of the organ over a 61-note range (C2 to C7) with all stops out. Symphonic Organ Tutti Pedal provides the matching pedal notes with the same powerful all-stops-out sound over a 32-note range (C2 to G4). The Symphonic Organ Fonds 16' 8' 4' Instrument offers a rich yet less-strident combination of low, midrange, and high pipes played in unison. The Symphonic Organ Fonds 8' Instrument produces a velvety, ethereal, flutelike sound through 8-foot pipes. Both Instruments have the same 61-note range as the first patch. The fifth Instrument, Symphonic Organ Pedal 32' 16', offers a thunderous set of deep pedal notes over a 32-note range.

Organically Grown

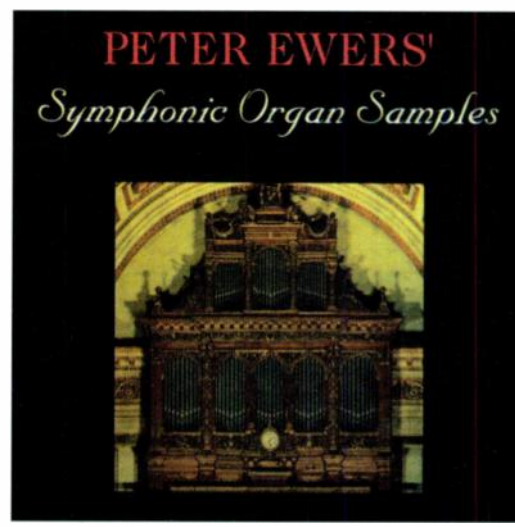
The samples for the five Instruments were recorded at a 44.1 kHz sampling rate with 20-bit resolution and then dithered down to 16 bits. On average, each note is about 30 seconds long. Because an organ sound does not have a natural decay, each sample was looped. However, it's unlikely that you'll ever perceive the loops during normal playing because the loop lengths are so long.

Each sampled note has a corresponding note-release sample that captures the natural reverberation of that note as it occurs in the Saint Madeleine Cathedral. Those reverb tails last for several seconds, and

the combined reverberations build as you play. The release samples provide an amazing realism that you wouldn't be able to duplicate with a dry organ sound processed with a studio reverb.

You can use the modulation wheel to control the amount of audible reverb. Some people might prefer to leave the reverb all the way up, but I like to adjust the reverb according to the piece that I'm playing. For instance, I might dampen the reverb a little bit for pieces that feature rapid note runs or moderately rapid chord changes to prevent the reverb buildup from becoming too thick. On the other hand, I might open up the reverb for slower pieces or selections with simple phrasing in which the reverb buildup is not so likely to be a problem. Ewers suggests keeping the reverb setting at a low level during a performance and then opening it up on the final chord to get its full impact when you release the notes.

In addition, you can disable the reverb completely using MIDI Control Change (CC) message 94 instead of turning down the reverb with the mod wheel. Using the mod wheel to eliminate the reverb does not prevent the Instrument from playing the release samples, even if you don't hear them. By contrast, using MIDI CC 94 to disable the release samples increases polyphony, and it lets you process the sound with an outboard reverb or other processor if you prefer.



Peter Ewers's Symphonic Organ Samples **from NemeSys re-creates the sound of a French cathedral organ with stunning realism.**

Pulling Out the Stops

My only complaint is that the CD's Help file—parts of which are written in English by a native German speaker—is difficult to understand. Nevertheless, I can live with that shortcoming because the organ samples are truly impressive. They make you feel as though you were actually sitting in a cathedral playing a real pipe organ. I hope Ewers plans to release another volume of this excellent set.

Overall EM Rating (1 through 5): 4.5

NemeSys Music Technology, Inc.; tel. (512) 219-9181; e-mail sales@nemesysmusic.com; Web www.nemesysmusic.com

SHERMAN

Filterbank 2

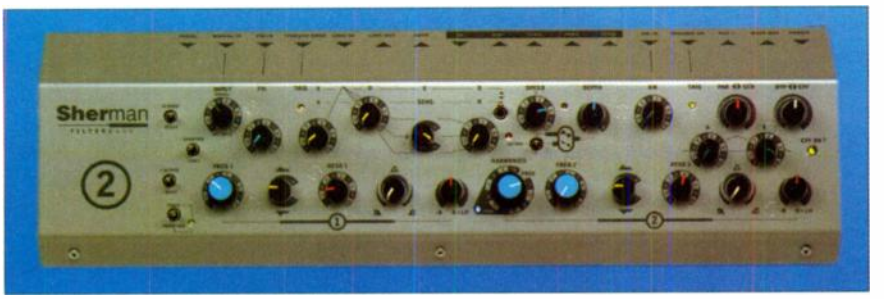
By Peter Freeman

The Filterbank 2 ($799) from Sherman Productions offers a number of electronic enhancements and cosmetic refinements to the original Filterbank (see the March 1999 issue for a review). Like its predecessor, the Filterbank 2 is an analog processor with MIDI I/O for added control.

The original Filterbank's white finish has been supplanted by a metallic gray, and the front-panel layout has changed slightly with the addition of several key features. Although the changes are not a dramatic departure from the original device, they do increase the Filterbank 2's functionality.

Under the Hood

The Filterbank's circuit-design changes are based primarily on user input. They include high-frequency shelving (cut/boost), a monophonic pitch tracker, a sensitivity control, a limiter, an octave switch, and faster envelopes as well as a sawtooth wave shape and attack/release (AR) retriggering capabilities for the LFO. In addition, the Filterbank 2's rear panel has an added ¼-inch pedal-input jack. Sherman is developing a proprietary pedal that can be used as a frequency



Sherman's Filterbank 2 includes a number of enhancements to the original Filterbank, including a pitch follower and a sensitivity control.

control for Filter 1 or as a global effect bypass. A standard two-position switch plugged into the jack gives you effect bypass only.

In addition, the front panel has two added LEDs. The white LED indicates that the pitch-tracking function is locked to the audio input. The green LED indicates that the Filterbank 2 is on. Like the original Filterbank, the Filterbank 2 employs a wall-wart power supply and does not include a power switch.

Addition and Subtraction

The Hi Boost/Hi Cut switch allows broad tailoring of the frequency response at the input stage, permitting the Filterbank 2 to accommodate different input signals. That welcome addition lets you escape the sometimes harsh tone of the original Filterbank.

The Filterbank 2 includes another much-needed feature: variable trigger sensitivity. The new three-position toggle switch lets you increase (Sensitrig) or decrease (Limit) the trigger sensitivity so that the Filterbank 2 can handle a variety of input signals.

An octave (+1 Octave) or a fifth (+ Quint) can be added to the filter cutoff by using the next toggle switch. That feature works best with monophonic material, although users may enjoy the unpredictable results that come from processing a polyphonic source.

The Filterbank 2's most interesting new feature, however, is the pitch tracker. The tracking function forces the frequency of both filters to track a monophonic source connected to the rear-panel FM In jack. The tracking function tends to lag a bit, so Sherman recommends using the + Quint setting to alleviate the problem.

Noise Reduction

Overall, the Filterbank 2 is more rewarding to work with because it has a greater range of timbres than the earlier model. Of particular interest are the muted sounds available with the Lo Cut setting. The pitch-tracking feature also opens up new possibilities, proving itself useful on a variety of sources, such as basses and melodic synths.

In addition, the Filterbank 2 has an improved noise specification. Although the Filterbank 2 is by no means silent, it's quite likely that many users will welcome the change.

You don't need to throw away your original Filterbank in favor of the Filterbank 2, however. Simply connect the older unit to the Filterbank 2 using the Link In and Link Out jacks and then take advantage of the pitch-tracking capabilities of the newer device.

Positive Resonance

The Filterbank 2 is completely analog and sounds like it. As such, it is difficult at times to achieve subtle results. However, the Filterbank 2 is still a little more grown up than its sibling and behaves slightly better.

Although the Filterbank 2 isn't a radical improvement in design and sound over the earlier version, I enjoyed its flexibility. The Filterbank 2 retains the distinctive character of the original and offers greater flexibility and a cleaner sound. ●

Overall EM Rating (1 through 5): 4

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WAVES Gold Native™

It's all new: Version 3 for MAS!

Waves is the industry standard, and Version 3 Gold Native includes the entire line of Waves native plug-ins, including the C4 Multiband Parametric Processor and new Renaissance Reverberator! Waves Gold Native is the ultimate package with everything you need—from daily tools, to sweetening and mastering processors, to sound design mind benders. From the original Q10 and L1, to the Renaissance series, to Enigma and MondoMod. Don't skimp. Go for the Waves Gold, on the way to your Gold record...

RADIKAL TECHNOLOGIES SAC-2K™ controller

Precision touch-sensitive automated worksurface

The Radikal Technologies SAC-2K sets a new standard for hands-on control of Digital Performer with a custom plug-in for DP and easy, one-touch access to every element of the recording process in Digital Performer with responsive, touch-sensitive automated controls. Within minutes, you'll achieve a whole new level of interaction and creativity that you never thought possible with fader groups, mix automation, plug-in automation (up to 12 parameters at once), transport with jog/shttle, solos, mutes...it's all just one touch away.

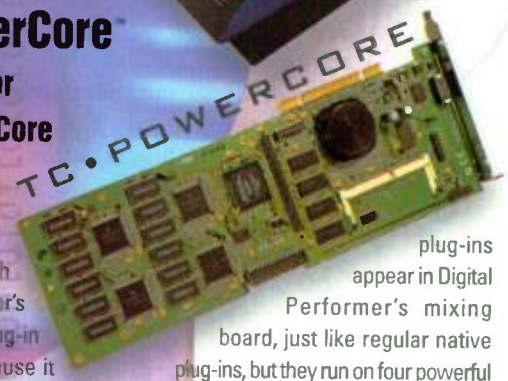
NATIVE INSTRUMENTS SOFTWARE SYNTHESIS GMBH Absynth™

Feed your addiction to sound...

ABSYNTH, new from Native Instruments, is the benchmark for the future of soft-synths. The powerful semi-modular architecture and clean interface let you effortlessly sculpt everything from organic textures to rhythmic madness, from time-evolving soundscapes to vintage sounds. ABSYNTH's unique strengths lie in its multiple synthesis techniques combined with the most flexible envelope control ever. To get a taste of ABSYNTH's potency, try drawing the shape of your LFO with the mouse while twelve rhythmic envelopes twist your sound. Absynth is surprisingly efficient, giving you plenty of leftover bandwidth for mixing and processing. And Absynth feeds directly into your MOTU mixing environment for seamless operation.

TC • PowerCore™

DSP Turbo™ for MAS • PowerCore Plug-ins



TC•PowerCore is a major breakthrough for Digital Performer's real-time MAS plug-in environment because it provides DSP turbocharged plug-in processing. At last, the renowned TC TOOLS/96 studio-quality FX package (included), with TC MEGAVERB, TC Chorus/DELAY and TC EQ[sat], can be at your fingertips in Digital Performer, plus other TC I Works plug-ins such as TC MasterX and TC Voice Tools (sold separately). These powerful plug-ins appear in Digital Performer's mixing board, just like regular native plug-ins, but they run on four powerful 56K DSP chips on the TC•PowerCore PCI card. It's like adding four G4 processors (equal to 2.8 gigahertz of extra processing power!) to your computer. Run 12 studio-quality TC plug-ins with no hit on your CPU power, and run other native plug-ins at the same time! TC•PowerCore is an open platform, so it will also run plug-ins from other respected 3rd party developers, too (details TBA).

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WRH

By Larry the O

They Are What You Ask

Unless you work entirely alone, the day will arrive when you will be in a position to select a partner of sorts. Whether seeking a band member, an employee, or someone with whom to share studio space, the decision is crucial because you will commit time and energy to working with that person and, to one degree or another, you will tie your fortunes to his or hers.

The process by which you choose your cohorts has everything to do with how well things turn out in the long run. Good information and solid techniques can be garnered from the numerous books, seminars, and courses about job interview methods, but auditioning or interviewing for a band or some other creative enterprise differs in important ways from traditional job interviewing.

In any situation, you evaluate candidates' qualification for the position, be it their ability to build a compelling sci-fi ambience or their repertoire of Chicago blues riffs. The standard tools, demos, and résumés provide a good start toward determining those qualities.

But those are just the basic prerequisites that get a candidate in your front door. I think the most important criterion is how the person fits into the situation and works with everyone else involved—a much trickier thing to determine, as it involves that elusive quality: chemistry. (For this discussion, I will forgo discussion of the legalities in interviewing and assume you are abiding by all applicable laws.)

So what's so different about auditioning or interviewing for an artistic enterprise? In a creative effort of any quality, emotion is necessarily involved. Of course, you want to be as professional as possible, and part of that is managing how emotional content is manifested. The emotion is present nonetheless, and trying to pretend it isn't leaves you vulnerable to later finding out the hard way how much it matters. If people trying out for a band have no emotional involvement, they are darned unlikely to be expressive players, something generally desirable even in straight-up session situations. Those who can't control their emotions will be counterproductive at best.

Creative and personal orientation—that is, attitude—are also very important. Those are largely subjective evaluations that the business world couches in terminology such as *team player* and *degree of motivation* to make them seem less so. It still comes down to a question of who the person is.

I've been involved in quite a few auditions and interviews, and the techniques I have learned for uncovering that sort of information frequently amount to asking questions whose answers lie at more than one level: the direct answer to the question itself and the candidate's decisions in responding.

When interviewing guitarists for one band, I did phone screenings before devoting time to personal meetings. As soon as the candidate identified him- or herself as responding to my ad seeking a guitarist, I asked the person to tell me about him- or herself as a player, before I even said a word describing the band.

Some answered with a list of their equipment, others told me of their influences, and yet others described their experience. In each case, I immediately learned something important just by how he or she chose to respond to that deliberately broad question.

In another interview situation, I asked what made the person lose control and what happened then. If the person wasn't immediately forthcoming, I pressed harder to get the answer. Why? To see how the candidate responded when pushed, because the job would sometimes entail high-pressure situations.

One must always take care in auditions and interviews to maintain an atmosphere of respect, professionalism, and courtesy (as well as legality), but creative jobs call for creative tactics when making personnel choices. Try some inventive techniques, and I guarantee you'll be amazed at the insights you'll gain.

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