And your drummer better watch his step.

We'd also like to introduce the new Micro RhythmTrak MRT-3. The easy-to-use MRT-3 drum machine has 199 ultra-real drum and percussion sounds which can be individually selected to build custom drum kits. 396 preset patterns are built-in, and there's room for up to 99 of your own. With a simple MIDI connection, the MRT-3 and MRS-4 sync up to become the ultimate complete, affordable digital recording studio.

The Zoom RhythmTrak MRT-3

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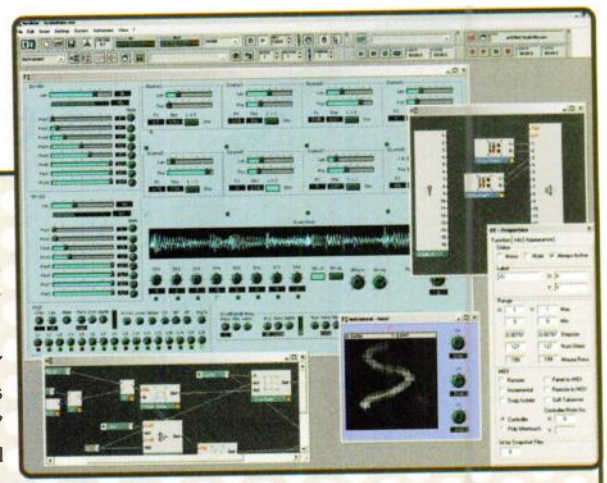
Rev Up

By Marty Cutler



Native Instruments

Native Instruments' Reaktor 3 ($499; upgrade from version 2, $135) incorporates a completely new audio engine that is optimized for the SSE and AltiVec instruction sets, making the software more efficient for Windows and Mac computers. The program's user interface now supports drag-and-drop importing of audio files, instruments, and macros. The upgrade presents several new modules, too.

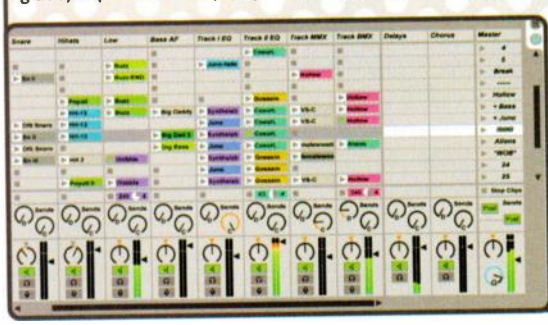
You can drag and drop multiple audio files into sampler and Beat Loop modules. Offline operations such as loading Ensembles or samples feature a new progress bar. All knobs, sliders, buttons, and toolbars are redesigned for greater visual clarity, and you can choose colors for the panel background as well as the selection color. Reaktor's Level Meters now offer coarse and fine resolution modes, and you can align meters horizontally or vertically.

Reaktor 3 also adds new filter modules: the Pro-52 filter is taken from Native Instruments' Pro-52 software synthesizer, and the Ladder Filter module emulates a classic Moog filter. Other modules include an x-y control object that lets you control two parameters simultaneously and an Audio and Event Array in which you can draw envelopes, sequences, and waveforms. Envelopes can have an unlimited number of curves.

PC users will need a Pentium III/300 MHz or faster computer with 128 MB of RAM; Windows 98, ME, 2000, or XP; and a USB port. Macintosh users will need at least a G3/300 MHz machine with 128 MB of RAM, OS 8.6 or later, and a USB port. Native Instruments USA; tel. (818) 678-5100; e-mail info@native-instruments.com; Web www.native-instruments.com

Ableton

Ableton's Live 1.5 (Mac/Win; $299.95; free upgrade) improves the loop sequencer's flexibility by adding the ability to serve as a ReWire master or client with Steinberg Cubase, Emagic Logic Audio, Propellerhead Reason, or MOTU Digital Performer. The updated software can serve as MIDI Clock master or slave and can be controlled with any programmable hardware MIDI control surface.



The program gets a sonic boost from a new reverb simulator that offers control of over a dozen parameters, including the input filter, diffusion, early reflections, and randomized movement. The Render-to-Disk function lets you export audio files to other audio programs.

With its support for Mac OS X, Live 1.5 offers lower latency and native support for multiple channels of audio. Mac users will need at least a G3/300 MHz machine with 192 MB of RAM and OS X 10.1.3 or OS 9.04 or later with OMS 2.38. The Windows version requires a Pentium II/300 MHz; Windows 98, 2000, or NT 4.0; and 64 MB of RAM. Midiman (distributor); tel. (626) 445-2842 or (800) 969-6434; e-mail info@midiman.net; Web www.ableton.com.

TIPS

To use Absynth VST in VST Wrapper, begin by adding a new stereo audio track to Digital Performer's Sequence Editor window. Next, insert Absynth VST into that track in the Mixer window. In the Track List, add a new MIDI track and select an Absynth VST MIDI channel as the output. Repeat this procedure for each different Absynth timbre you desire. Each audio channel will record a separate instance of Absynth VST, and you can play each instance on its own MIDI channel.

—Geary Yelton

Smooth Movies

If you are composing soundtracks and you're working with a QuickTime movie synchronized to your digital audio sequencer, you may find that the computer has a difficult time playing 30 frames per second and playing multiple sequencer tracks simultaneously. If your computer can't provide the necessary throughput, QuickTime will drop frames in order to maintain synchronization.

However, there are a number of steps that you can take in order to improve the performance of QuickTime and smooth out playback:

1. Keep the movie window small.
2. Choose one of the standard movie sizes (double, full, or half).
3. Close unnecessary windows and turn off autoscroll, moving wipers, level meters, and other onscreen activity.
4. Play the movie from a fast hard drive, not from a CD-ROM drive.
5. Reduce the number of audio tracks during playback.

—David Rubin

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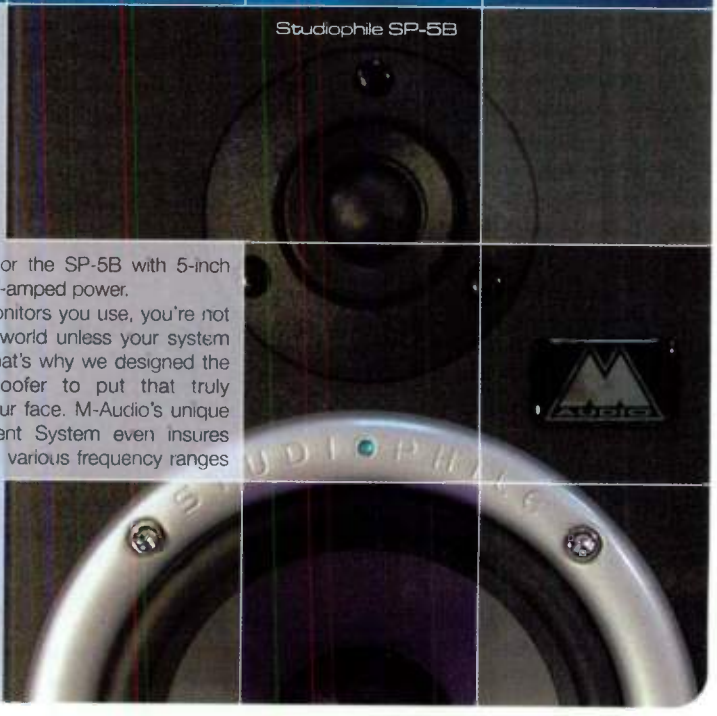

You can have all the best gear in the world and still turn out inferior mixes unless you have monitors that tell your ears what's really happening. With that in mind, our design team set out to prove that world-class reference monitors don't have to cost a fortune. The result is M-Audio's affordable new Studiophile line of active reference monitors, delivering exceptional quality at amazingly affordable prices. Choose from the SP-8B with 8-inch woofer and 100 watts of bi-amplification or the SP-5B with 5-inch woofer and 75 watts of bi-amped power.

Regardless of what monitors you use, you're not really mixing for today's world unless your system includes a subwoofer. That's why we designed the 120-watt SP-8S subwoofer to put that truly bone-shaking bass in your face. M-Audio's unique Stereo Bass Management System even insures optimal fidelity by routing various frequency ranges to only the appropriate speaker components throughout the system.

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15 Years Ago in EM

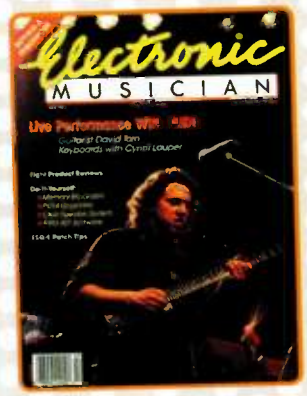
By Steve Oppenheimer

Our July 1987 issue focused on live performance and sound reinforcement. In the cover feature, John Diliberto interviewed guitarist David Torn, covering lots of ground, including Torn's emphasis on improvising onstage not only with his guitar but also with his electronics—no preprogrammed effects allowed. In a more technical story, keyboard ace David Rosenthal discussed in detail the MIDI rig he used for Cyndi Lauper's 1986–87 world tour, including not only the gear—several Yamaha DX-series synths, a Moog Memorymoog Plus, a Roland Juno-106, an E-mu Emax, and Lexicon digital delays—but how everything was routed and why. He even described his surge protector!

Mike Sokol addressed one of my pet peeves: using a pair of large front-of-house stacks and blasting the volume to reach the back of the room. Sokol explained how to create a compact, wide-dispersion system with multiple satellites to provide superior coverage at lower sound-pressure levels.

Back in the studio, sound-design guru Frank Serafine gave us a practical article on ergonomic studio design, and Jim Johnson offered a class in imitative synthesis, in this case emulating bowed stringed instruments (especially violin) using analog synths. Jeff Burger's story on buying your first sequencer explained the basic issues of the day. George DaNova provided a tutorial on effectively using MIDI Program Change messages at a time when many synths still had less than 128 programs and used screwy numbering schemes.

We offered several DIY projects. The Roland MPU-401—for years the standard MIDI interface for IBM PCs—had its own microprocessor and memory, and you could program it to do a number of tricks. Les Penner provided a routine that created a keyboard split point, something many keyboard synthesizers lacked in those days. Meanwhile, Charles R. Fischer showed us how to build custom expansion boards and "RAM sandwiches" to expand the user RAM on many 1987-vintage synths, and Alan Gary Campbell's "Service Clinic" column explained how to install firmware ROM updates and discussed the latest firmware for a variety of instruments.



Our product reviews included the Ibanez SDR1000 stereo digital reverb, Countryman Isomax headset mic, Alesis Midiverb II effects processor, Grey Matter Response E! Revision 2 memory and function expander for the Yamaha DX7, and Dr. T and Compu-Mates editing software for the Kawai K3 synth and Atari ST computer. All but the Compu-Mates software earned a thumbs-up.

"What's New" included E-mu's Emax Rack sampler, Dr. T's The Copyist scoring program for the Atari ST, and Boss's LM-2 limiter stompbox. Opcode Systems announced a new Patch Factory random patch-generation feature for its MIDI patch-editing software for the Mac; Patch Factory quickly became a favorite for many users.

We also offered several useful extras, such as our DataBank glossary of terms and an extensive list of user groups (in the pre-Web era). Finally, music reviewer Robert Carlberg introduced us to a wide variety of new releases, from Wendy Carlos (*Beauty in the Beast*) and Larry Fast's Synergy (*Metropolitan Suite* and *Computer Experiments*, vol. 1) to many unknowns.

TIPS

Convolving WAV Files in Acoustic Mirror

Sonic Foundry's Acoustic Mirror convolution plug-in, now included with Sound Forge 5.0, is normally used to apply the ambient characteristics of a space to a recording that was made somewhere else. In other words, you can give a sound the quality of having been recorded in a stairwell when, in fact, it was recorded in a dry room.

What many users don't know, however, is that it is possible to use Acoustic Mirror to convolve any two WAV files—for example, a sample of a rainstorm with a cello sample. As long as the two sounds you choose have some overlapping region in their spectra, you can easily create "clones" or morphing effects by selecting a WAV file as the impulse response and applying it to the file that is currently open in Sound Forge. Here's a combination to try: mix vocal samples and bird sounds or other animal noises with power chords. You're sure to happen upon some amazing results before too long.

Sonic Foundry's Acoustic Mirror is a great way to convolve sound files.

—Dennis Miller

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WHAT'S NEW

By Marty Cutler

ACCESS VIRUS C

There are four new models in the series of Access Virus C synthesizers: the Virus C Desktop module ($1,995); the 61-key Virus kc ($2,595); the 37-key Indigo 2 ($2,595); and the single-rackspace Virus Rack XL ($1,795). All four units feature the same synthesis engine with greater polyphony, an expanded modulation matrix, improved digital signal processors, and more. The redesigned user interfaces offer intuitive real-time parameter controls.

Each synth offers 32-note polyphony with 16 multitimbral parts. You can deploy as many as 98 simultaneous effects, including the new 3-band EQ, which offers low, mid, and high bands with independent frequency and gain controls and adjustable midband width. A single synth voice can use two independent multimode filters with resonance

The new modulation matrix offers six sources and nine destinations. You get dedicated buttons for randomizing and undo that can govern the modulation matrix, the arpeggiator, or other parameters. Nearly every time-based parameter, including LFOs and envelopes, can sync to MIDI Clock. The instrument also offers 16 independent arpeggiators.

Each synth has 24-bit D/A converters and six ¼-inch unbalanced analog outputs. You also get a pair of ¼-inch unbalanced analog inputs with 18-bit A/D converters for processing external signals. GSF Agency/TSI International Sales (distributor); tel. (310) 452-6216; e-mail gsf.agency@gte.net; Web http://www.access-music.de.

GROOVE TUBES GT 44

The GT 44 Studio Tube Condenser microphone ($999) is a top-address, medium-diaphragm mic suitable for a wide variety of instruments. A shock-mount, a 25-foot multipin audio cable, and a PSM1 power supply are included. The microphone offers interchangeable all-brass capsules; the cardioid capsule comes standard, and omni and supercardioid patterns are also available.

The GT 44 features a ¾-inch diameter, 6 µm evaporated gold diaphragm; a 15 dB attenuation pad; and a 75 Hz low-frequency roll-off filter. Groove Tubes touts the mic's Disk Resonator feature, listing a 20 Hz to 20 kHz frequency response. The mics are available as matched pairs at no extra charge. Midiman (distributor); tel. (626) 445-2842 or (800) 969-6434; e-mail groovetube@aol.com; Web www.groovetubes.com.

ALESIS MODFX

Alesis has released the ModFX line ($129 apiece), 14 stereo digital effects processors that each take up a third of a rackspace. Each effect has a ModLink port that connects to other ModFX units and passes digital audio, word clock information, and power to the next processor in line.

Individual ModFX processors include Fidelity X, which simulates tape, vinyl, radio, megaphone, and other audio mediums; Vertigo, a Leslie simulator; Spectron, which adds harmonics to the signal in the bass and treble frequencies; Formantz, a filter processor that models vocal formants; and Metavox, a vocoder with four different carrier waveforms. The Koruz, Phlngr, Lymitre, Faze, and Philtre processors are self-explanatory.

All ModFX boxes feature stereo 48 kHz, 24-bit A/D/A converters with a pair of unbalanced ¼-inch analog inputs and outputs. Internal processing is 28 bit. Each processor includes an AC power adapter. Alesis Distribution LLC; tel. (800) 525-3747 or (310) 301-9563; e-mail info@alesis.com; Web www.alesis.com.

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Analog Modeling Synthesizer

AND THE BEAT GOES ON AND ON AND ON...

Electribe • R
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check out the demos at www.korg.com/electribe

Electribe • S
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Electribe • M
Music Production Station

Korg's four different and distinctive ELECTRIBES cross the spectrum of beats and genres. Used alone, together, with your favorite MIDI gear or even with turntables, they provide everything it takes to throw down hot tracks. High-velocity rhythm patterns, cutting-edge sounds, creative sampling/resampling, and massive groove capabilities guarantee that the beat will never stop, never pause and never die.

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KEYBOARD KB AWARD REVIEW

SOUND ADVICE ▲▲▲▲

▲ KEYFAX

More than 650 Standard MIDI files of authentic reggae groove elements are compiled on *Reggae Grooves* ($39.95). Keyfax recorded solid reggae musicians to create the music.

The centerpiece of the collection is the mass of 225 drum loops. You also get more than 100 guitar parts as well as organ "bubbles," Clavinet licks, and horn parts. Styles include stepper's beats, dance hall, and ska. Among the featured musicians are Tim Siefert of the Yardies, Vince Black of Black Uhuru, and Dale Ockerman, who has worked with the Doobie Brothers and Zigaboo Modeliste.

The MIDI files come on a data CD arranged by style and tempo, but you can easily mix and match parts. In addition to Standard MIDI Files, the CD offers MOTU Clipping and Yamaha Motif Pattern–format files, and a 20-page PDF document containing groove listings, hints, and tips.

Keyfax Software/Hardware; tel. (800) 752-2780 or (831) 460-0172; e-mail us@keyfax.com; Web www.keyfax.com.

GMEDIA

The GMedia Signature Series introduces banks of patches for virtual synths programmed by progressive rock artists Rick Wakeman (Yes) and Richard Barbieri (Japan, Rain Tree Crow). Wakeman programmed sounds for Steinberg's Model E software synth; Barbieri's patches are programmed for Native Instruments' Pro-52.

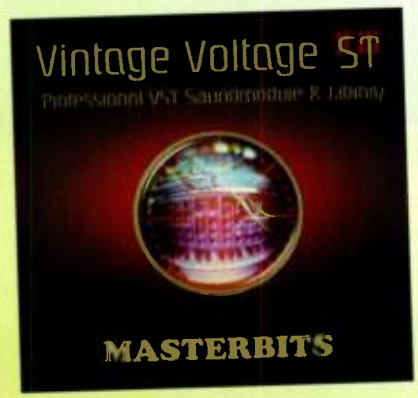
Patches in Rick Wakeman-Model E ($21.96) derive their names from the songs they were originally used in, such as "You and I," "Catherine Parr," and "Close to the Edge." That collection includes 128 patches.

Richard Barbieri-Pro-52 contains sounds from the musician's Sequential Circuits Prophet 5 archives, which represent 15 years of programming. Because Prophet 5 System Exclusive is compatible with the Pro-52 software synth, Barbieri transferred sounds directly from his instrument to the software synth. You get 128 patches as individual files and arranged as two banks of 64 sounds. Barbieri's collection includes Cross Mod Gamelans, Grainy Wheel Melody, Intro Pad, and Slo Filter Drone. Both titles are available as downloads from the Gmedia Web site. Gmedia Technology; tel. (800) 454-4563 or (801) 486-8225; e-mail gforce@gmediamusic.com; Web www.gmediamusic.com.

▼ IK MULTIMEDIA

Two new sound sets, *Vintage Voltage* and *Mello Zone* (Mac/Win; $99), focus on vintage keyboards for SampleTank. Both CD-ROMs come with SampleTank LE, which offers four MIDI channels and a single output in MAS or VST host programs.

The Vintage Voltage collection comes with 180 instruments from more than



430 MB of samples. Instruments sampled include Roland's Jupiter 8, MKS-70, Planet S, and Juno 106; Oberheim's Matrix-12 and Xpander; the Yamaha CS-15; Korg's Polysix; the Teisco 60F; and Kawai's SX 350.

Mello Zone taps Mellotron sounds from collector and specialist Klaus Hoffman-Hook. The collection is based on more than 800 single tapes in semitone steps. Sounds include violin and violin ensemble, cello, strings, flute, clarinet, trumpet, trombone, brass ensemble, and male and female choirs. IK Multimedia; tel. (866) 243-1718 or (561) 466-9763; e-mail info@sampletank.com; Web www.ikmultimedia.com.

VINTAUDIO PRODUCTIONS

For Tascam's GigaStudio comes *Giga Clean Electric Guitars* ($134.95), which presents chromatically sampled electric guitars on four CD-ROMs. Vintaudio recorded each instrument at three neck positions with three Velocities; all samples provide the full decay time for each note.

The collection gives you three guitars: a 1959 Gibson Les Paul sampled at two different pickup settings, a Godin Artisan, and a Fender Stratocaster. The samples are clean and untouched, so you can apply your own processing. Vintaudio Productions; tel. (450) 638-9295; e-mail info@vintaudio.com; Web www.vintaudio.com.

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For complete specs and a manual visit
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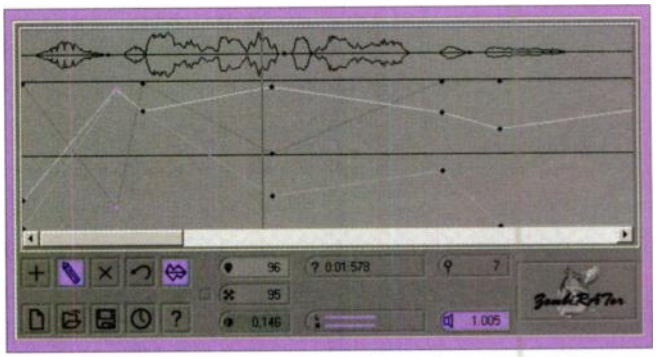
GENIESYS SCHIZORAT PACK

SchizoRat Pack (Win; $47.95) gives sound designers a bundle of five DirectX plug-ins for real-time processing of digital-audio files. Proprietary algorithms for fast Fourier transforms (FFTs) analyze the input signal, and user-designed break-point envelopes control the parameters of the plug-ins, allowing you to create animated timbres. Each plug-in offers a scalable panel showing the source material and the break-points. Parameters can also be automated by text entry.

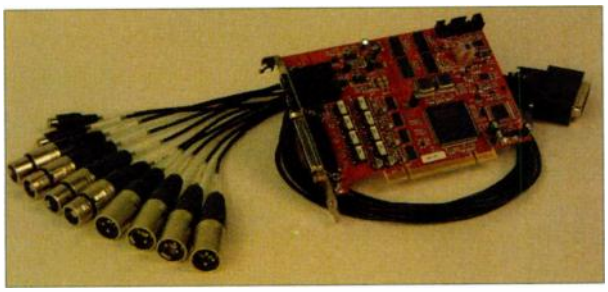
BubbleRATor adds vibrato to selected spectra in the source material. According to GenieSys, the effect adds a simmering or boiling quality to the sound. DistoRATor creates nonlinear frequency shifts, producing sounds similar to ring-modulated effects. FutuRATor is designed to add a very rich and complex spectrum to sounds. PolyRATor creates four-note polyphonic material from monophonic audio tracks and allows you to reshape pitch and melody. ZombiRATor lets you momentarily freeze selected harmonic ranges within the audio source material.



SchizoRat Pack's minimum system requirements are a DirectX-compatible host; a Pentium III/400 MHz computer with 128 MB of RAM; Windows 98, 2000, or XP; and DirectX 6.1. GenieSys; tel. (972) 527-5269; e-mail software@genevoice.com; Web www.genevoice.com.

SEK'D PRODIF 88

Prodif 88 (Win; $799) from Sek'd is a PCI digital-audio interface that offers eight channels of 24-bit, 96 kHz audio over four AES/EBU connectors on a breakout cable. Each input and output is capable of sending data at different sampling rates. You can choose 32, 44.1, 48, 88.2, and 96 kHz rates, at resolutions of 16 or 24 bits. The card supports external synchronization and works with different clocks simultaneously. As many as three cards can be used together to get 24 channels of digital I/O. Two balanced ¼-inch jacks provide analog monitor outputs.



The maximum output level of the Prodif 88 is +4 dBu. It has an internal clock and supports SES and word-clock external clocks. Sek'd says the interface should work with Emagic Logic Audio, Magix Samplitude, Steinberg Nuendo and Cubase VST, and Syntrillium Cool Edit Pro.

Prodif 88 works with Windows MME and ASIO drivers. You will need a Pentium II/300 MHz computer, 64 MB of RAM, and Windows 98, NT 4.0, 2000, or XP. Sek'd America; tel. (800) 330-7753 or (707) 578-2023; e-mail info@sekd.com; Web www.sekd.com.

HHB CDR830 BURNIT PLUS

The CDR830 BurnIt Plus ($649), HHB's successor to the BurnIt, has a built-in preamp that allows direct recording with dynamic or condenser mics (although you will need an external 48V power supply for condensers). The balanced XLR analog inputs offer switching for line- or mic-level gain. You also get balanced XLR analog outputs and RCA analog I/O. S/PDIF digital I/O is available on coaxial, optical, and balanced XLR jacks.

The CDR830 is unique in that it offers level controls for both analog and digital input. The CDR830 has 24-bit converters and an onboard sampling-rate converter. Word clock input allows you to synchronize playback at a sampling rate of 44.1 or 48 kHz.

Other features include defeatable SCMS copy-protection and the ability to edit and store track names and artist information. HHB Communications USA; tel. (310) 319-1111; e-mail sales@hhbusa.com; Web www.hhbusa.com.

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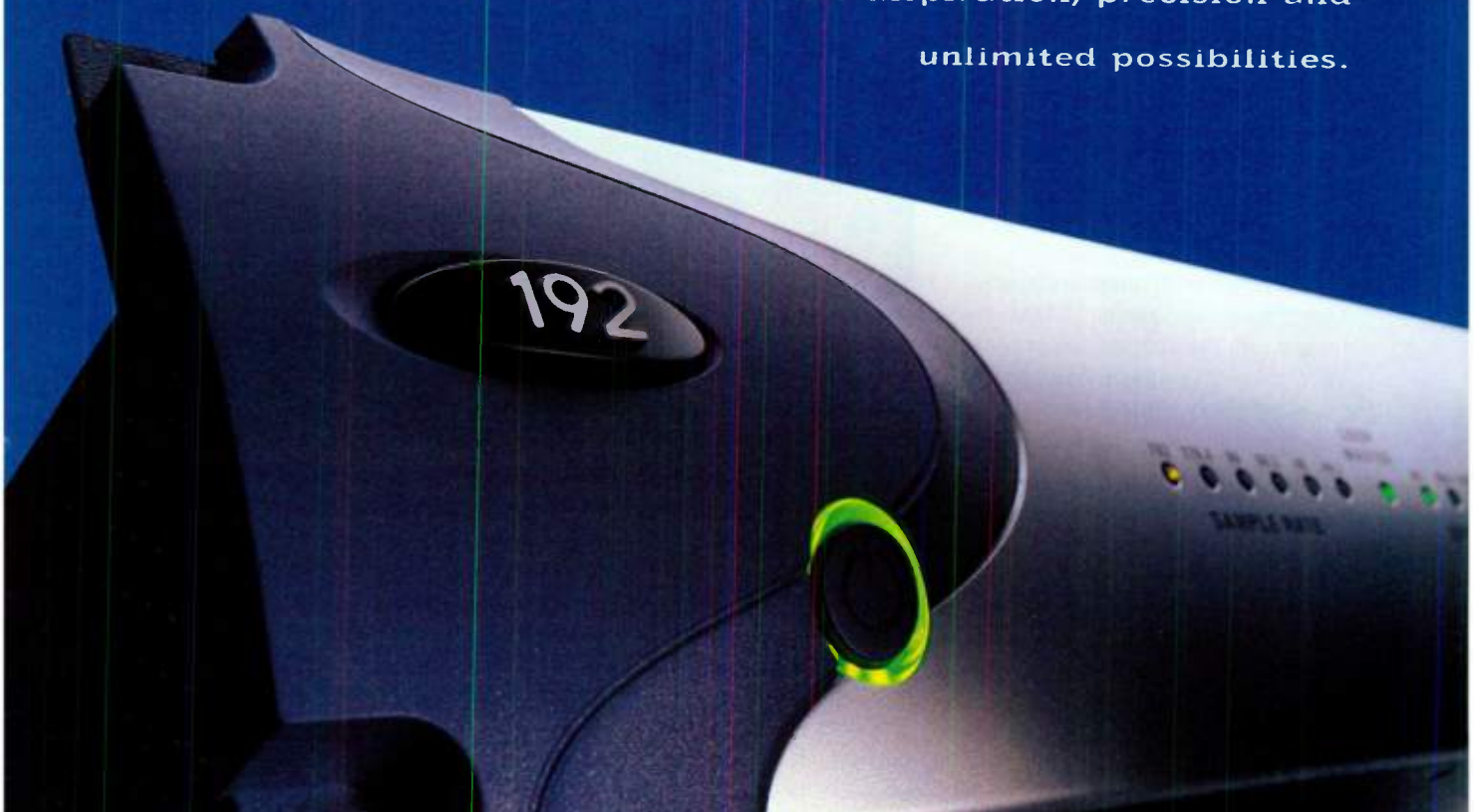

For more information on a new Pro Tools | HD system, call 1.800.333.2137 or visit www.digidesign.com.

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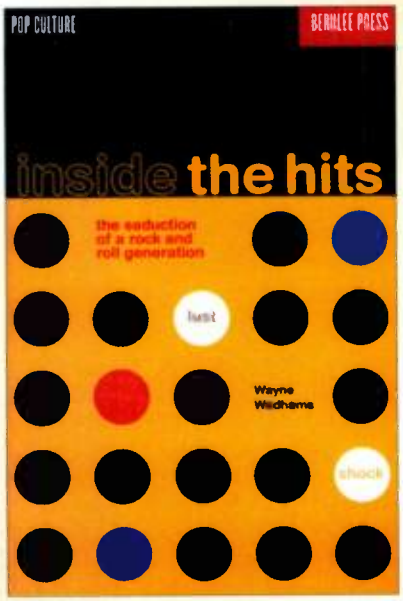
GET SMART ▲▲▲▲



▲ BERKLEE PRESS

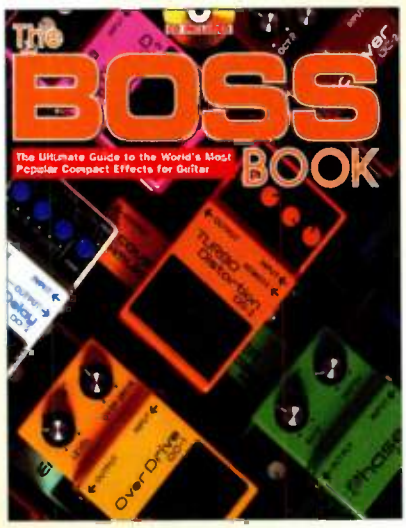
What makes some songs great? *Inside the Hits* ($29.95) by Wayne Wadhams offers colorful anecdotes and in-depth analysis of what makes hit tunes tick. Songs are described in chronological order, which provides an overview of musical trends and recording technology through the years.

Interviews with composers, engineers, managers, and musicians offer insight into the songwriting process; Wadhams cites song lyrics and discusses the way musical elements amplify lyrics and song mood. *Inside the Hits* analyzes Elvis Presley's "All Shook Up," a slew of Beatles songs that span the group's career, "Respect" by Aretha Franklin, and songs by Steely Dan, to name only a few. Key signature and tempo listings are included for all songs. Berklee Press; tel. (617) 747-2146; Web www.berkleepress.com.

▶ HAL LEONARD

More than a historical tally of the company's stompboxes, *The Boss Book* ($19.95) is rife with specifications and collector's info. The book includes interviews with product designers who relate behind-the-scenes development tales, numerous color photos, notes from collectors, charts of feature sets, and more.

One chapter is devoted to an analysis of the differences between the myriad Boss distortion products; in addition to notes on each model, waveform views graphically illustrate variations in sonic characteristics. Another section, which discusses effects as heard on popular recordings, provides



top-down illustrations of pedal settings for various boxes. An accompanying CD-ROM demonstrates the resulting tones. Hal Leonard Corp.; tel. (800) 637-2852; www.musicdispatch.com.

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Curtis Roads's long-awaited *Microsound* ($47.95) provides an exhaustive look at the quantum level of acoustics and granular synthesis. The first chapter begins with a discussion of the temporal domains of sound as they relate to music, ranging from the infinite at one end to the infinitesimal at the other. Roads then addresses the perception of sound as it moves from one boundary to the next. Diagrams illustrate time domains from the physical age of the universe to a 44.1 kHz sample, periods of ultrasonic frequencies, and smaller slices of time.

Subsequent chapters include the history of microsonics, referencing such diverse sources as Henry Cowell, Norbert Weiner, Karlheinz Stockhausen, and Ezra Pound; a section on the theory and practice of digital granular synthesis; a survey of granular synthesis techniques; and compositional applications. Roads also includes an overview of software applications that offer granular synthesis, and he devotes an entire chapter to the aesthetics of composing with microsound.

Various forms of particle synthesis are also discussed, including glisson, grainlet, trainlet, pulsar, particle cloning, and particle-based formant synthesis. The book includes an audio CD with examples of those synthesis types, as well as historical examples such as Iannis Xenakis's *A et B* for string quartet and

analog granular synthesis. MIT Press; tel. (800) 356-0343 or (617) 253-5646; e-mail mitpress-orders@mit.edu; Web http://mitpress.mit.edu. ●

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PRO FILE

By Matt Gallagher

As Luck Would Have It

The Sinister Luck Ensemble weaves adventurous new folk tales with lullabies.

The debut album from Chicago's daring Sinister Luck Ensemble, *Anniversary,* offers listeners tight orchestration combined with improvisation and breaks down boundaries between chamber music, pop, indie rock, and jazz. *Anniversary* features an eclectic collection of mostly acoustic instruments that were recorded in a pair of home studios.

Musician and composer Charles Kim formed the Sinister Luck Ensemble with friends and associates from diverse musical backgrounds. The group comprises Kim on guitar, pedal steel, and dobro; Jason Adaciewicz on drums and vibraphone; Robert Cruz on accordion; Kent Kessler on upright bass; Glenn Kotche on drums and percussion; and Diana Parmeter on cello. *Anniversary* also features guest performances from Andrew Bird on violin, Rob Mazurek on trumpet, and Ken Vandermark on alto and bass clarinet.

The album realizes "a nice balance between spontaneity and arrangement," says Kim. "Behind every piece is a story or a theme or something visual." Compositions began as improvised exchanges between Kim on guitar and Adaciewicz on drums, which were tracked in Adaciewicz's home studio onto ½-inch analog tape with an 8-track Tascam 38 reel-to-reel machine.

"Basically, we were looking at each other five feet away with the idea that we would try and get a really good sound and performance with just those two instruments," Kim says. "My theory was you can pile on top of that, even if you have multiple overdubs. Because this music is very cinematic, it was the most feasible approach."

Kim transferred those sessions from the analog machine to his ADAT and moved the project into his personal studio, The Garden, located in his apartment. The Garden includes a modest Pentium III/100 MHz Dell Dimension PC and a Digidesign Digi001 digital audio sequencer with Pro Tools LE software. Kim's outboard processors consist of an Aphex Model 107 2-channel mic preamp, a Lexicon LXP-1 digital effects processor, a Tech 21 SansAmp Bass Driver DI box, and assorted guitar stompboxes. Kim relied heavily on his Røde NT1 for miking instruments and used his Shure SM57 sparingly.

"I used a lot of plug-ins," Kim says. "I wanted this record to have the punch of a rock record [with] the acoustic grain of a chamber record or a jazz record." He tried to maintain a consistent aural depth while recording each instrument, "and not have trumpets that were two inches away and a pedal steel that was five miles away."

Kim scored parts for the other instruments to play during overdubbing sessions. "The aesthetic of this band is we let the melodic stuff on top—which is all scored and arranged—be much more orchestrated," Kim says. He adds that having a personal studio gave him the flexibility to arrange sessions around the other musicians' busy touring schedules.

After overdubbing, Kim developed thematic continuity by cutting and pasting parts in Pro Tools. For example, he says, "I took the first melodic theme from 'Reservation Dream' and made that into 'Anniversary.' You hear that same theme on 'Channel.'" Kim describes this as a painstaking process: "Like trying to make a chocolate Easter bunny out of scraps left in other people's tinfoil." ❦

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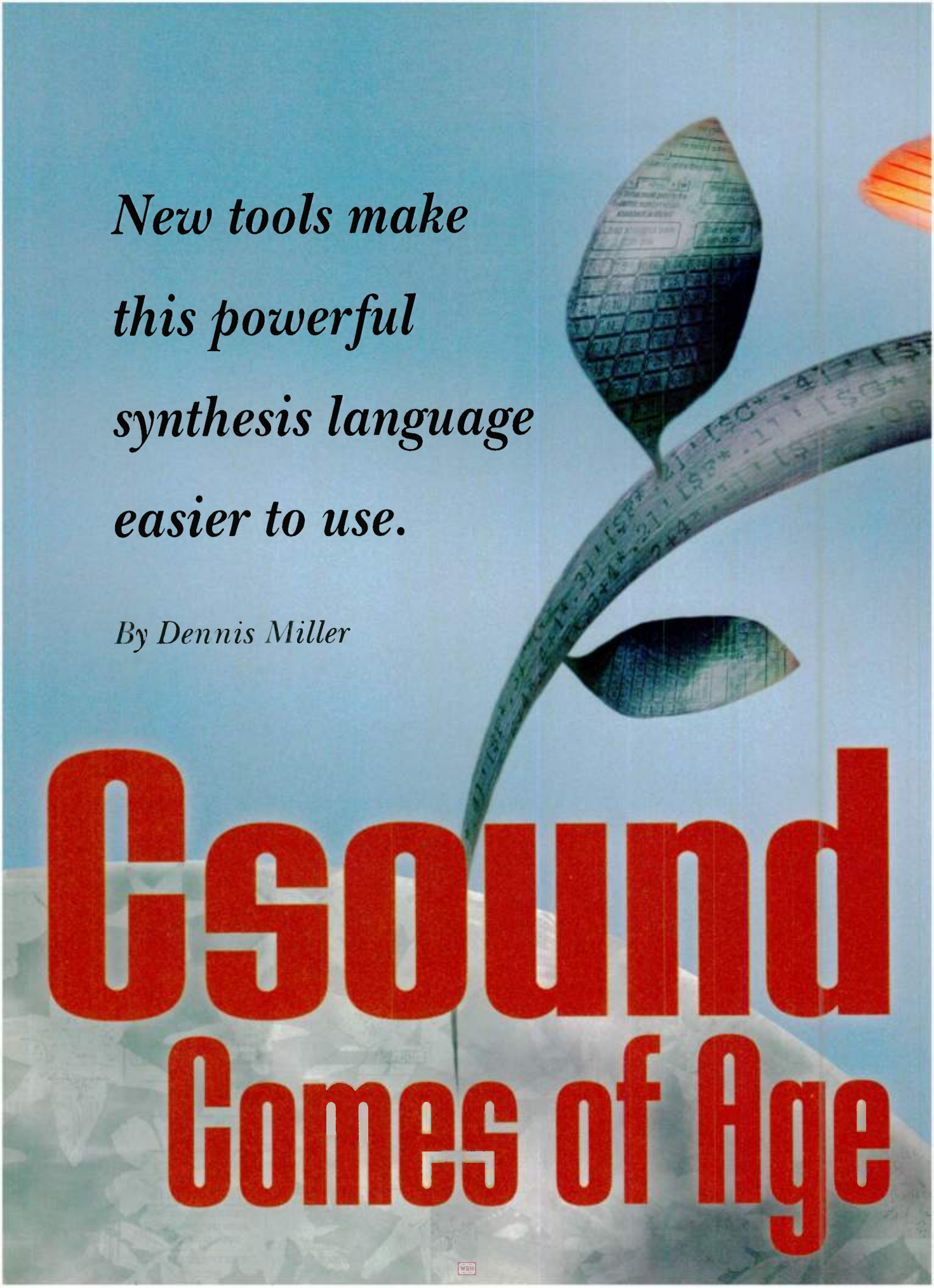


New tools make this powerful synthesis language easier to use.

By Dennis Miller

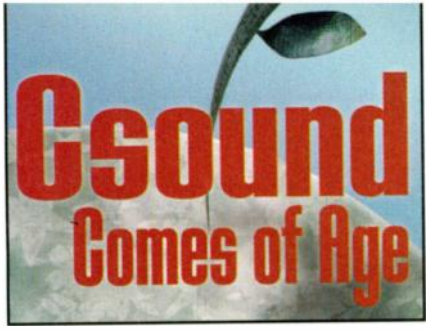
Csound Comes of Age

Csound is the latest in a long line of synthesis languages that have roots that go back to Bell Labs in the late 1950s. The language provides an almost unlimited number of resources for sound generation and processing. Until recently, however, using Csound involved typing often-cryptic commands into your word processor and then letting the Csound compiler turn those commands into audio signals (see "Master Class: Building Blocks" in the October 2000 issue of EM). Though many users will attest to the popularity of that approach, it certainly can't be termed a user-friendly way to make music.

During the past few months, a number of new tools have appeared that make using Csound almost as easy as using any modern, graphically based soft synth. What's more, like Csound itself, all of these tools are free. Among the most important new resources in the Csound world are CsoundMax, a graphical user interface for Csound on the Mac, written by Joo Won Park, and Gabriel Maldonado's CsoundAV, a similarly powerful tool for real-time use on the PC. In addition, Matt Ingalls recently released a Max/MSP Object called csound~. Many readers will find Michael Gogins's CsoundVST even more familiar; it allows you to use Csound as a plug-in under most Windows-based VST hosts. All of the software mentioned in this article is available from the Csound home page, www.csounds.com.

In addition to discussing these and other new developments, I'll offer a number of pointers on how to get them up and running. I'll also tell you about a special front end for Csound written by Glenn Ianaro that turns Csound into a powerful phrase sampler.

Illustration by Mike Cruz



Keep in mind that Csound is co-developed by a large group of avid users who do their best to supply documentation and support for their efforts. None of them receive any commercial reward for their work, which means that you won't find 24/7 tech support if you run into a problem. However, in the many years that I've been a Csound user, the Csound community has proven an extremely helpful and dedicated bunch of people. You can count on them to give you quick and accurate advice.

FIRST STEPS

During much of its 50-year history, sound programming has been a thankless task that involved coding the design for a sound using the vocabulary and syntax that was required by a specific programming language, and then rendering the code as a sound file for playback. The entire process occurred out of real time; in fact, on a slow computer, producing the sound could take many times the length of the sound file. As part of the exponential leap Csound has taken in recent years, you can now create sounds in real time and even use a MIDI controller to input values that a particular Csound instrument requires. (See the sidebar "Scores and Orcs" for a quick review of basic Csound terminology.)

Building on the significant efforts of others, Matt Ingalls's work has made Csound on the Mac far more efficient and powerful. Ingalls created a Mac System Library called CsoundLib that is optimized to take advantage of the Mac operating system's resources. He also wrote an entirely new version of Csound called MacCsound that incorporates CsoundLib and allows users to control their instruments in real time. It lets Csound interact in new and unique ways with other applications running on the same computer. For example, you can send audio or MIDI into MacCsound or route its output to another application for additional processing.

MacCsound incorporates a text editor directly into its interface and should be fully compliant with OS X by the time you read this. It includes an array of features, such as a screen of sliders that can be assigned to any parameters in your instrument, for quickly building and performing on Csound instruments. MacCsound also makes it easy to toggle between real-time audio output and recording to disk (WAV, SDII, AIFF, and raw formats are supported). Though technically still in alpha after many months (noncommercial programs often have lengthy development times), it performed well on my G3/266 MHz, even in real time.

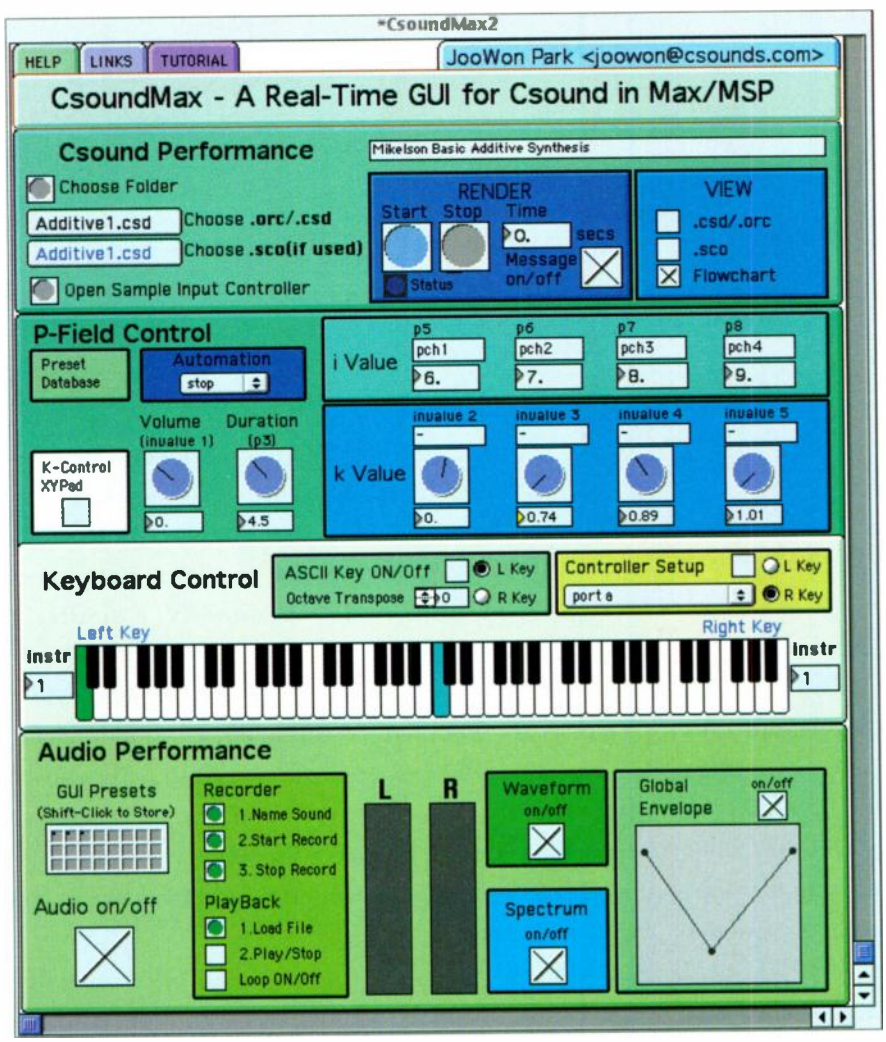


FIG. 1: Joo Won Park's CsoundMax is a graphic front end for Csound that allows you to tweak the parameters of your Csound instruments in real time. It can play an audio file from disk as you render your Csound files, and it offers several ways to display the audio it generates.

MAD MAX

Moving another step further, David Zicarelli, founder of Cycling '74 and a pioneer in desktop music making, encouraged Ingalls to turn CsoundLib into an external Max/MSP Object called csound~. Cycling '74's Max/MSP programming software is an open-ended environment in which creative users can design nearly any type of sound-generating or sound-processing tool. Incorporating csound~ into that environment combines an extremely capable and potent synthesis engine with a production platform that's already powerful. Using Max/MSP as a

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Csound Comes of Age

shell for your Csound creations means you can, for example, run multiple instances of Csound simultaneously, generate scores algorithmically, update wavetables in real time, or trigger external video gear in sync with a Csound loop. (For more information on Max/MSP and its Objects, see "Master Class: The Max Factor" in the June 2002 issue; also see the review of Max 4.0/MSP 2.0 in the April 2002 issue.) You can also route your Csound audio output to a VST host using Propellerhead's ReWire technology or use Csound as an effects plug-in for Steinberg Cubase audio tracks.

Dr. Richard Boulanger of the Berklee College of Music has spearheaded many of the new developments in Csound and has devoted a good portion of his life to making Csound accessible to the world. He recently premiered a new Csound composition using csound~ wherein he generated multiple channels of high-quality audio in real time merely with an Apple iBook G3/600 MHz. That may not seem earth-shattering to musicians who are accustomed to getting multichannel audio from their commercial applications. But to the Csound world, it is a major landmark and an important indication of things to come.

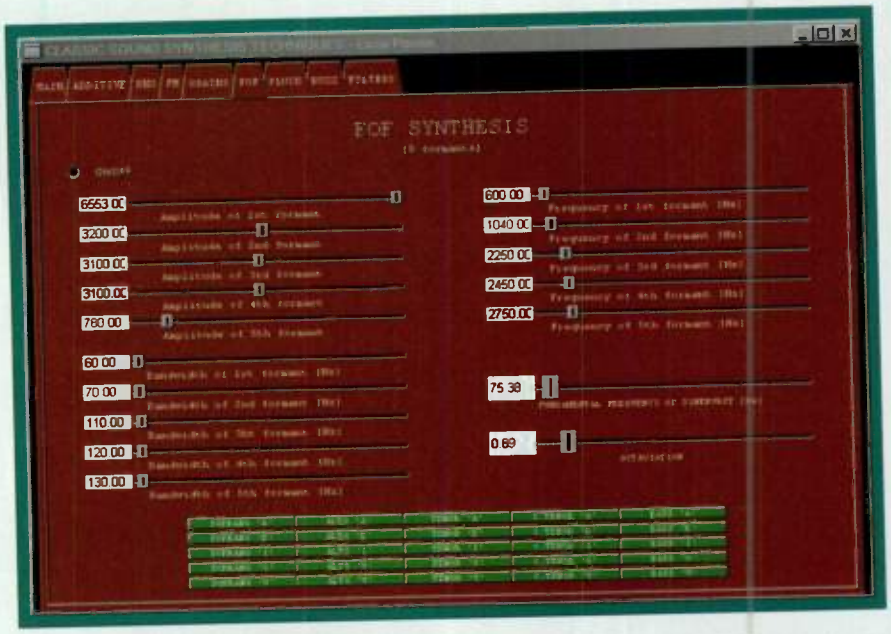

FIG. 3: Luca Pavan's Classic Sound Synthesis Techniques instrument is an elaborate interface that incorporates several synthesis methods, a waveform generator, a granular synthesizer, and four filters. The instrument runs under DirectCsound and is easy to use, but customizing it requires some knowledge of Csound.

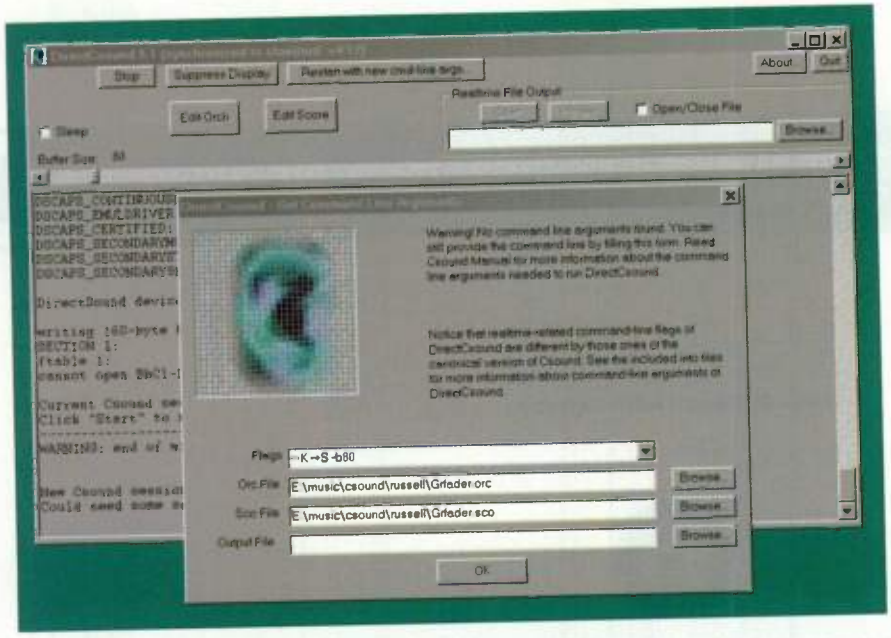

FIG. 2: Gabriel Maldonado's DirectCsound for Windows provides tools for editing your score or orchestra file and supports the use of sliders and other graphic controls in Csound instruments. It also includes features that are not found in the official Csound version.

Csound supports as many as 64 discrete channels of audio, although it would take a CPU considerably more powerful than any current desktop model to take full advantage of that capability. Creating multichannel mixes is just one of the many new applications that are now available under the Max/MSP environment. Other developments are sure to appear on the Csound home page in the near future, so check the page periodically. For example, Sean Meagher's CsoundFX, an elegant multieffects processor that runs alone and under Max/MSP, showed up the night before I finished this article.

MAXIMUM CSOUND

Still another offshoot of CsoundLib comes from Joo Won Park, a recent graduate of the Berklee College and former student of Boulanger's. Park has written CsoundMax, which can be used as a standalone, real-time soft synth and audio processor or as a Max/MSP Object.

The standalone version, which does not require Max/MSP, has a brightly colored interface that is neatly organized into four main sections (see Fig. 1). At the top of the screen is the Csound

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Performance section, where you pick the Csound files you want to work with, start and stop the real-time rendering process, set the path to the folder containing your files, and more. You can also access the text files that you're compiling if you need to edit them, and you can view a signal-flow chart (or any other graphic image) that is associated with your files. Other options include loading a preexisting sample and changing its speed, enabling and disabling looping, and adjusting the amplitude of a sample.

The second section, marked P-Field Control, contains the real-time controls you'll use to tweak your sounds. Assuming you've designed your Csound instrument with a number of controllable parameters—such as filter cutoff, grain size, or reverb amount—you'll find a knob there to govern each value. There are also controls for global volume and overall sound duration, as well as a switch to toggle automation on and off. Using the automation feature, you can capture all of the movements you make to the various controls and then play back your entire performance hands-free. There's even a nifty K Control Pad to which you can map any two parameters so that you can control them with your mouse.

Keyboard Control is at the center of the interface; there you'll find a virtual keyboard to trigger notes on your instruments. You can transpose the note range up or down, map your computer's keyboard to trigger sounds, and split the keyboard so it triggers two instruments at once.

CsoundMax's final section, Audio Performance, offers a large number of features that truly demonstrate the power of the software. For starters, you can see a real-time display of your audio using a sonogram or oscilloscope display. That has great potential for teaching situations—students could watch the sidebands evolve in a demonstration of FM synthesis, for example—and it can also be useful during mastering for locating the exact spot where a sound clips.

Beyond just looking at your sound, you can also designate a preexisting file to play back while the program is generating sound in real time, or you can turn on the Recorder to record your performance to disk. To modify the overall level of the audio, you can draw a global amplitude envelope directly on the screen that will kick in when you trigger a new note.

CsoundMax is able to play standard Csound scores and orchestras, but to get the most from the program, you'll have to modify your existing files. Fortunately, Park has written a tutorial on doing just that, and even novice users will have no trouble performing the necessary steps. You can get the tutorial at the Csound home page, along with the latest version of the software.

You won't find a more intuitive or user-friendly tool anywhere for experimenting with Csound, and I highly recommend that all Mac users download CsoundMax and see what it can do for them. In the distribution bundle are examples covering several synthesis methods, including emulations of classic analog synths, as well as various types of sample processing. If you've been reluctant to jump into the Csound world, CsoundMax will make the step an easy one.

SCORES AND ORCS

Like any modern programming language, Csound has its own naming conventions for the many types of functions and files it incorporates. Here is a short primer that should help you understand some of the most basic terms in the Csound vocabulary.

Instrument: Many conventions that Csound uses are similar to those found in traditional music. For example, the sounds you design using Csound's functions are called *instruments*. You can have as many instruments as you want in an *orchestra* file (see below).

Orchestra file (ORC): Historically, Csound has required two source files. One has the extension ORC and the other uses SCO. In the ORC file, you specify what your Csound instruments will do and you tell Csound what sampling rate it should use for its audio output.

P-field (parameter field): A *p-field* is a column in a score where the parameters of your instrument are defined. The first three p-fields are reserved for instrument number, start time, and duration (in seconds). After that you can use p-fields for any aspect of your instrument, though it is common to use the fourth p-field (p4) for amplitude and the fifth (p5) for frequency.

Opcode: Csound has many built-in subroutines that perform a wide range of tasks. These include things such as oscillators (oscil), filters (reson, atone, and so forth), and table-generating functions (Gen01, Gen10, and so on). Functions of this type are known as *opcodes*. Csound now includes many user-contributed opcodes.

Score file (SCO): The SCO file is a text file where you specify how and when a Csound instrument will play. If you have built your instrument with some flexibility—for example, including a filter but not specifying the filter's cutoff frequency—then you can put that information in the score and change the value on every note.

Csound Structured Data (CSD): This unified file format, developed by Michael Gogins, is a fairly recent addition to the Csound world and contains the orchestra and score data. It also includes tags that provide information about the way you want Csound to compile your files.

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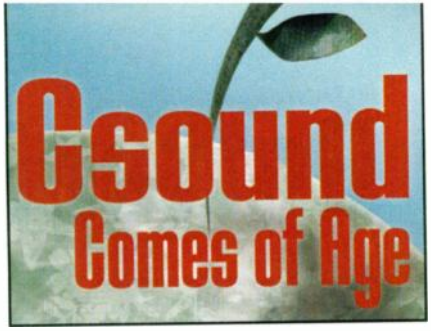

WINDOWS WONDERS

A number of developments for Csound on the PC have recently been announced that are just as exciting as developments for the Mac. Of the many people involved with updating and enhancing Csound on the PC, no one deserves more credit than John Fitch, a British mathematician who has worked feverishly during the past few years to add new features, clean up and optimize code, and generally manage and incorporate the many contributions of users from around the world. The "canonical" (official) version of Csound is always available from Fitch's Web site, ftp.cs.bath.ac.uk/pub/dream/newest, and Fitch himself can often be found lurking on the Csound newsgroup, answering questions, explaining new features, and generally making himself available to advise and direct the work of others.

Gabriel Maldonado of Italy has also made significant contributions to the Csound world. His DirectCsound, the first version of Csound to run in real time on the PC, added a significant number of new opcodes to the Csound language and represents a major expansion of its capabilities (see **Fig. 2**). DirectCsound offers numerous new core sound-generating and processing features, and its support for hardware-accelerated DirectSound3D application programming interfaces and Creative Labs' Environmental Audio Extensions (EAX) 2.0 gives it 4-channel surround capabilities. With the recently announced support for ASIO, which should be available by the time you read this, additional surround capabilities will be in place. Beyond the included documentation, Maldonado's work is detailed in an excellent text by Riccardo Bianchini and Alessandro Cipriani called *Virtual Sound* (Contempo sas, 2000). It's the best resource you will find for getting started with Csound.

Maldonado surprised the Csound community recently by adding graphic elements such as sliders and faders to DirectCsound, and new instruments incorporating those features showed up almost immediately. Among my favorite instruments that use these new elements is Josep Comajuncosas's JCM303, a Csound clone of the famous Roland TR-303 beatbox. You'll also enjoy Luca Pavan's Classic Sound Synthesis Techniques instrument, which allows you to choose any of eight windows, each of which offers real-time control over a sound-generating method (see **Fig. 3**).

Pavan's instrument includes additive synthesis, FM, and ring modulation, as well as a physically modeled string method called Pluck. There's another panel for speech synthesis that uses Csound's FOF function, a complex-waveform generator called Buzz, a granular synthesizer, and a set of four filters, each of which uses a white-noise generator as its preset sound source. To run the code smoothly on my Pentium III/933 MHz, I had to scale the sampling rate down to 22,050 MHz, but at that rate, I could run multiple instruments simultaneously and easily change several parameters at once. If you're up to the challenge, you can jump into Pavan's source file—a single unified file in the CSD format—and change any aspects of the interface or the sound-generating processes that you want.

ANIMATED PERFORMANCE

Maldonado's latest effort, CsoundAV, incorporates even more new elements: for example, the ability to scan a bit-mapped graphic image and extract data that can be used by a Csound instrument. CsoundAV can also be used to render animations in real time, in sync with Csound audio. Chris O'Donnell, a student at Brown University in Rhode Island, built an interface using CsoundAV in which the same onscreen controls are used to manipulate a synthesized sound and a spinning 3-D torus image in real time. With CsoundAV, Maldonado includes working examples such as Hallocube, which generates a spinning 3-D cube upon receiving a MIDI Note On message. Though it can't yet record the generated visuals to disk, CsoundAV is a powerful resource for those interested in animation.

Keep in mind that if you want your Csound instruments to respond to real-time MIDI instructions, you'll need to use a few special commands that convert MIDI data into a form that Csound

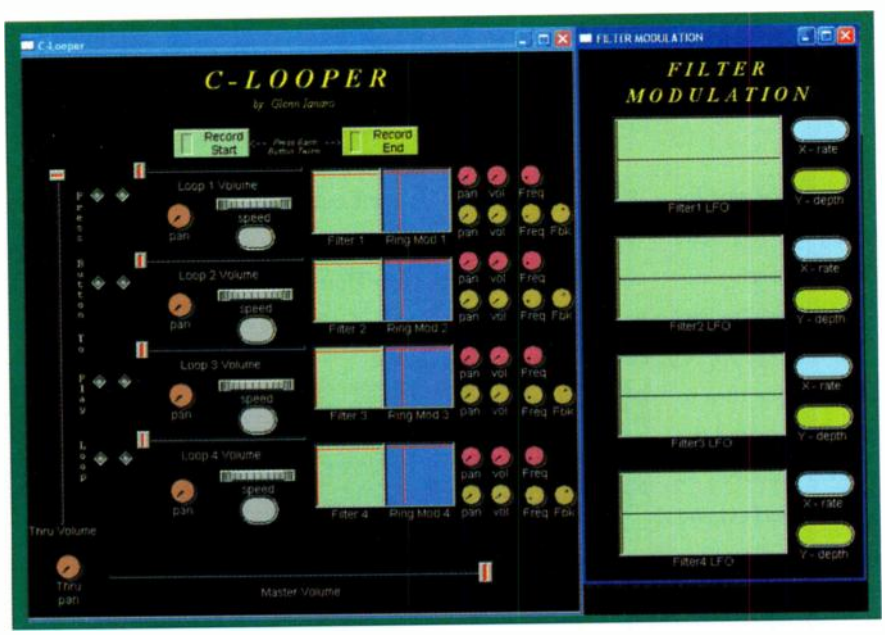

FIG. 4: You can use Csound as a four-way phrase looper with Glenn Ianaro's C-Looper. Though all four loopers use the same audio source, each has its own set of customizable parameters.

This changes everything.

kantos 1.0

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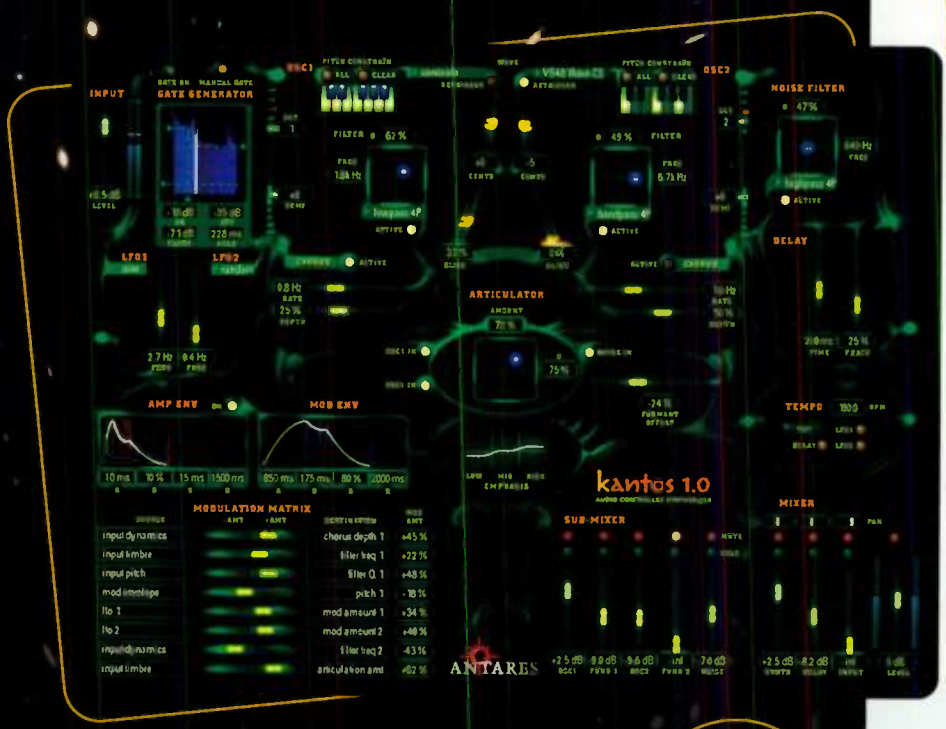

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kantos 1.0 is controlled by audio. Any pitched monophonic audio.* Like your voice. Or a musical instrument. Live, in real time. kantos 1.0 analyzes incoming audio and instantaneously extracts pitch, dynamics, harmonic content and formant characteristics. This information is then used to control the kantos 1.0 sound engine. In ways never before possible with a conventional MIDI synth.

To learn more about kantos 1.0, visit our website at www.antarestech.com for audio demos, guided tours and more. Whether you are looking for an alternative to traditional controllers, or are looking to produce electronic music with a level of sonic innovation and dynamic expression that's simply not otherwise possible, kantos 1.0 will, quite literally, change the way you make music.

*Actually, kantos 1.0 can also respond to unpitched or polyphonic input. While the output isn't always predictable, it's rarely less than interesting. And particularly with rhythmic input, you can get extremely dynamic (and sometimes downright surprising) results.

KANTOS 1.0 WILL INITIALLY BE AVAILABLE IN MAS, RTAS (MAC) AND VST (MAC) FORMATS, WITH DIRECTX FOLLOWING NOT TOO FAR BEHIND. CHECK OUR WEBSITE FOR DETAILS.

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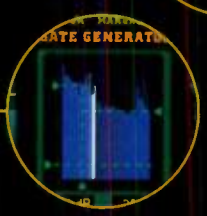

GATE GENERATOR

The Gate Generator gives you control over the triggering and duration of the envelopes as well as retriggering the oscillators' wavetables. Also included is a variable-threshold noise gate to help clean up any annoying background noise in the control audio.

ANTARES

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can use. For example, MIDI note numbers are converted to frequency values using the *cpsmidi* command, and Velocity is converted into amplitude with the *ampmidi* command. There are similar commands for converting or scaling controller data and special envelope generators that will add a short release to a note regardless of that note's duration. You'll find example files that use MIDI at the Csound home page, in the section maintained by Russell Pinkston. Pinkston is a professor at the University of Texas at Austin and is among the greatest Csound masters.

LOOP-THE-LOOP

It would be hard to find an application of Maldonado's DirectCsound more unusual than Glenn Ianaro's Windows-based C-Looper instrument. C-Looper is a four-way phrase looper that uses nothing more than readily available Csound resources. In fact, the two files needed to render the system total a mere 32 KB. (You'll need a copy of DirectCsound on your computer, of course.)

Each of the four phrase loopers has adjustable volume and panning, but even more important, there are controls to add ring modulation, apply a lowpass filter, or change the speed of the loop in real time (see **Fig. 4**). At the moment, all four loopers access the same audio file on your drive or the same incoming audio signal. Ianaro has plans to expand this capability to support as many as four discrete audio streams and has also announced other plans to turn C-Looper into a more robust composition and "improvisation environment."

Although it hasn't overcome the latency inherent in any audio environment, Ianaro's system seems less prone to the inevitable lag time than you'd expect from a traditional soft synth. He recommends using large buffers when running the system (a setting that you specify in whatever interface or "launcher" you are running Csound under) and has indicated that a Pentium III/500 MHz is the minimum processor needed to run it at 44.1 kHz. An article Ianaro wrote about C-Looper is available in the summer 2001 issue of Csound Magazine (www.csounds.com/ezine), a quarterly online publication put together by Hans Mikelson that offers articles for beginners and advanced users. (The article refers to the software as Schnackertronics, its former name.) In the article, you'll get a thorough explanation of the instrument's genesis and capabilities.

Even without any knowledge of the program's inner workings, however, you should be able to load the SCO and ORC files and start jamming with the system. If you want to change the default WAV file that the loopers use, look for the line

```
strset 10, "mysound.wav"
```

near the top of the orchestra file and replace the file name in quotes with one of your choosing.

VERY SPECIAL TOOLS

If working with a new interface is more than you want to manage, you'll definitely feel right at home with Michael Gogins's CsoundVST plug-in. CsoundVST allows you to use your Csound instruments as VST Instruments, which means they'll show up alongside all your favorite soft synths inside the VST interface. Equally important, you can use Csound's massive processing engine as a plug-in effect for processing audio tracks.

I tested CsoundVST on a Windows 98 system and had some trouble getting it to run; when I switched to a Windows 2000 machine, however, the problems disappeared. My test application was Cubase VST/32 5.01, and I got the plug-in to work as a VST Instrument and as an effects processor. Some users running Steinberg Nuendo have reported problems using CsoundVST as a VST effect but have had good luck with the Instrument option. (Under Steinberg WaveLab, it will only run as a plug-in effect.)

CsoundVST does not have a slick graphic interface. Instead, when you click on the Edit button after loading it into any plug-in slot, you'll see a text-based screen that includes all the options the plug-in provides (see **Fig. 5**). CsoundVST supports standard Csound ORC and SCO files in addition to files

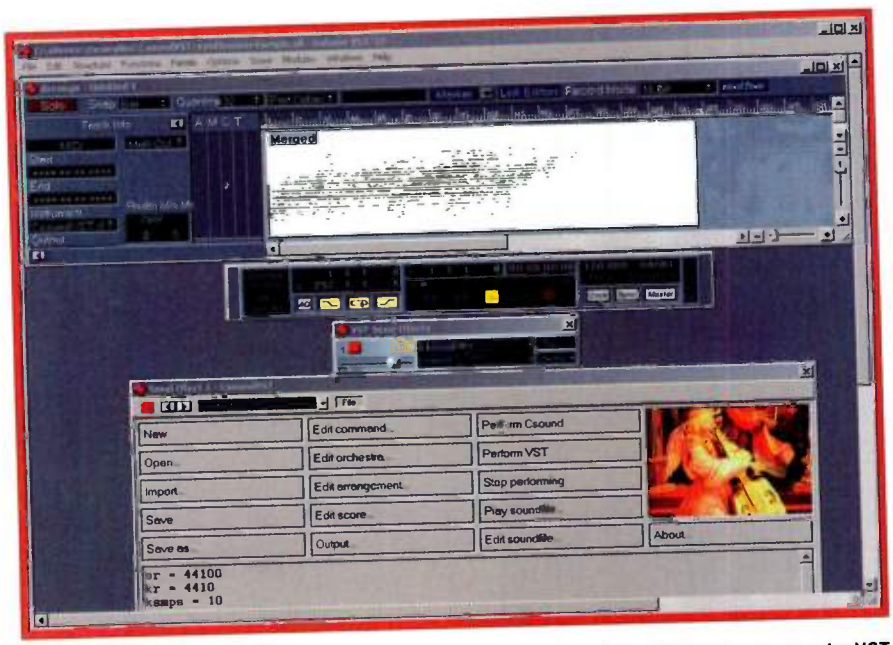


FIG. 5: CsoundVST, by Michael Gogins, allows Csound to be used as a VST Instrument and a VST plug-in effect. The plug-in works only on the PC and functions best under Windows 2000 and XP.

in CSD format. Because of the resources required to run Csound and your VST host, you should expect a bit more latency than you would normally get from a highly optimized software synthesizer.

To configure the plug-in, you need to tweak a few lines in your autoexec .bat file. One way to do that is to jump to a DOS window and then type "edit c:\autoexec.bat" (don't type the quotes), enter the lines below, and then reboot. The process is well documented in Gogins's release notes.

```
SET PATH=%PATH%;c:\Silence\bin;
SET SILENCE_HOME = C:\Silence
SET CSOUND_HOME =C:\SILENCE\bin
SET STK_HOME=c:\SILENCE
```

You'll also need to set a few configuration parameters so that Csound passes audio back to the host rather than writing its output to disk. That's accomplished by adding the appropriate "flags" (-h, -n, and so on) after the CsoundVST command that appears at the top of your Csound file. You should also use the –d command to keep Csound from generating a running display of its activities as it compiles your sound. A typical command (configuration) line will look like this:

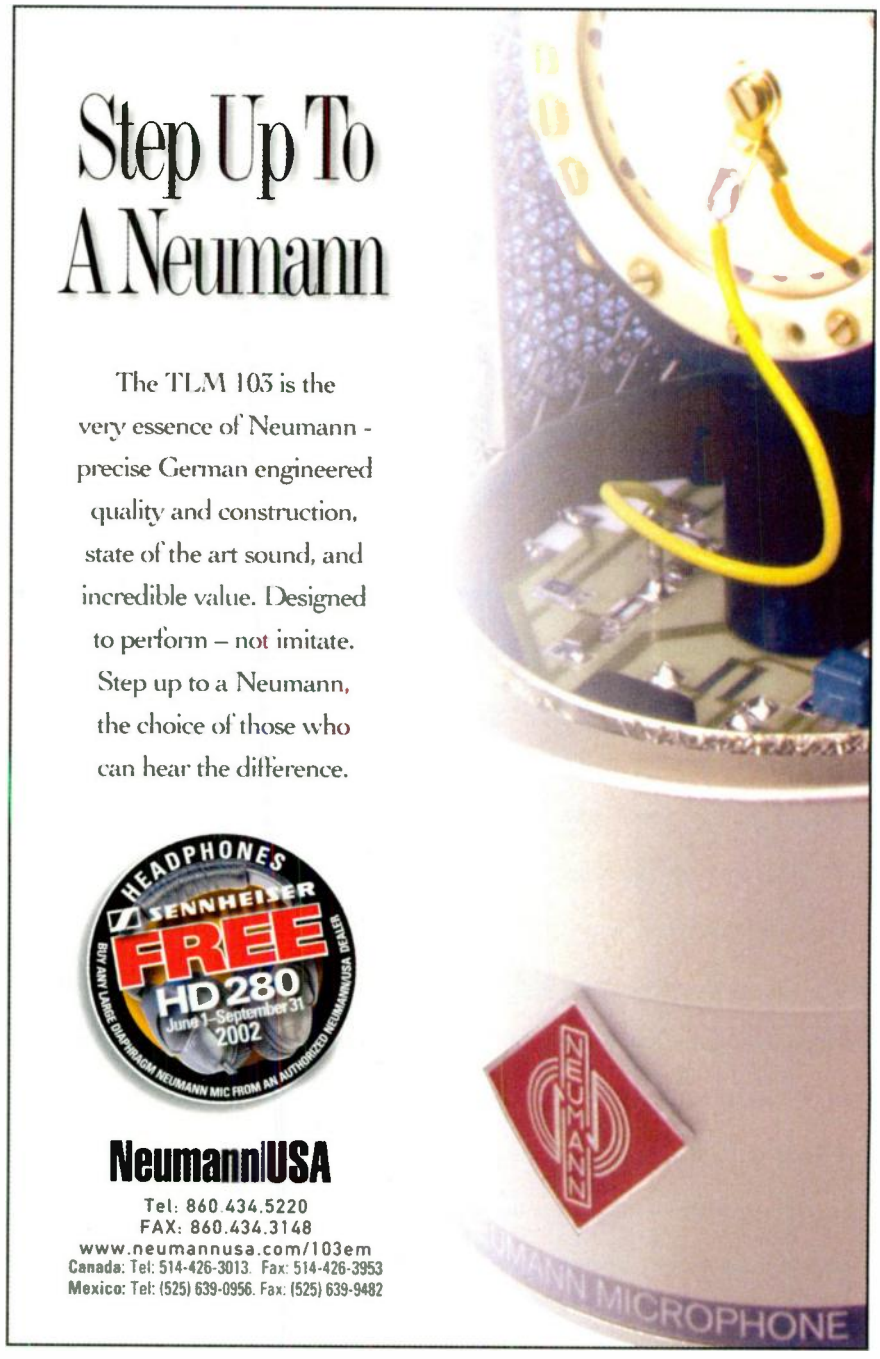
```
CsoundVST -h -n –d temp.orc temp.sco
```

Gogins has also implemented new opcodes in CsoundVST such as Jezar's freeverb, an excellent reverb based on the Schroeder/Moorer model (available as a free DirectX plug-in at www.dreampoint.co.uk); and Perry Cook's Synthesis Tool Kit, a set of high-quality physical-modeling opcodes. In addition to his VST plug-in, Gogins has created an elaborate environment for working with Csound called Silence, which is a Java application optimized for algorithmic composition.

It would be impossible to mention all the exciting developments appearing across the Csound landscape, and I can hardly imagine what Csound's original developer, Professor Barry Vercoe of MIT, must think of the enormous universe he has engendered. There are now thousands of example files online to get you started, dozens of tutorials and two major books on Csound in print (see, in particular, Boulanger's *Csound Book* [MIT Press, 2000]), and a multitude of creative and unique contributions that are readily available for you to test out. Moreover, it seems that nearly every day, a new user appears on the Csound newsgroup, introducing him- or herself and asking a few questions or proposing some enhancements to the language. If you haven't kept up with the latest developments in the Csound world, it's high time you had a look!

EM *associate editor* **Dennis Miller** *never thought he'd end up writing music by typing text into his word processor. But Richard Boulanger enlightened him to the world of Csound, and the rest is history.*

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



Build a Personal Studio on Any Budget

Six editors go shopping for complete personal studios.

As you can imagine, we **EM** editors are often asked to recommend gear for a reader's studio. Of course, we regularly evaluate gear in our reviews, and we can try to help with specific problems, but your personal studio is, well, personal. The right gear for your situation depends on your existing gear, goals, budget, and way of working. After all, no one product is right for everyone.

The closest we can come to answering those pleas for help is to consider what we would buy if we were building new studios. You and your friends have varying goals and tastes when it comes to designing a personal studio, and so do our editors. When I assigned Marty Cutler, Brian Knave, Dennis Miller, Gino Robair, David Rubin, and Geary Yelton the task of mapping out personal studios from scratch, based on clearly defined (if imaginary) budgets, each followed his own muse. I set the rules, offered advice, challenged assumptions, and edited the results.

We consulted freely, but each editor made his own choices, specifying the gear he would buy if building a real studio rather than spending play money. We used the same process you would: we created a budget, determined what sort of projects we wanted to take on, and assembled our wish lists, keeping in mind how the parts would work together as integrated systems.

We aren't saying the products in these eight studios are necessarily the best of their kind—although some are. This is not a variation on our annual Editors' Choice Awards. We have selected quality products that integrate well to form studios the editors want to own and use.

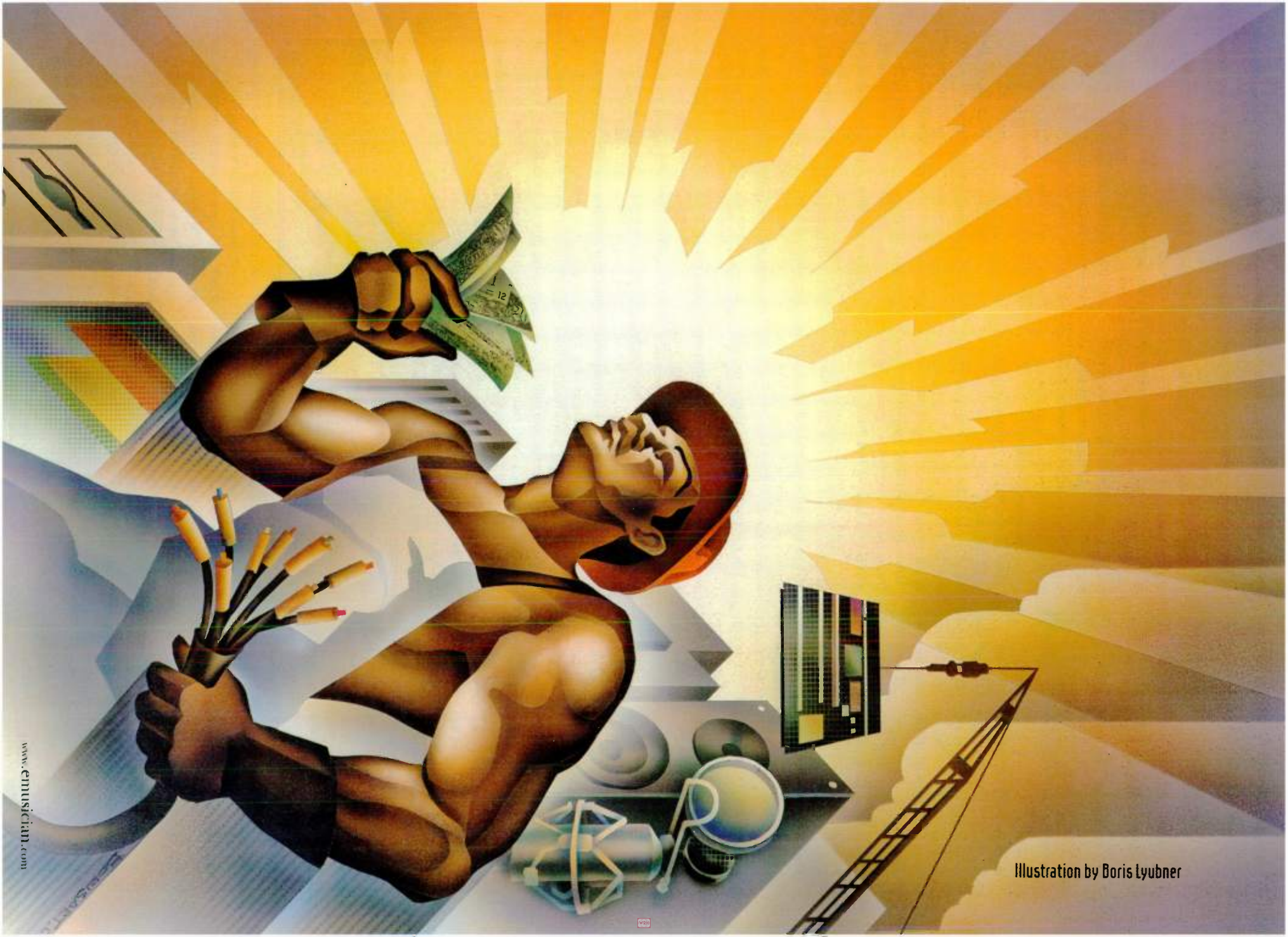


Illustration by Boris Lyubner

PAST IS PROLOGUE

If you have been reading EM for the past four years, you may understandably have experienced déjà vu when you read the title of this story. Indeed, our July 1998 cover story had the same title and theme. "Build a Personal Studio on Any Budget" was one of our most popular cover stories. The time seems right to revisit that theme: our choices have changed, and so has our staff. Our 1998 studios were created by Brian Knave, Dennis Miller, Jeff Casey, and yours truly. Knave and Miller contributed again this time and are joined by Marty Cutler, Gino Robair, David Rubin, and Geary Yelton.

The 2002 version follows roughly the same format we used four years ago: we outlined plans for eight studios, half with computers and half without, complete with price lists and manufacturer contact info. But we divided it up differently this time: two studios are based on portable digital studios (desktop hard-disk recorders that integrate a mixer and effects), two are Mac-based (more or less), two feature Windows PCs, and two eschew computers in favor of a rackmount modular hard-disk recorder, a mixer, and outboard gear.

In 1998 hardware samplers were still a major item, but you will find only one in the 2002 edition: a keyboard workstation with a sampling option. Furthermore, we followed one of today's hot trends: one of our "Macintosh" studios is, in fact, a hybrid that uses a Mac for most work but also includes a Windows PC dedicated to sampling.

DEALING THE DOUGH

I assigned the funny money differently this time than in 1998. In the earlier story, we specified two studios—one with a computer and one without—at each of four price points: $4,000, $8,000, $16,000, and $32,000. This time we decided against strictly parallel budgets because it generally costs more to assemble a "classic" studio without a computer, using discrete devices such as modular hard-disk recorders and mixers, than to buy a comparable portable digital studio or computer-based system.

For the computer-based studios, I gave Yelton $5,000 in play money to build a Mac-based system, and Miller got $5,000 for his Windows-based recording rig. I encouraged them to enhance their studios' capabilities with freeware or shareware, a wise choice when you have a low budget. At the high end, Rubin designed a mostly Mac-based studio for $15,000, and Miller got another $15,000 in funny money to build a high-end Windows wonderland.

On the hardware side, Cutler delights in portable digital studios, so he received $2,500 to build a low-budget studio based on one of the integrated devices and $6,000 for a more elaborate portable-digital-studio-based solution. Robair was given $10,000 for his lower-end, traditional-style, computerless studio, and Knave was the big spender, building a traditional studio without computer for $30,000.

I allowed a bit of slack, but not much. Miller blew his $15,000 budget by $103, but he pleaded so piteously that I let him get away with it. Rubin ran over budget by $78, but I consider an overrun of one half of 1 percent to be insignificant in view of his ambitious sound-for-picture studio design. Everyone else stayed within a few dollars of his target, except Cutler, who came in $38 under budget on one studio and $56 under on the other.

RULES OF THE GAME

We assumed we were starting from scratch, but we stuck with the major pieces and did not consider such items as cables, mic shockmounts, pop filters, stands, patch bays, acoustic treatment, studio furniture, power strips, extension cords, and personal instruments (such as guitars). Obviously, you would need most or all of that stuff in an actual studio, but including it would have made an already large story almost unmanageable. Interestingly, none of the editors opted for AC power conditioners, although Cutler, Knave, and Rubin put uninterruptible power supplies on their wish lists for future expansion. Power conditioners are like acoustic conditioners: you can work without them, but it isn't a safe practice.

To ensure that these studios could actually be built for the prices stated, we only chose gear that is currently in production, and to the extent possible, we used manufacturer's suggested retail prices (MSRP). Each manufacturer has its own pricing policies, and street prices vary widely, so that was the closest we could come to a level playing field. We made no attempt to account for sales tax. On the other hand, you undoubtedly can find discounts on many items, and in some cases, you can buy used equipment; that should cover the sales tax.

We had a blast designing these studios, and we hope you will find our choices and explanations interesting and useful. No matter what we choose, you will surely disagree with some of our selections because we can only tell you what we would buy and why. By putting our choices in the context of designing a (more or less) complete studio, however, we hope to provide a framework that is both practical and meaningful.

—Steve O

Portable digital studios integrate the essential studio components in a small, self-contained unit, and they can produce high-quality, professional results. I want to take the "studio-in-a-box" concept as far as I can; consequently, my portable digital studio of choice offers built-in CD-mastering capabilities. I also want to ensure a healthy degree of portability for the

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entire system; that means evaluating ancillary devices for compactness and buying products that offer as many integrated features as possible. Adaptability and versatility are key issues.

Although my budget doesn't immediately allow for it, I might eventually want to expand my system by adding the powerful MIDI-sequencing and audio-editing features offered by a computer, so a solid MIDI implementation is essential. I eliminated the so-called pocket recording studios from consideration because I wanted at least uncompressed, 16-bit, linear recording. All current pocket recording studios use data-compression schemes, sampling rates lower than 44.1 kHz, or both, and they're too small to hold a built-in CD burner.

Portable digital studio. I'm devoting the bulk of my spending money to the portable digital studio, which will be my mixer, effects rack, tracking machine, and mixdown and mastering deck. For the centerpiece of my budget studio, I winnowed my selection down to the Boss BR-1180, the Fostex VF80, and the Korg D12. All three units offer an option to install an onboard CD-RW drive for mixing down and data backup.

All three units let me import and export tracks as WAV files. That's convenient if I want to edit tracks on someone else's personal computer (there's no room in my budget for my own computer), or if I want to pull WAV loops into tracks. The Fostex and the Boss units come with 20 GB hard drives; the D12's drive is a modest 6 GB, but hard drives are cheap, and when the occasion arises, I can install a larger one (though Korg does not officially sanction that practice).

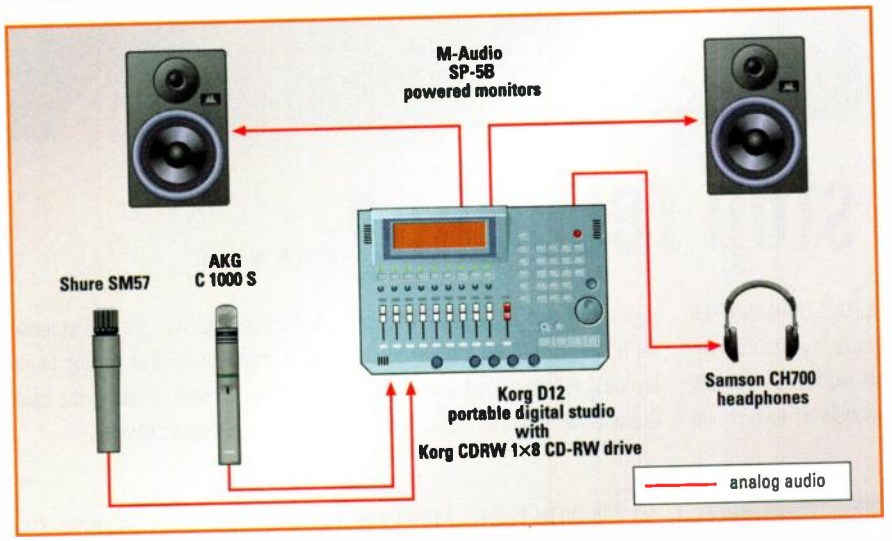
The number of simultaneous recording tracks proved to be an important deciding factor. The Fostex and Boss recorders can record just two tracks at a time. That would be acceptable if I only intended to record stereo room mixes of live bands or lay down MIDI tracks in my personal studio, but I want to record several musicians to separate tracks simultaneously. That makes the D12, with its simultaneous 4-track recording, the leader of the pack.

As the centerpiece for a $2,500 recording studio, Korg's D12 provides complete basic recording, processing, and mixing features with plenty of capabilities for integration into larger, more elaborate systems.

The Korg unit gives you a dozen 16-bit, 44.1 kHz tracks or six tracks at 24 bits and 44.1 kHz. The two XLR inputs provide phantom power, and four balanced ¼-inch analog inputs let you connect keyboards or other line-level devices. Trim pots for the ¼-inch inputs allow you to adjust for line- or mic-level input. An unbalanced ¼-inch high-impedance input lets you record guitars and basses directly through a roster of great-sounding amp models and effects. You also get a ¼-inch expression-pedal jack for modulating effects such as wah-wah and chorus.

All 12 tracks have high, midrange, and low EQ, and the mids are sweepable. The built-in effects processors provide additional 4-band parametric EQ for precision frequency tailoring. I like the arrangement of the effects-processor algorithms. You can apply some basic dynamics processing, such as compression or limiting, to all tracks simultaneously, or you can choose more powerful multiple-effect algorithms (for example, amp and cabinet simulators with compression, overdrive, chorus, and delay) specifically tailored for guitar, bass, vocals, and keyboards.

The D12 also has a healthy complement of less mainstream effects, including vocoding, ring modulation, and bit reduction. You can apply two Final effects, such as reverb, with individual send levels for each track. Last, to provide overall punch and gloss to the final stereo mix, the D12 lets you choose a single Master effect such as parametric



Portable digital studios such as the Korg D12 combine a recorder, an effects rack, and a mixer and, in many cases, incorporate a CD-RW drive. Built around the Korg D12, this system is portable and can synchronize and exchange WAV files with a computer DAW.

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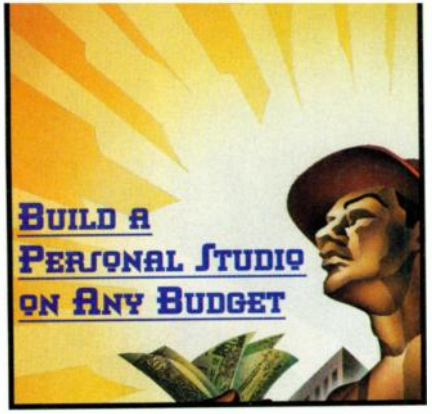


EQ, compression, or multiband limiting. All effects are programmable, and you can store your tweaks in user memory.

A stereo rhythm track provides drum grooves that you can link together as you would drum-machine patterns. You can print the patterns to tracks or just use them to keep recordings in the pocket. That sure beats a metronome.

The D12 provides all of the basic track-editing features—including copy, delete, and insert—and it has track-management features such as optimizing and swapping. The unit offers 99 levels of undo (although anyone reaching that level of distress should probably start over from scratch). Accordingly, the D12 lets you select 1, 9, or 99 undo levels, keeping you from getting mired in confusion.

The D12 is a machine I can grow with when my budget allows. The unit's MIDI implementation is quite respectable. It's the only unit in its price range that can act as master or slave to MIDI Time Code (MTC) or MIDI Clock. The D12 also sends and receives MIDI Machine Control (MMC), letting you automate the recording process for any additional units. You get dynamic, automated control of mixing parameters and effects with MIDI Control Change (CC) messages, and Scenes respond to Program Change messages. Because the D12 offers S/PDIF inputs and outputs, I can eventually add an external tube preamp with digital outputs. (One possibility is the A.R.T. DPS, which accommodates microphones as well as guitar, bass, or synth signals, adding the analog warmth of a 12AX7A tube.)

Finally, I like the D12's mixdown capabilities. You can, for instance, bounce tracks to overwrite the first two tracks even if all tracks are full. The unit also lets you bounce to virtual tracks. To produce masters and back up song data, I am going with Korg's CDRW1×8 rather than a SCSI-based CD-RW. Like the other units, the recorder offers a SCSI port for data backup, recording, or CD burning, but I can always add external drives when my budget allows.

Speakers. Following the philosophy of maximum portability, I'm using active monitors. They eliminate the need for a separate power amp, thereby minimizing bulk and taking up less space. M-Audio SP-5B biamped monitors deliver great bang for the buck. They offer a stable, balanced frequency response in the low to midrange and well-defined mids and highs. A subsonic port channels frequencies below 30 Hz, offering an impressive amount of bass for a speaker with such a small footprint.

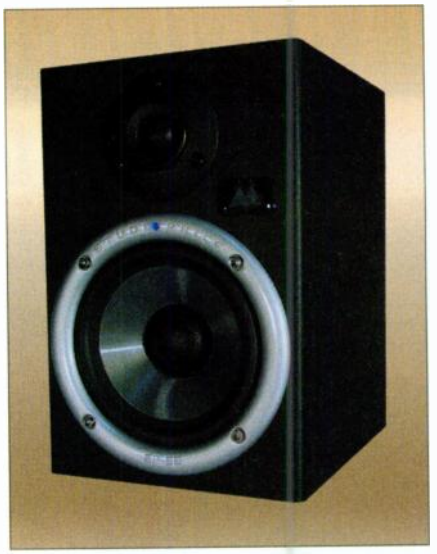
The swivelmounted, ¾-inch silk-dome tweeters let you adjust the sweet spot to accommodate different listening environments—a handy feature for a portable system. The speakers each have a 5.25-inch woofer with a crossover frequency of 2.7 kHz. The low-frequency amp delivers 42W of power, and the high-frequency amp puts out 33W.

A small but important item on my shopping list is headphones. I want a closed-ear model so I can minimize audio leakage from the headset, and Samson's CH700s fill the bill. The headphones feature 40 mm diaphragm drivers and a frequency response of 20 Hz to 20 kHz.

Microphones. I've made room for two microphones in my budget. The Shure SM57 is versatile enough for recording vocals, amplified guitar and bass, or rhythm sections. Furthermore, the D12 offers built-in mic modeling, and although I don't expect letter-perfect replications of vintage microphones, that feature is adequate for creating the variety of coloration that might normally be provided by a broader range of mic types.

My second mic is the AKG C 1000 S, a good multipurpose condenser mic. I love its sound for acoustic guitars, banjos, and mandolins—instruments that show up frequently in my music. The C 1000 S runs on either 48V phantom power or a 9V battery. Furthermore, the C 1000 S comes with a cap that fits over the capsule; you can use that to change the pattern from cardioid to a tighter hypercardioid pattern.

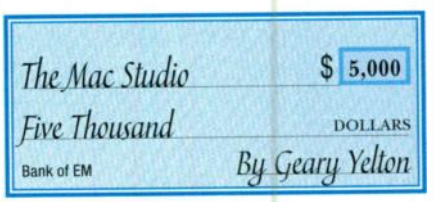
With my ceiling of $2,500, I was left with enough money to buy a couple of blank CDs and maybe a beer or two.



M-Audio's SP-5B monitors' swivelmounted tweeters let you adjust the sweet spot for different listening environments.

THE $2,500 PORTABLE DIGITAL STUDIO

ITEMS	PRICE
AKG C 1000 S condenser microphone	$312
Korg CDRW 1×8 CD-RW drive	$400
Korg D12 portable digital studio	$1,150
M-Audio SP-5B powered monitors (2)	$399
Samson CH700 headphones	$55
Shure SM57 dynamic microphone	$146
TOTAL	**$2,462**



A $5,000 budget is big enough to let me build a versatile Mac-based studio. Whether it's for synth-based

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work, recording vocals and acoustic instruments, designing sounds, or mixing down live recordings, the basic requirements are the same: a computer with lots of RAM, recording software, an audio interface, a mixer, effects and dynamics processors, microphones, headphones, and a pair of monitor speakers.

Of course, different goals might mean different purchasing priorities: more or better mics, additional software, and so on. I'm primarily a synthesist, so you're sure to find a synth in my studio, and I also want a MIDI interface for the computer. In addition, I don't want to play and sing all of the parts myself, so I need a system that lets me record other musicians.

Computer. The computer is the most crucial component in my studio, and selecting one is easy. I want a Mac with a fast processor, a fast data bus, a fast hard disk, and preferably some degree of portability. The PowerBook G4 is too expensive, and the Power Mac G4 is too bulky, but the new G4-based iMac is just right. It's much more powerful than the G3-based iBook, and at just over 21 pounds (including the display), the iMac is portable enough for location recording should the need arise.

Considering my budget, I chose the G4/700 MHz model with a combination CD-RW and DVD-ROM drive. (For $300 more, the 800 MHz model with a CD-RW/DVD-R SuperDrive would be better, but I'm making music, not movies.) With a round footprint that's less than 11 inches across, this year's iMac features a built-in 15-inch display that's brighter and sharper than most other LCDs, even when viewed at an angle. Two FireWire ports, three USB ports (and two more on the keyboard), an internal modem, Apple Pro speakers, a keyboard, and a mouse are standard equipment. The iMac ships with 256 MB of RAM, a 100 MHz system bus, and a 256 MB L2 cache running at the processor's speed.

In case I ever need a second display, the iMac's video card supports video mirroring. There's no room for hard-drive expansion bays, but by the time I outgrow the 40 GB Ultra ATA internal drive, I'll have saved enough to buy an external FireWire drive. In the meantime, I can record to the main drive and then burn my recordings to CD-R.

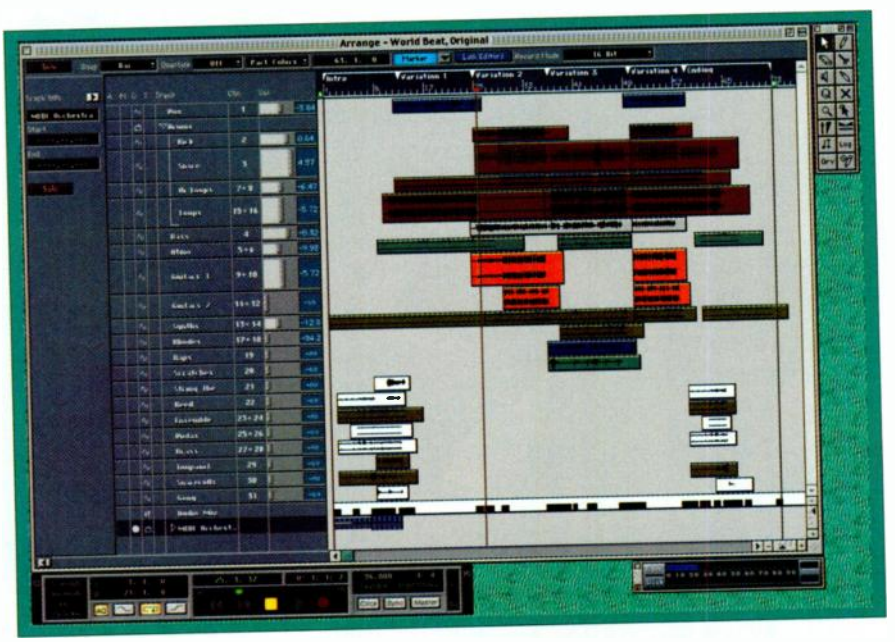
COURTESY OF APPLE

It resembles a cross between a desk lamp and a kitchen appliance, but the self-contained Apple iMac is a powerful and portable computer.

For the memory demands of music software and the Mac OS, the stock 256 MB of RAM just doesn't cut it. I need room to stretch out. At the moment, another 256 MB of Kingston RAM retails for $122, but generic RAM might do just as well. Because it's hard to quote a retail price for generic RAM, I'll allot enough for the Kingston RAM.

Audio interface. Selecting an audio interface and mixer took the most research. For a long time, I thought I would go with a combination USB audio interface and control surface, but USB's limited bandwidth and unpredictable polling interruptions led me to choose the FireWire-based Mark of the Unicorn (MOTU) 828. Featuring a pair of built-in mic preamps, eight balanced analog inputs, 8-channel Lightpipe, and stereo S/PDIF, the 828 has enough I/O to let me save money by getting by without a hardware mixer. I'll mix with the sequencer's virtual console.

MIDI interface. As noted, I'm going to buy a synth, and I also need to be prepared for anyone who brings a MIDI instrument into the studio, so I must have a MIDI interface. Money's tight, so I need the least expensive interface I can find—the MOTU FastLane-USB. Although it's the economy model, the



Steinberg's Cubase VST 5.1 supports both 16- and 24-bit audio and has the most complete support for VST plug-ins of any digital audio sequencer.

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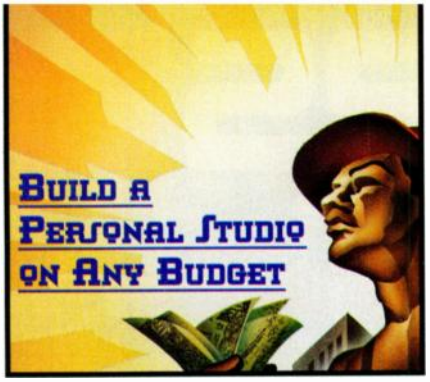


FastLane still provides two MIDI Ins and two MIDI Outs for 32-channel operation.

Speakers. Because I've already spent over a third of my budget on a computer and RAM, I have to economize. Accurate sound reproduction is critical to any recording studio, however, so I had to choose carefully. I settled on Event Electronics PS5s. The PS5 has a 5.25-inch polypropylene woofer driven by a 70W power amp and a 25 mm silk-dome tweeter driven by a 30W amp. Although the PS5 is the smallest bi-amplified monitor that Event makes, its stereo imaging is impressive, and its transparency and response are quite acceptable for use in a personal studio.

To overdub vocals and live instruments, I'm going to need headphones. For years I've loved and trusted Fostex T20s, so they're my first choice. They're not the most accurate headphones, but I like the way they sound, and they're lightweight and comfortable enough to wear for extended periods.

Microphones. Given my budget, two microphones immediately come to mind: the Audix OM-2 and the Shure SM57. Both are good, dependable dynamic mics for recording vocals, yet they're flexible enough for recording electric or acoustic guitars, drums, and most anything else that's likely to come around. At the very least, I want to be able to record in stereo. Call it a matter of personal taste, but I chose a pair of OM-2s.

Digital audio sequencer. For recording software, I cannot afford to go with the top of the line, but I want to ensure expandability. For anyone with any intention of working with synthesizers or samplers at some point, the best bet for recording software is to use a sequencer that records audio. I considered several digital audio sequencers in the $300 range, but their feature sets were a bit too stripped-down for serious recording.

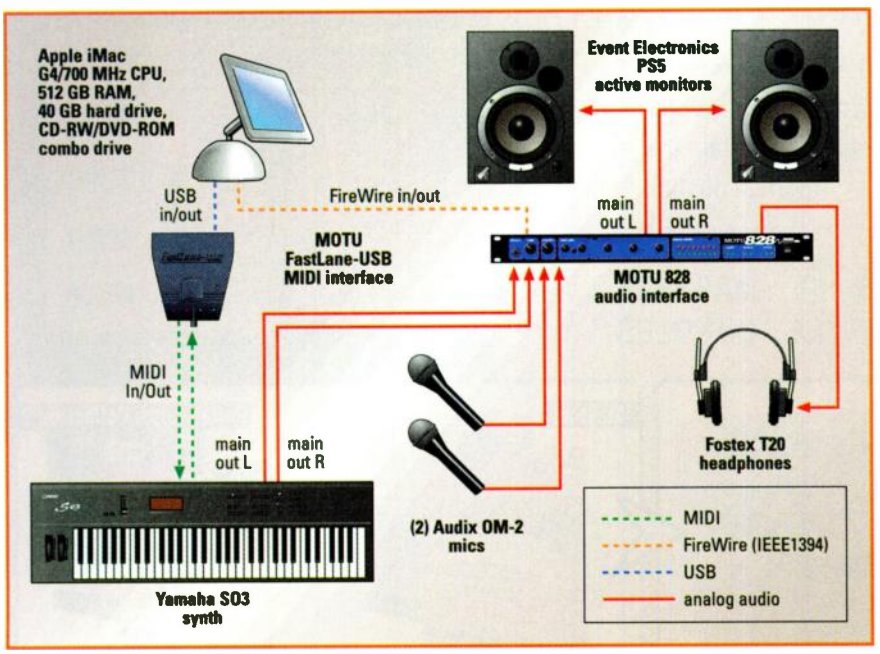
THE $5,000 MACINTOSH STUDIO

ITEMS	PRICE
Apple iMac G4/700 MHz with CD-RW/DVD-ROM combo drive	$1,599
Audix OM-2 microphones (2)	$298
Event Electronics PS5 active monitors (2)	$599
Fostex T20 headphones	$119
IK Multimedia SampleTank FREE	free
Kingston RAM (256 MB)	$122
Mda JX10, DX10, and ePiano plug-ins	free
MOTU 828 audio interface	$795
MOTU FastLane-USB MIDI interface	$79
Rumpelrausch Täips ZR-1 and ZR-3 virtual drawbar organs and Crazy Diamonds virtual string ensemble	free
Stefan Jeworowski's Vivaldi and Ganymed FM synths	free
Steinberg Cubase VST 5.1 digital audio sequencer	$450
Waves Renaissance Collection Native plug-ins	$300
Yamaha S03 synthesizer module	$630
TOTAL	**$4,991**

Stepping up to the $500 range, my choices are Steinberg Cubase VST and Emagic Logic Gold. It was a tough decision, but I picked Cubase VST 5.1. It supports both 16- and 24-bit audio and provides as many as 72 audio channels, which should be enough for almost any recording project. One of the main reasons I chose Cubase is that VST has the largest library of third-party plug-ins, and Cubase VST has the most complete VST plug-in support. Because third-party VST plug-ins are designed with Cubase in mind, you can usually count on automation and other features to work correctly. Even the basic version of Cubase VST includes plenty of effects and virtual-instrument plug-ins to get you started.

Plug-ins. Top-shelf reverb, compression, and equalization are essential. Even with my budget, I can afford the three good-quality Waves plug-ins bundled in Renaissance Collection Native 3.2. Like any good reverb plug-in, Renaissance Reverberator is certain to guzzle CPU cycles, but my 700 MHz iMac should easily handle several instances.

Freeware. Just because I'm on a budget doesn't mean I can't afford a virtual stockpile of MIDI instruments and effects. Two good Web sites for freeware



With $5,000 you can afford a flexible recording setup with all the basics: a fast iMac G4/700 MHz, a MOTU 828 FireWire interface, Event PS5 speakers, Audix and Shure mics, and software centered around Steinberg's Cubase VST 5.1.

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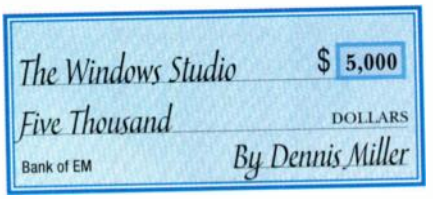
and shareware are www.krv-vst.com and www.sharewaremusicmachine.com. Both sites offer up-to-date descriptions of what's available as well as links for downloading.

I'm taking advantage of that to load up on free VST instruments, starting with IK Multimedia SampleTank FREE (www.sampletank.com), which is a fully functional version of SampleTank without the sound library; new content is available for free download every month. Three more free instrument plug-ins—JX10, DX10, and ePiano—are available from JX16-developer mda (www.mda-vst.com). I'm also downloading two free FM synths, Vivaldi and Ganymed, from German developer Stefan Jeworowski (http://mitglied.lycos.de/blueflameman). Yet another source is Rumpelrausch Täips (available at http://rumpelrausch.de.vu), which offers ZR-1 and ZR-3 virtual drawbar organs as well as Crazy Diamonds, a virtual string ensemble. I'll use them all.

Synthesizer. The Yamaha S03 really caught my ear at the 2000 Winter NAMM show. I was amazed by its excellent sound and versatility in combination with its bargain-basement price. The S03 is 64-note polyphonic and 16-part multitimbral, and its 61-note keyboard is Velocity- and Pressure-sensitive. It contains plenty of sampled waveform memory and more than 700 Voices, including the same fine piano (and many other sounds) as the upscale S30 and S80. Other features are GM and XG compatibility, 32 user-programmable Multis, 3 effects processors, and a CD-ROM that contains a computer program for graphically editing Voices, Multis, and drum kits.

Future expansion. Now that I have all the basics, what would I add when I have more money? That depends on what I plan to record. First of all, I'd probably buy Metric Halo Channel-Strip VST when it's available. More microphones would be another important addition, and if I want to record more than two tracks at a time, I'd need additional mic preamps. A few more software-based instruments, such as Native Instruments FM7 and Waldorf Attack, would be handy. Beyond those, I'd like a control surface such as the Steinberg Houston or the Midiman Surface One. Even without the additional gear, I have a recording system that will handle all of the jobs I want to do.

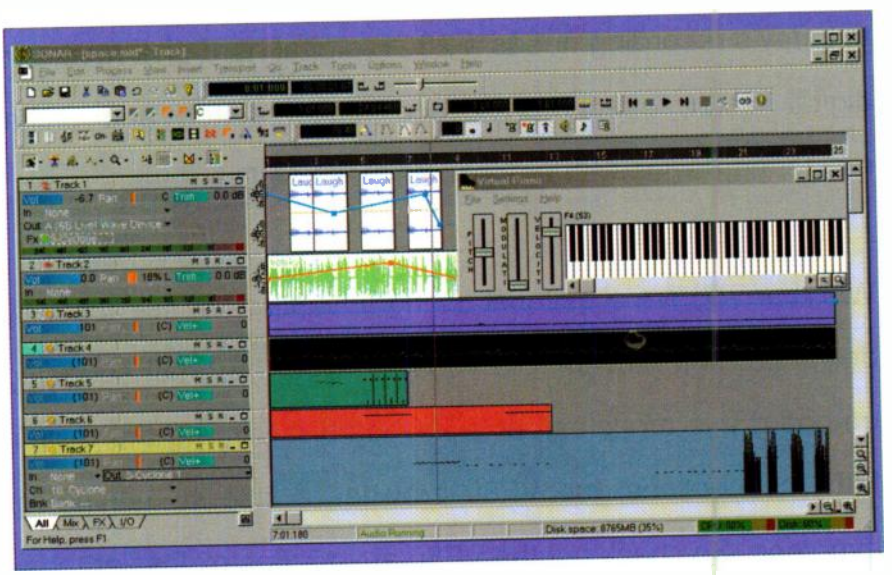


With a $5,000 budget, I'll design a Windows-based studio that will be useful for many music-production tasks. I'll have the right set of tools for creating compositions that combine MIDI and digital audio, working with loops, producing sound effects for any purpose, or composing computer-music pieces that include synthesized sounds and processed samples. I will be ready to write music to accompany a video, although I will have to do it the old-fashioned way—by manually syncing my sequencer to a video deck—and I'll be able to distribute my music on CD or directly onto the Web.

Computer. I'll start with the most important component: the computer. Today's PCs provide awesome performance at reasonable prices. I'm devoting half of my budget to the PC so that I won't be screaming for upgrades anytime soon.

Because I want to ensure that all my components are well matched, I'm not going to spring for the top-of-the-line processor (the Intel 2.4 GHz, as of this writing) and scrimp on other components. Instead, I'm going to go with a slightly less powerful CPU and then get the fastest RAM and hard drive I can afford so that neither memory nor storage will slow me down. I'll be running Windows XP, which is my preference based on its merits but also because it is the recommended OS for my audio interface (which I will discuss shortly).

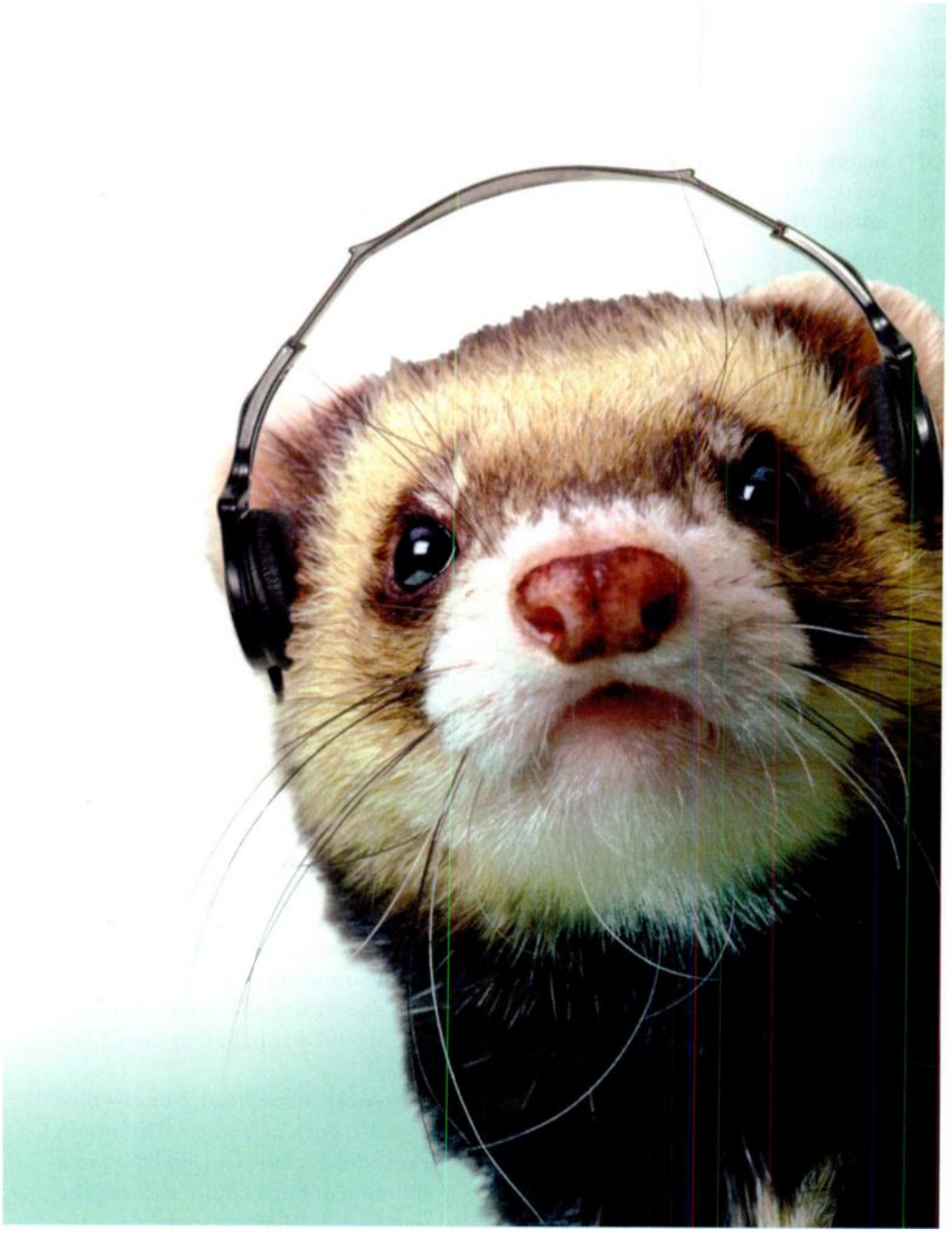
As I write this, Gateway is offering a package for $2,500 that includes a Pentium 4/2.0 GHz, 512 MB of RDRAM, an 80 GB 7200 rpm hard drive, a 21-inch CRT display, a 56 kbps modem, a 250 MB Iomega Zip drive, 3-year on-site service, a DVD-ROM/CD-RW drive, a 64 MB AGP



Cakewalk's Sonar 2.0 is a powerful Windows digital audio sequencer that includes music-production tools. In addition to its core audio and MIDI editing and recording features, it provides a groove sampler, a drum editor, and several soft synths. ReWire 2.0 support is also included.

The ferret is listening.

Feedback Ferret by Peavey



What's slim, quick and goes after feedback like...well, a ferret? The new Feedback Ferret from Peavey. It's a plug and play feedback eliminator that uses dynamic filter allocation to rapidly reduce feedback in your signal without killing its range. Unlike other devices out there, the Feedback Ferret has 16 actively roaming filters. When they detect feedback, they quickly respond with surgical precision, attacking only those troublesome frequencies. And because it continuously monitors the signal, when the source of feedback is gone, the filters drop off and resume roaming. So the full richness of your sound is restored. With four user presets, it's incredibly easy to set up. And it fits into just one rack space. The Feedback Ferret. It's fast, it's smart, and it fits into tight spaces. Just like a.... Well, you know.

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display adapter, a 10/100Base-T Ethernet adapter, and FireWire support.

When I buy, I'll be sure to choose a computer with at least two free PCI slots, and I'll try to get a system with one or two USB ports accessible from the front of the machine (a nice convenience). Any PC comes bundled with a Sound Blaster, which I will leave in for my General MIDI synth and MIDI I/O. I will describe my main audio workhorse later on.

A 21-inch CRT and a 17-inch LCD should run about the same money. I could opt for the superthin 17-inch LCD monitor if space is a problem, but the size will be somewhat limiting when I'm doing multitrack editing. LCDs are also not as good as CRTs for displaying video and animation. On the other hand, LCDs don't emit as much electromagnetic interference as CRTs, so they're better for playing an instrument with magnetic pickups while standing or sitting close to the computer monitor. An LCD would need to support digital connectivity (DVi), as would my graphics adapter.

Though I'll be buying from one of the biggest and best-known clone makers (Dell, Gateway, and the like) I also considered companies making dedicated PCs for the audio market. Those systems include components that work well under the demands of audio editing and also contain parts, such as quiet fans and hard-drive enclosures, that keep the PC's acoustic noise to a minimum.

Midiman's Oxygen 8 is a two-octave MIDI controller with eight programmable knobs and one programmable slider. The compact unit needs no external power source and can run off a computer's USB port or with batteries.

Audio interface. Now that I have the computer, I'll focus on the audio and MIDI interfaces. For starters, I need to upgrade from the Sound Blaster that came with my system. There are enough options here to make anyone's head swim, and I certainly couldn't guess exactly what configuration and number of channels any given reader will need.

I've used the LynxStudio LynxOne card in my main music machine for several years, and the company's newest card, the LynxTwo, appears to be a winner. For this studio, however, I'm going with the MOTU 828 audio interface because of its wide range of drivers (ASIO, GSIF, and WDM) and its FireWire connections. The 828 also gives me eight 24-bit analog inputs and eight 24-bit outs, a headphone out, and ADAT and S/PDIF (coaxial and optical) I/O for connecting to any other device I might get down the road. The two onboard mic preamps allow me to hook up my mic directly to the interface and mix everything on the PC, so I don't need to buy a hardware mixer.

I'm on a tight budget, so I'm going to take care in picking the rest of my components. I'll include some freeware in the software column, but before I deal with that, I'll get some external components out of the way.

MIDI keyboard controller/interface. Because I'm not set up for jamming and I am not concerned about playing elaborate keyboard parts, I'll use a 25-key Midiman Oxygen 8 as my primary MIDI keyboard. It is small enough to fit on the desktop, connects to my PC with USB, and requires no external power supply. It can also be used as an external MIDI interface and has enough programmable knobs and sliders to allow me to tweak my soft synths or audio-recording software.

Speakers. Everyone needs good monitors to ensure that they know exactly how their music will sound when it reaches the public. I'll keep the small speakers that came with my PC for testing mixes under less-than-ideal conditions, but I also need a good pair of speakers to hear what's really happening in the mix. I've chosen the new Fostex PM-1 two-way powered speakers with 6-inch woofers. They're clean and natural sounding, with lots of detail across the entire spectrum. Furthermore, at $499 per pair, they are a heck of a deal.

I also need some headphones—how else will I work at 2 a.m.? The open-back Audio-Technica ATH-M2Xs are a good choice, but I could also get the closed-back ATH-M3X headphones for only ten dollars more.

Mics. My studio is not intended for

THE $5,000 WINDOWS STUDIO

ITEMS	PRICE
Audio-Technica M2X headphones	$39
Cakewalk Sonar 2.0 digital audio sequencer	$479
DMI dmiFlute VST Instrument	free
Fostex PM-1 powered speakers (2)	$499
FXpansion VST-DX Adapter Standard	$60
IZotope Vinyl DirectX plug-in	free
MOTU 828 audio interface	$795
Midiman Oxygen 8 keyboard controller	$179
PC with Intel Pentium 4/2.0 GHz, 512 MB RDRAM, 80 GB 7200 rpm hard drive, DVD-ROM/CD-RW drive, FireWire/IEEE 1394 card, Sound Blaster Live Value sound card, 21-inch CRT monitor, Windows XP	$2,500
RgcAudio Triangle II DirectX 1.02 analog-synth plug-in	free
Shure SM57 microphones (2)	$292
Sonic Foundry Sound Forge XP Studio	$99
Tascam GigaStudio 32	$99
Tobybear Deconstructor VST plug-in	free
TOTAL	**$5,041**

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high-end recording—the $15,000 systems are better suited for that—but I want a mic for an occasional demo or for use as a mono sound source. The Shure SM57 is an old favorite that will definitely do the job. What the heck—I'll add a second SM57 so I can record acoustic sources in stereo.

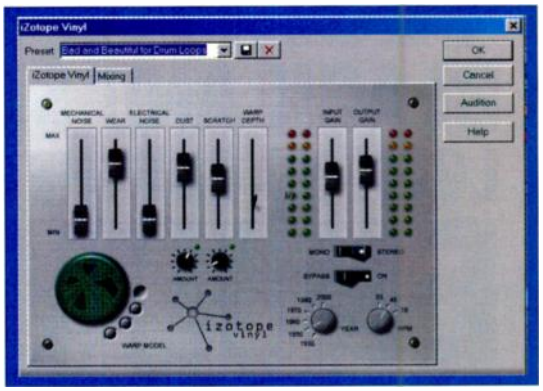
Digital audio sequencer. I've spent a big chunk of change and haven't even made the first step toward selecting software. However, with just under $1,000 remaining, I should have enough to get off to a good start. I'm going to focus on my main production platform, a digital audio sequencer, and skimp on the extras until I have more cash.

There are three main players in the Windows digital audio sequencer world, and all of them make beginner, intermediate, and professional programs. That's good news, because it lets me start with a low-end version and then work my way up the ladder through economical upgrades. Choosing among the three is very much a matter of personal taste. Do I want a deep program that allows me to create my own custom, complex audio routings? One that comes from a company that manufactures its own hardware, thereby ensuring rock-solid communication between the hardware and software? One that offers an ever-growing line of integrated virtual instruments? If so, then Emagic's Logic series would be the way to go.

But how about a program that raises the bar for audio support with each new release, has users all over the world making plug-ins in its native format, and includes some of the most unusual MIDI-data processing around? Steinberg's Cubase VST fits that description nicely.

Those are great options; in this case, I'll go with a third: Cakewalk's Sonar. Sonar has made enormous strides in the past few years, is certainly among the most popular of all desktop music programs, and is renowned for its ease of use and stability. Though you should certainly try out demos of each to see what fits you best, I'd recommend Sonar for most startup studios.

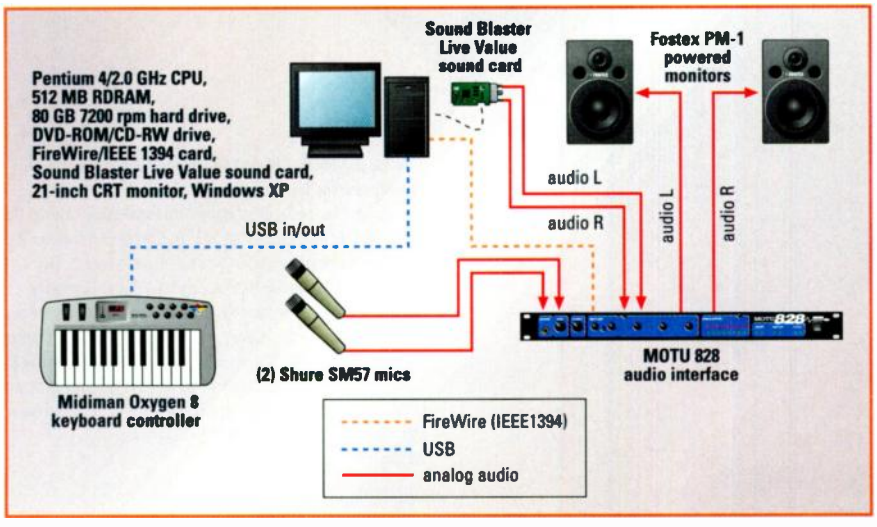
Sonar's cost will take almost half of my remaining budget, but it offers so many resources that I won't need to buy much more. Version 2.0, just released at the time of this writing, adds a groove sampler, more efficient project-management features, a dedicated drum editor, and ReWire 2.0 support. Combined with its excellent handling of multitrack audio and built-in soft synths, Sonar is the right program for my studio's musical needs.



IZotope's free Vinyl DirectX plug-in offers numerous ways to sonically impair your pristine audio tracks. Scratches, pops, clicks, and dust are yours, all at no charge!

Audio editor. I'll pick up a copy of Sonic Foundry's Sound Forge XP Studio for times when I really need a dedicated audio editor. XP also gives access to all the DirectX and VST plug-ins on my system.

Plug-ins. Even though Sonar includes a number of professional-quality effects, I'll pick up a copy of FXpansion's VST to DirectX Adapter Standard so I can take advantage of the numerous freeware and shareware VST plug-ins available on the Internet. To get a sense of what scale of resources this will provide, have a look at www.kvr-vst.com, one of the premier sites for VST goodies. That's the place to grab a copy of DMI's physically modeled flute, dmiFlute, which is capable of producing some wicked multiphonics, and Tobybear's Deconstructor VST, both of which are free. Also, check out Cakewalk's site for DirectX plug-ins, the DirectX Files (www.thedirectxfiles.com). For adding a lo-fi touch to your audio tracks, iZotope's freeware Vinyl is excellent. I will also download a free copy of rgcAudio's Triangle II, a two-oscillator "analog" modeling synth with



The basic Windows studio employs a Pentium 4–based PC. The outboard hardware includes Shure SM57 mics, Fostex PM-1 speakers, and a MOTU 828 audio interface. The real focus, though, is on software.

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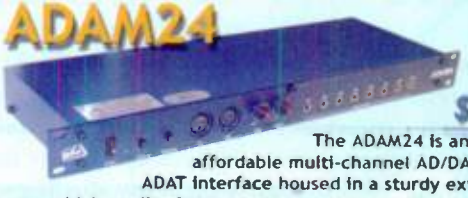
8 IN 8 OUT ADAT INTERFACE WITH MIC PREAMPS.



$299 Estimated street price

The ADAM24 is an extremely flexible and affordable multi-channel AD/DA converter featuring an ADAT interface housed in a sturdy external rack. The ADAM24 uses high quality 24bit AD/DA converters delivering uncompromising sound and with the ADAT interface it is extremely well suited for use in all kinds of studio setups.

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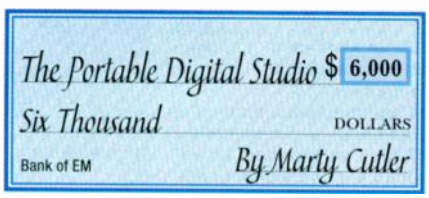
Soft sampler. Because I'm not buying a hardware sampler, I will add one of the most popular software samplers to my toolkit, Tascam's GigaStudio 32. GigaStudio integrates nicely with Sonar (always launch GigaStudio first and then run Sonar from inside it) and allows me to use the numerous Giga-format sound libraries to enhance productions. As a "lighter" tool for sampling, I would also consider Maz's VSampler DXi for only $50 and end up with a few bucks to spare. Vsampler doesn't have GigaStudio's clean and elegant interface, but it is an excellent bargain.

Future expansion. I'd expand by adding many key components of my $15,000 Windows studio (described later), especially on the software side. But for now, I have enough tools to get myself squarely in the music game, so I will go forth and make sound!



My $6,000 studio will be a personal creative tool rather than a studio for commercial use. I want a deep but direct way to combine synthesis with acoustic instruments, so I'm going to build the studio in part around a sampling synthesizer, with as much communication as possible between synth and recording unit.

Portable digital studio. As I strolled out of the bank with my newfound funny money, I contemplated the merits of the Roland VS-2480, the Akai DPS24, and the Yamaha AW4416. Those well-equipped power tools offer features and expandability galore, but sadly, the price tags of my first picks would leave little headroom for a decent synthesizer and the rest.

On the other hand, Roland's VS-1824 and the Yamaha AW2816 sound great, they offer enough simultaneous recording and playback tracks, and they provide automated mixing. The Roland unit provides two more tracks than the AW2816, but ultimately, I opted for the Yamaha unit's superior expansion capabilities and the remarkable synergies that it opens up with my synth workstation.

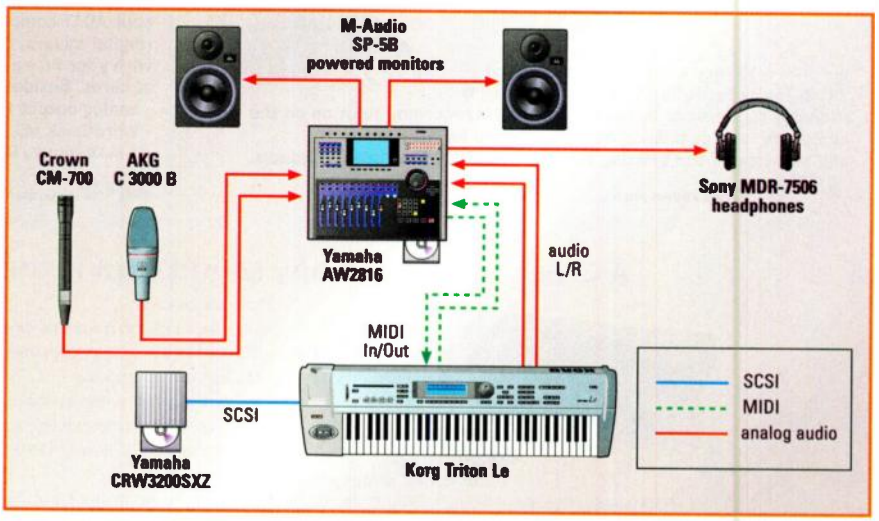
THE $6,000 PORTABLE DIGITAL STUDIO

ITEMS	PRICE
AKG C 3000 B large-diaphragm condenser microphone	$520
Crown CM-700 small-diaphragm condenser microphone	$290
Korg EXB-SMPL sampling option	$260
Korg Triton Le keyboard workstation	$1,600
M-Audio SP-5B powered monitors	$400
Sony MDR-7506 headphones	$125
Yamaha AW2816 portable digital studio	$2,400
Yamaha CRW3200SXZ external SCSI CD-RW	$349
TOTAL	**$5,944**

The Yamaha AW2816 can record simultaneously to 8 tracks and can play back up to 16 tracks. Recording is at 24- or 16-bit resolution, with sampling rates of 48 or 44.1 kHz. Internal processing is 32 bit. The mixer offers 28 channels with 4-band parametric EQ for each channel. The unit writes to a 20 GB hard drive but can address drives with capacities as large as 64 GB. The drive sits in a convenient bay, allowing you to swap drives with ease.

You get a generous complement of inputs, although I would have appreciated four XLR mic inputs instead of two because I want to record multiple acoustic instrument and vocal tracks simultaneously. Fortunately, there are eight balanced ¼-inch input jacks, and I can always get an external mic preamp or two when the occasion arises. The two XLR-input channels provide defeatable 48V phantom power and ¼-inch TRS insert jacks, which will come in handy when I can afford to add external processing. A dedicated ¼-inch high-impedance input lets me plug an electric guitar or bass in to the unit without requiring a direct box or amp.

In addition to left and right RCA mix outputs, the AW2816 sports balanced ¼-inch monitor outs. Four unbalanced ¼-inch Omni outs can serve as effects sends, direct outputs, bus outs, or duplicate stereo outs.



The Yamaha AW2816 and Korg Triton Le make a great combination, integrating MIDI sequencing, sampling, tracking, mixdown, and automation. The two can exchange WAV files, and the AW2816 can control synthesizer parameters in real time.

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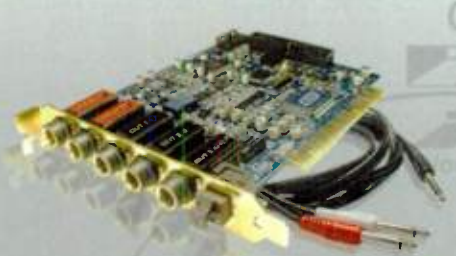

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The effects section delivers excellent-sounding mono-in, stereo-out effects and includes libraries of patches that draw from reverb, chorus, delay, distortion, filters, and more. Some effects offer MIDI parameter control, such as MIDI Velocity for shaping frequency cutoff on a filter. You can assign an effect as an insert or send it to an auxiliary bus or a return channel.

It's nice to know that the AW2816 features motorized faders for dynamic mixing; if my project is not MIDI-driven, I can create automated mixes without a computer or my synth's onboard sequencer. In addition, the 2816 transmits MIDI CCs for fader moves and the like. That provides serious synergy with my keyboard workstation, allowing me to create and use templates to automate synthesizer parameters. Once I have mixed a project, I can burn masters to the built-in CD-RW drive, back up song data, import or export WAV files, or import Red Book audio.

In order to communicate better with the external world, the AW2816 offers a slot for its proprietary YGDAI cards, which add an 8-channel ADAT or TDIF interface, eight additional ¼-inch analog inputs, 8-channel Apogee A/D/A, or the formidable Waves Y56K DSP card. I can't afford any of these now, but it's good to know they're available.

Keyboard workstation. I am not a skilled keyboardist, and my budget doesn't allow for a computer, peripherals, and sequencing software. My keyboard is therefore going to need an onboard sequencer with a decent set of editing tools.

I didn't have to think twice. Korg's Triton Le features the same 62-note polyphonic synthesis engine, 32 MB sound set, and 16-track sequencer as the Triton. The main compromises (for my purposes) are the Le's single insert effect, compared with the Triton's complement of three, and the lack of sampling features for the base unit. Most importantly, I love the Triton's sound set, and its strong synthesis features provide the sound-shaping abilities I need. I'd like to spring for the 76-key version of the Le, but the additional $200 hit isn't worthwhile for me.

The Le workstation's 192 ppqn sequencer can record a hefty 200,000 events and 200 songs. Coupled with the unit's linear sequencing capabilities, that gives me plenty of room to sequence a song from start to finish without the need to divide the material into smaller, repetitive chunks. Still, linking smaller patterns lets you reorganize verses, choruses, and bridges more easily, and the Triton Le's Cue List feature allows me to quickly compile songs from individual sequence patterns. The sequencer even has separate tempo and time-signature tracks.

Sampling board and CD-RW. I'm going to invest $260 of my hard-earned play money on the Korg EXB-SMPL sampling option. The board ships with 16 MB of RAM, and that will have to do for now. It also has a SCSI port, which can address a CD-RW drive.

Yamaha's AW2816 offers 16 tracks of 24-bit, 48 kHz audio and provides a number of options for analog and digital I/O.

SCSI CD-RW drives are a vanishing breed in this day of FireWire and USB, but I found a Yamaha CRW3200SXZ external unit that will fit the bill. With its fast read and write speeds, the CD-RW is overqualified for the job, but slower units are rapidly vanishing from the marketplace. Besides, the price is right.

Apart from its ability to add new waveforms to the sound set, the combination of the CD-RW drive and the EXB-SMPL sampling board offers some exciting creative options. For example, it's easy to shunt WAV files between the Triton Le and the AW2816. That means that I can record full-length tracks on the recorder, burn a WAV-file CD, import the files into the Triton Le, use the synth's time-slicing feature, and map parts to MIDI keys. Once the sounds are keymapped, I can sequence the sampled parts and record the Triton Le's considerable real-time synthesis and effects processing into the sequencer.

The AW2816's ability to import Red Book audio lets me take advantage of a wealth of sound libraries in that format. The Triton can read Akai-format sample libraries, which I can then save as WAV files to bring into the Yamaha recorder if I want to.

Speakers. Because portability is one

With the optional sampling board, Korg's Triton Le keyboard workstation can load WAV files from CD, process them through the synth engine, and assign sections of the new samples to keys.

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of my goals, I chose a set of active monitors. I was tempted by editorial compadre Gino Robair's evaluation of the Event PS5 (see "Little Wonders" in the July 2000 issue of **EM**), but after comparing feature for feature and spec for spec, I decided to go with the M-Audio SP-5B. It offers broader frequency response; clear, powerful bass; and swivel-mounted tweeters that let you adjust the sweet spot.

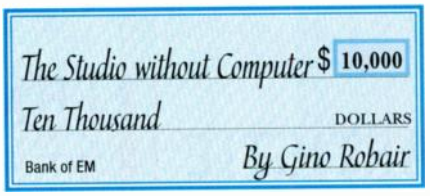
For headphones, I decided on Sony's MDR-7506s. They're extremely comfortable closed-ear cans with a frequency response of 20 Hz to 20 kHz. I've used them in lots of studios, so I'm happy to add them to mine.

Microphones. With a decent amount of cash left over, I am able afford to buy an AKG C 3000 B, a versatile large-diaphragm condenser mic that provides a smoother, more detailed high end than the AKG C 1000 S and a beefier bottom than the original C 3000.

I chose the Crown CM-700 as my second mic. It's a small-diaphragm condenser with a warm sound, a versatile list of applications ranging from percussion to stringed instruments, and a low-cut filter for cleaning up a goopy bottom end. This is another mic I've recorded banjo with, and I like it a lot.

Future expansion. I would have liked a bit more cash for a MIDI guitar controller, such as the Axon AX100, but I couldn't get Steve O to spring for the extra dough, even when I held my breath. In the future, I'd like to add a second C 3000 B mic for stereo recording, a few sample libraries for the Triton Le, and an uninterruptible power supply to protect my digital electronics.

As it is, I have a versatile studio built around a portable digital studio and synth workstation that will greatly enhance my imaginative possibilities. The key was to carefully examine the features and consider how interactions between two well-implemented yet cost-effective components can provide an enormous creative springboard for my work.



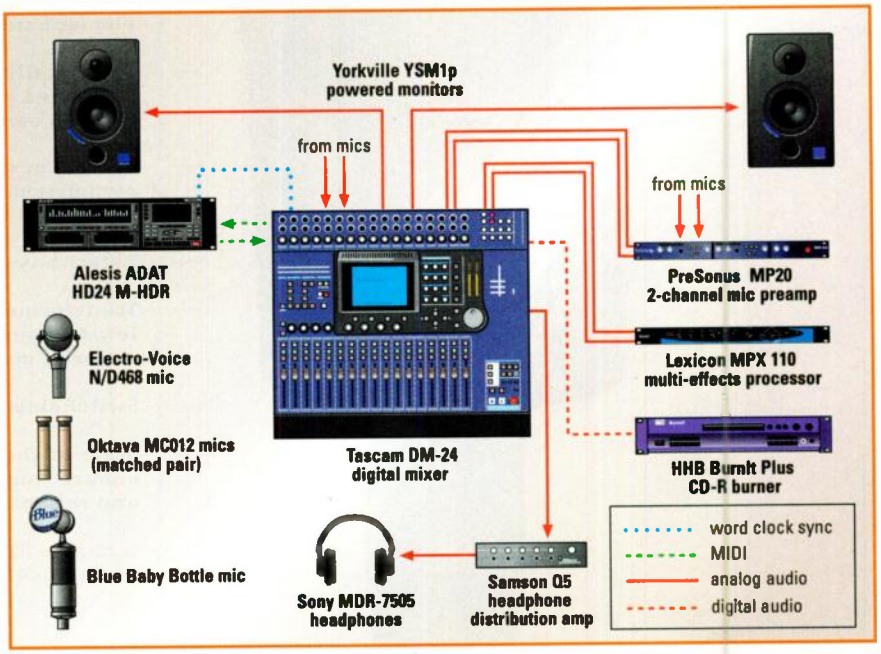
My needs are simple: I want the ability to record a small group of musicians while monitoring and mixing in stereo. Given my budget, the trick is to get more than you pay for. Fortunately for me, quality gear continues to drop in price, and for that reason, there has never been a better time to build a personal studio on a limited budget.

As I assembled this studio, I kept reminding myself that a studio is a work in progress: there are so many items I want but don't have the money for. A number of items ended up on my wish list for a time when my bank account is flush again. In the meantime, let's go shopping!

Mixer. My budget doesn't allow me to buy a full complement of the outboard processors I'd like, such as compressors, EQs, gates, and mic preamps, so I chose a digital mixer with onboard effects. The Tascam DM-24 is a 32-channel, 8-bus board that can handle 24-bit, 96 kHz audio right out of the box (although running the DM-24 at 96 kHz reduces the channel count to 16). It has the connections I need, too: 16 analog inputs, 6 aux sends, 4 sends and returns, 24 channels of TDIF I/O, 8 channels of ADAT Lightpipe I/O, and 2 channels of both AES/EBU and S/PDIF I/O.

I'm filling one of the open interface slots with an IF-AD/DM 8-channel ADAT Lightpipe I/O card so that I have digital interfacing that matches my multitrack hard-disk recorder (which I will discuss in a minute). I really want to buy two of these cards, but my budget doesn't allow it, so I will buy one now and save my money to buy another one later. Tascam also offers the MU-24 meter bridge; it would be useful, and I would like to buy it, but I can't afford that right now, either.

Each of the DM-24's analog input channels offers phantom-powered XLR mic inputs (switchable in groups of four), TRS line inputs, and inserts. In the digital realm, I can assign a compressor, a gate/expander, and a parametric EQ to each input. The onboard



This $10,000 studio is compact yet powerful, combining a 24-channel M-HDR, a 32-channel digital mixer, an outboard preamp and multi-effects unit, and a CD-R burner.

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effects also include Antares mic and speaker modeling, TC Works reverb, and assorted effects from Tascam. Together, this complement of inputs and processing should cover most of my needs for the time being.

I can use the mixer's onboard automation to adjust fader levels, panning, muting, aux and bus master levels, and compression, EQ, and gate settings. The 17 motorized faders have a comfortable 100 mm range.

The mixer sends word clock, so the DM-24 can act as the master clock and make sure the digital words are synced between mixer and recorder. The DM-24 requires MTC for automation duties, so I'll choose a recorder that sends MTC. The DM-24 can send and receive MIDI and send MMC. Overall, it should give me a fair amount of flexibility.

Recorder. The heart of my studio will be the Alesis ADAT HD24, a 24-track hard-disk recording system that sounds excellent and is as intuitive to use as a tape machine. The recorder has 24 channels of balanced ¼-inch analog I/O as well as 24 channels of Lightpipe digital I/O. The two combined give me plenty of options for interfacing with my DM-24 mixer.

The Tascam DM-24 mixer has 16 analog inputs, motorized faders, a flexible routing system, and effects by Antares and TC Works.

The ADAT HD24's 24-bit converters run at 44.1 and 48 kHz, but the unit can also record and play back at 88.2 and 96 kHz using external A/D/A converters and the Lightpipe I/O; however, that reduces the track count to 12. Alesis is also developing the EC-2 optional 96 kHz I/O board. With the HD24 and DM-24, then, I'll be able to record at high resolution when I'm ready to, and in the meantime, I can record 24 channels simultaneously at 44.1 and 48 kHz, which is exactly what I want.

The ADAT HD24 has a word-clock input and MIDI In and Out and sends MTC, so I can sync to the DM-24 and use its automation. I'll place the HD24's LRC remote controller next to the mixer.

The recorder's storage configuration is another great feature: the ADAT HD24 includes two IDE drive bays with removable caddies that allow me to hot-swap hard drives during a session. A 20 GB drive comes with the recorder, and any IDE-compatible drive with a spindle speed of 5,400 rpm or greater can be used in either bay. (For a review of the Alesis ADAT HD24, see p. 138.)

Speakers. Whether or not my studio has a separate control room, I'm going to need close-field monitors. I'm choosing the Yorkville YSM1p, a bi-amped, active monitor that is an excellent value. The YSM1p is small and relatively light, and it offers a balanced frequency range, free of EQ hype. That's what I want from a pair of monitors intended for critical listening. The 6.5-inch woofer and 1-inch tweeter are both shielded and are driven by 115W and 30W power amps, respectively. A 2-inch port adds to the monitor's bass response.

The YSM1p includes filters to help tailor the monitor to its location in your control room. The low-frequency filter lets you boost or cut the response at 80 Hz by 2 dB. Other filtering variables include what Yorkville calls HF Reflection Optimization, with settings for a dampened room, a normal room, and a bright room. The filters are set using rear-panel DIP switches. The YSM1p also includes an input trim pot ranging from –6 to +9 dB, a limiter switch, and a Neutrik combo connector that offers XLR and ¼-inch TRS input.

While I'm on the subject of transducers, I'll need headphones for my studio. Because most musicians already have headphones, I'm budgeting for only one pair: the tried and true Sony MDR-7505s. Although I can't buy them now, I also plan to save up for a pair of open-ear Grado Prestige Series SR125 headphones for critical listening. The

THE $10,000 STUDIO
WITHOUT COMPUTER

ITEMS	PRICE
Alesis ADAT HD24 modular hard-disk recorder	$2,495
Blue Baby Bottle microphone	$649
Electro-Voice N/D468 microphone	$278
HHB BurnIt Plus CD-R burner	$649
Lexicon MPX 110 multi-effects processor	$329
Oktava MC012 mics (matched pair)	$659
PreSonus MP20 2-channel mic preamp	$699
Samson Q5 headphone distribution amp	$199
Sony MDR-7505 headphones	$135
Tascam DM-24 digital mixer	$2,999
Tascam IF-AD/DM ADAT card	$249
Yorkville YSM1p powered monitors (2)	$640
TOTAL	**$9,980**

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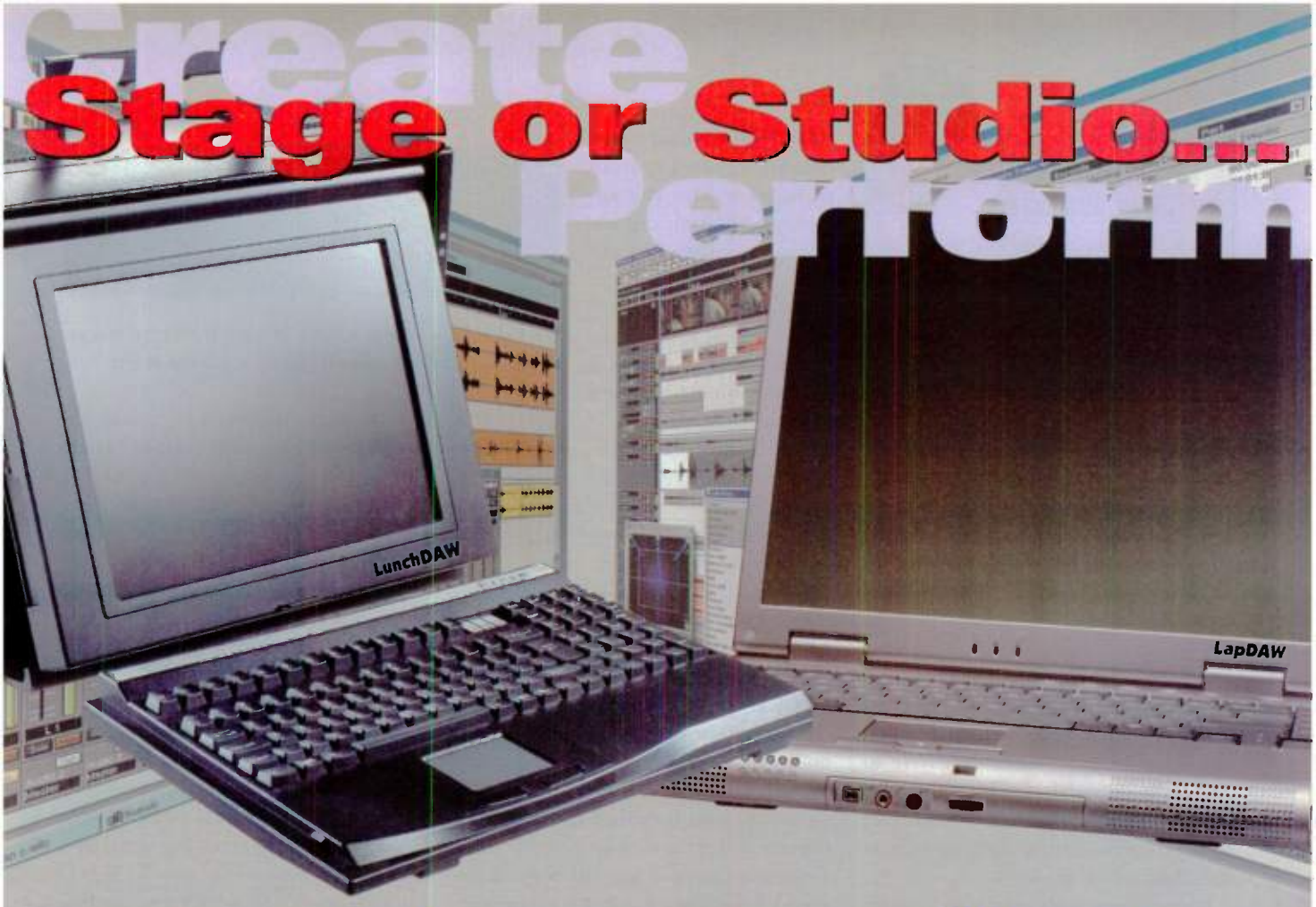

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For times when I have more than one musician recording simultaneously, I'll need a headphone distribution amp. The Samson Q5 is small and rugged and comes with five outputs, each with its own volume control. This is especially helpful when you're overdubbing string, brass, or wind instruments, because the players have different listening requirements based on the size and position of their instruments. Although five outputs may seem excessive at first, remember that you might want an extra set of cans for the conductor or producer—during a string-quartet overdub, for example.

Microphones. Choosing mics is always tough because there are so many good options. I want to be able to track anything that comes through the door—vocals, guitar, bass, keyboards, drums, and various acoustic instruments—so I need a handful of multipurpose mics that are quiet, can handle high sound-pressure levels (SPLs), and won't wipe me out financially. I'm choosing four mics that will also give me adequate coverage for a drum kit: a dynamic mic that can double on snare, a large-diaphragm condenser that will cover voice and bass drum duties, and a matched pair of small-diaphragm condensers for drum overheads and acoustic guitar.

I've chosen the diminutive, supercardioid Electro-Voice N/D468 as my dynamic mic. The nice high-end definition and beefy lower mids of the N/D468 give me an evenly balanced snare sound right away, and the adjustable, rotating capsule lets me aim the mic right where I want it. Because of its low profile, it also makes a great tom mic, so I'm planning to augment my mic cabinet with more of these in the future.

The Alesis ADAT HD24 is a 24-bit, 24-track M-HDR that lets you record all 24 channels simultaneously at 44.1 and 48 kHz.

Next up is a large-diaphragm condenser, and that was an easy choice: Blue's latest release, the Baby Bottle, is possibly the best large-diaphragm condenser in its price range. This single-pattern (cardioid), solid-state wonder features a 1-inch capsule and a Class A, transformerless output circuit with self-noise that rates at an impressively low 5.5 dB. The Baby Bottle has no pad, no filter, and best of all, no EQ circuitry. What you get is a transparent, high-output transducer that's quiet but can handle high SPLs. It sounds great on voice, electric and acoustic guitar, and bass drum—exactly what I need. Eventually, I'll spring for the optional shockmount/pop filter accessory package in order to get the most out of the Baby Bottle. (For a full review, see the June 2002 issue of **EM**.)

A matched pair of mics can't be beat for those occasions when I want to record an instrument in stereo. The best value I found is the Russian-made Oktava MC012. Each mic comes with three interchangeable capsules (cardioid, hypercardioid, and omnidirectional) and an insertable 10 dB pad. Whether you use it individually or in a stereo pair, the MC012 is a bread-and-butter mic that sounds great on piano, acoustic guitar, percussion, and voice. Oktava microphones are available in the United States exclusively from the Sound Room (www.sound-room.com). Although you may be able to find these mics for less money elsewhere, it's worth getting a pair that's been professionally matched.

The HHB CDR830 BurnIt Plus has professional-level I/O to match its pro features.

Mic preamp. This is another tough category for a studio on a tight budget. Although my mixer has 16 mic inputs, I want at least two channels of Class A preamplification for recording critical tracks. If I can get a direct-injection (DI) box or two in the deal, that's even better. This sounds like a job for the PreSonus MP20. The MP20 offers two discrete Class A mic preamps, each with phantom power, a 20 dB pad, an 80 Hz rolloff, phase reverse, and PreSonus's IDSS circuit, which can be used to add harmonic distortion for simulating so-called vintage warmth. In addition, each channel has a front-panel ¼-inch, low-impedance input for use with electric guitars and basses. The rear panel has XLR I/O and individual ¼-inch TRS send and return jacks for inserting a compressor, a limiter, or EQ.

I've used the MP20 in the studio and in the field, and it performed admirably in both settings. The unit is clean and rugged, and the musicians I've recorded have always liked their sound through this preamp. I can never have too many preamp choices, so when my budget allows, I'm going to spring for a Grace Design Model 101, an exceptionally clean single-channel preamp, and for the Summit Audio TD-100 Tube DI and instrument preamp for those times when I want a little more color.

Dynamics processors. High on my wish list is an outboard dynamics processor, one I can use for tracking drums, bass, and guitar and can put on the stereo bus during a mix. The FMR Audio Really Nice Compressor will give me the most crush for my cash when I can afford it. The RNC offers two modes: Normal and SuperNice. The latter gives you the effect of three compressors in series, yielding gentle, transparent compression. The RNC's Normal setting has all the punchiness

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8 analog ins, 8 analog outs, word clock, lightpipe...it's just that simple

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needed to beef up guitars, drums, or an entire mix. For the price, the RNC can't be beat, which is one of the reasons it's so popular in both personal and pro studios.

Effects processors. Although the DM-24 offers most of the effects I'll need, I want a dedicated 2-channel outboard reverb. The budget-priced Lexicon MPX 110 is a 24-bit effects processor with 240 presets, including a stereo reverb, a flanger, a tremolo, a delay, and an echo, all of which are excellent. The high-quality sound is accompanied by a flexible routing scheme that lets you combine two independent effects with separate processing on the left and right channels. The unit has a coaxial S/PDIF output that can be used simultaneously with the analog outputs. The MPX 110 also has MIDI I/O, which is great for remote control and for editing hidden parameters.

Mixdown deck. I've been a loyal DAT user for longer than I care to admit, because the format is both ubiquitous and reliable. My loyalties changed, however, when I began using HHB's CDR830 BurnIt CD-R deck. The BurnIt is as easy to use as a tape deck and includes many features you wouldn't expect in this price range; for example, the device has front-panel level controls for the analog *and* digital inputs. The digital input offers ±20 dB of control, which is useful when archiving low-level digital recordings. In addition, the BurnIt automatically converts incoming digital signals at 32 or 48 kHz to 44.1 kHz. If you're going in and out from the analog domain, the converters sound great.

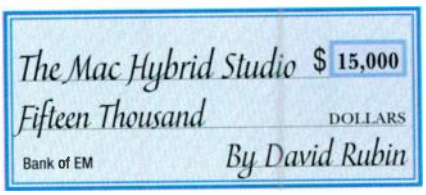
Other features make this item stand out: the BurnIt can create CD Text discs, and it can store text for three separate unfinalized CD-Rs. In Sync-Final mode, the BurnIt begins recording when the source deck begins playing, transfers all ID marks, and automatically finalizes the disc when finished. I've used this feature numerous times to back up digital source material, such as DATs and MiniDiscs.

The BurnIt has RCA jacks for analog I/O operating at –10 dBu, and optical and coaxial jacks for S/PDIF digital I/O. However, HHB has just released the BurnIt Plus, which adds pro-level I/O to match the professional interface. The BurnIt Plus adds balanced XLR analog inputs and outputs that operate at +4 dBu, balanced S/PDIF digital I/O (on XLR3 connectors), word-clock input, and a parallel-remote connector. I use the BurnIt on a daily basis already, so it's a no-brainer for the studio of my dreams. The added I/O closes the deal for me, so I'll splurge for the BurnIt Plus.

At this point, I can make a little extra scratch by offering remote stereo-recording services using a tidy setup culled from my list: a pair of MC012s going into the PreSonus MP20 preamp, with the HHB CDR830 BurnIt Plus as the recorder and the Sony MDR-7505 headphones for monitoring.

Future expansion. I've already noted several items that I'll add later, when I have more money: a second Tascam IF-AD/DM 8-channel ADAT Lightpipe I/O card and a Tascam MU-24 meter bridge for the DM-24 mixer, Alesis's optional 96 kHz I/O board for the ADAT HD24, the optional shockmount/pop filter accessory package for the Baby Bottle mic, more Electro-Voice N/D468 mics, the Grace Design Model 101 and Summit Audio TD-100 preamps, and the Grado Prestige Series SR125 headphones. In addition, I'm saving up to buy a $55 pair of Kiwi mic cables from Blue, which will help me get the most out of my microphones; I came in $20 under budget, so I'm already almost halfway there.

Finally, an analog patch bay is an important ingredient in a studio, even if you have only a couple of outboard devices. Unfortunately, I am unable to afford one right now, but when my budget permits, I will buy the Ace Products APB48S, a 48-point audio patch bay with ¼-inch TRS I/O. The APB48S has modular PCB cards that let you change the routing configuration of each vertical channel from half-normaled to denormaled (and vice versa) by simply turning the card around. This modularity allows me to configure my studio exactly the way I want to.



My main goal in designing this high-end Mac-based studio is to create a music-production system that is versatile enough to tackle almost any assignment, expandable enough to adapt to new situations, and powerful enough to deliver professional-level results. I want to be able to record mono or stereo live tracks, edit and process audio for CDs and sound designing, and create multitrack audio and MIDI sequences. Film scoring is a major consideration for my studio, so the system must also be capable of synchronizing to picture.

As many musicians will attest, the Mac

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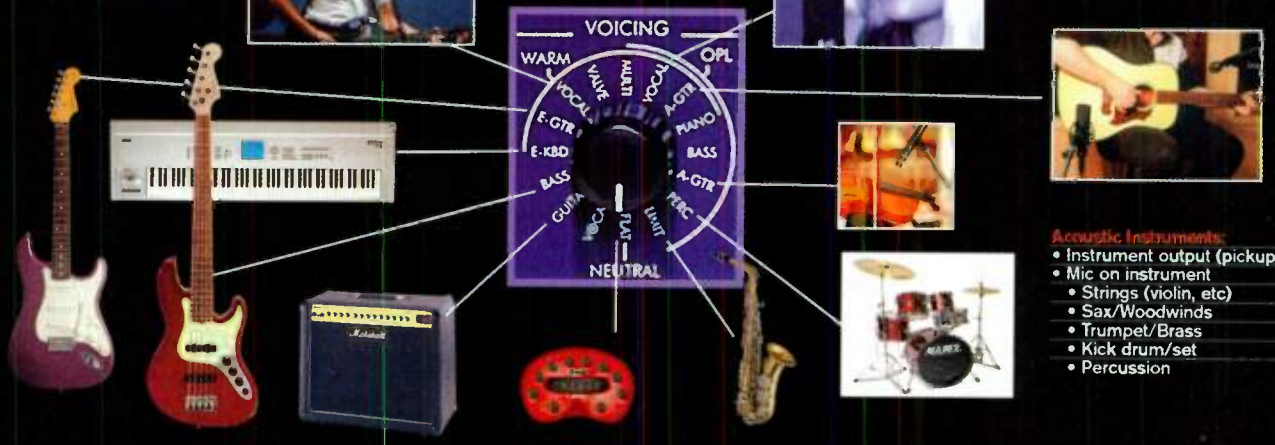

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makes an excellent front end for a desktop music system, and the new Macs are impressively powerful. On the other hand, Tascam's GigaStudio 160 software sampler is available only for Windows, and its intuitive user interface, its ability to handle gargantuan loop-free samples, and the huge variety of high-end sample libraries available for it make it a must-have for me. I'm not going to give up my Mac, though. Instead, I'm going to create a hybrid studio in which a Mac serves as the primary computer, and a PC functions as a dedicated sampler running GigaStudio.

This setup offers the best of both worlds and provides unparalleled flexibility for future expansion. It also centers my studio on a sampler whose capabilities far exceed any hardware sampler on the market. Of course, including two complete computers within my budget means I'll have to sacrifice elsewhere, but I'm willing to make those sacrifices in exchange for a system that delivers top-notch audio quality while remaining fast and user-friendly.

Primary computer. In this studio, the Mac runs the show, so it must be as powerful as possible. The top-of-the-line Power Mac boasts a dual 1 GHz G4 processor with 512 MB of RAM and support for up to 1.5 GB. The standard configuration includes the new SuperDrive, which reads and writes to CD-R, CD-RW, and DVD-R—plenty of options for multimedia authoring, audio archiving, and CD mastering.

The Mac includes an 80 GB Ultra ATA hard drive, but I'm choosing the optional configuration with a second 80 GB drive. That lets me keep the system software and applications on one drive and reserves the other drive for recording. The Mac's four built-in USB and two FireWire ports are adequate for now, and adding more ports with a PCI card or a hub is a snap.

Secondary computer. The main purpose of the secondary computer is to serve as a super-duper sampler with multichannel digital outputs. This PC sampler provides me with most of my instrumental sounds. To deftly manage the significant processing load and avoid rapid obsolescence, I am selecting one of the high-end Pentium 4 CPUs.

Although there are plenty of fine PC manufacturers, such as Gateway and Dell, most general-purpose PCs come loaded with garbage I don't want and options I don't need. Carillon Audio Systems, on the other hand, offers several models of Windows-based computers that are specifically designed and configured for studio use. The Carillon computers are rackmountable and employ a special fan with a radial-fin heat sink, offering much quieter operation than the usual desktop PCs. That's an important consideration if you don't have a way to acoustically isolate the computer from the studio area. Moreover, the Carillon computers are streamlined and optimized for specific hardware and software combinations.

Carillon's UltraSampler 160 model (which includes Sonic Foundry Sound Forge XP as well as GigaStudio 160) is ideally suited to my studio. The standard system is based on a Pentium 4/1.7 GHz with 512 MB of 400 MHz of RDRAM. I'm upgrading the basic setup by choosing a 40 GB, 7,200 rpm ATA hard drive for the system software and applications and an 80 GB drive for storing my sample libraries. I'm using Windows XP for my operating system because, among other things, it allows me to address quite a bit more RAM for future expansion. (With the release of version 2.5, GigaStudio 160 supports Windows XP.)

The standard UltraSampler 160 includes an M-Audio Delta 1010 audio interface, which is a fine system with excellent specs and drivers. For this system, however, I'm substituting a Frontier Dakota card. It combines a 2-In/2-Out MIDI interface, stereo coaxial S/PDIF I/O, and dual ADAT Lightpipe I/O, which is especially important for this system. (I'll explain why shortly.)

Video monitors. As part of my upgrade of the Carillon UltraSampler 160 package, I'm replacing the single CRT display with a matched set of 17-inch ViewSonic VE-170mb LCD monitors, which I'm sharing with the Mac. Having

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a matched set of monitors is important so that your line of sight and the cursor path stay consistent as you move between displays. I'm also substituting the Matrox G550 dual-output video card for the standard ATI Rage card.

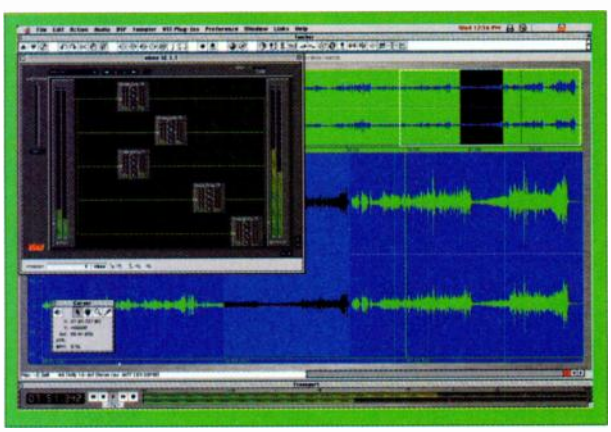
At this point in my setup, I have a Mac and a PC, both of which support dual-monitor displays. Most of the time, I'm viewing GigaStudio on the left and MOTU Digital Performer, my primary Mac application, on the right. With separate keyboards and mice, I can move quickly from one program to the other for maximum efficiency.

There will be times, however, when I won't need GigaStudio—for example, when recording live tracks or sequencing with MIDI sound modules. In those cases, it's great to be able to spread out across two monitors, especially because Digital Performer rapidly eats up on-screen real estate. I like to place the Mixer window, processing plug-ins, and smaller ancillary displays in the left monitor; that lets me open up the Track window, Sequence Editor, and Control Panel in the right monitor. So the right monitor remains dedicated to the Mac while the left monitor switches between the PC and Mac, depending on the task at hand. To switch the left monitor between the PC and Mac, I'm using a Dr. Bott MoniSwitch USB, a well-made switch box that includes high-quality cables.

The two video ports on the new Macs are not the same; one is a VGA (analog) port, and the other is Apple's proprietary ADC (digital) connection. The ViewSonic monitors have only VGA connections, so I need a Gefen Systems ADC-to-VGA adapter to convert the second Mac port to VGA. Some LCD monitors have DVI (digital) inputs that offer somewhat better image quality than VGA, and Apple's excellent Studio Display monitors can be made to work with PCs with the proper kind of converter, but those are typically more expensive solutions.

Why spend the extra money on LCD monitors? LCD flat-panel monitors offer several important advantages over CRT displays when used in a small studio. They weigh considerably less than CRT monitors, and because they have a much smaller footprint, they don't crowd the desktop. You can also put them right next to each other without causing image distortion, and they don't generate nearly as much heat as CRTs—their most important benefit, perhaps. Running two CRTs can quickly raise the temperature in a small room, especially during the summer.

Audio interface. The heart of my desktop music system is formed by the MIDI interface and the digital-audio interface. For hard-disk recording and playback, I'll be using MOTU's 828 digital-audio interface, which won a 2002 Editors' Choice award for being, among other things, the first multichannel FireWire audio interface. Like MIDI Timepiece AV (MTP AV), the easy-to-use 828 integrates especially well with Digital Performer, and it makes a fine partner for the Dakota card.



BIAS Peak 3.0 comes bundled with Vbox SE, which lets you combine multiple VST plug-ins for processing audio.

The affordable Canopus ADVC-100 lets you import analog video into your computer through a FireWire cable.

The 8-channel 828 offers several great features, such as CueMix Plus, which provides zero-latency monitoring. That comes in handy during multitrack recording sessions. It delivers 24-bit resolution and supports 44.1 and 48 kHz sampling rates, and it provides stereo S/PDIF I/O on RCA jacks. Its analog inputs and outputs employ balanced ¼-inch jacks boasting a 105 dB dynamic range. Inputs 1 and 2 also accept XLR mic inputs, and the two high-quality mic inputs let me record audio tracks without having to invest in a mic preamp right away. The front panel provides a 48V phantom-power switch and input-gain controls.

The key to my hybrid Mac/PC system, however, lies in the 828's 8-channel ADAT Lightpipe I/O. Because the Frontier Dakota card supports ADAT Lightpipe (16 channels on two outputs), I can send as many as 8 channels of digital audio over a single optical cable to the 828. Not only is the optical cable immune to hum and RF interference, but I can separate the two audio devices by at least 16 feet if I have to. That's important because although the Carillon CPU can live peacefully in my rack, the Mac, with its noisy fan, has to stay isolated behind a closet door.

With this configuration, GigaStudio functions as a massive yet intuitive eight-output sampler with clean, high-quality audio. If eight audio channels prove too limiting, I can add a second 828 later, turning GigaStudio into a true 16-channel sampler.

MOTU offers several options for expanding your system. For example, if you need high-resolution audio and more mic inputs, you can add a MOTU 896 to your 828. That high-end FireWire system adds another eight channels of

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ADAT Optical I/O along with eight more mic inputs. You can also install one of MOTU's venerable 2408mkII systems, which supports 24 channels of ADAT optical in a single rackspace, although it doesn't provide mic inputs. I'm not going to do that for this system, though.

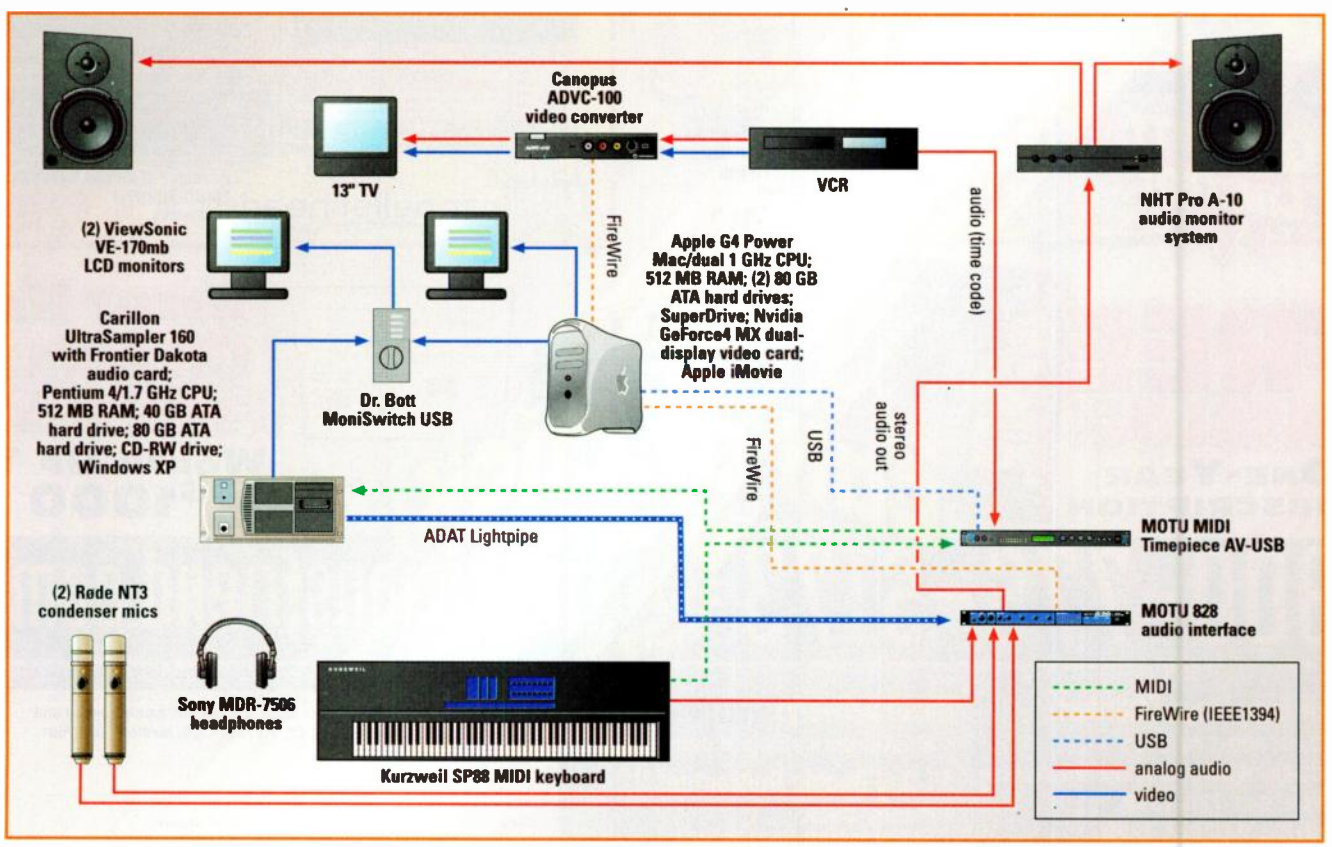
MIDI interface. For the MIDI interface, I'm choosing the USB version of MOTU's MTP AV. The MTP AV is one of the most versatile MIDI interfaces on the market, and it integrates extremely well with Digital Performer 3.1, the sequencer that I've chosen. The MTP AV provides eight pairs of MIDI Ins and Outs (128 channels), a front-panel LCD screen for standalone operation, and plenty of LED status indicators. It can even function as an 8×8 MIDI patch bay and merger. I'll connect MIDI Out 1 on the MTP AV to MIDI In 1 on the PC's Dakota card. Once I set up MOTU's FreeMIDI data-routing software, I can quickly select any of GigaStudio's MIDI channels from within Digital Performer.

The MTP AV's ability to handle a variety of hardware configurations is unsurpassed. It offers ADAT sync, video sync, word-clock output, Digidesign Pro Tools Superclock output, and support for MMC, and it can convert audio-click sources to MIDI. For film scoring, the MTP AV serves as a SMPTE time-code converter, generator, and reader with adjustable freewheeling. Because it's a USB device, it's easy to install or disconnect, and if your needs expand, you can add as many more MTP AVs as your system can handle.

Speakers. I need a good pair of magnetically shielded near-field audio monitors. If I had a bit more money in my budget, I would choose the award-winning NHT Pro A-20 powered monitors. They're amazingly clean and accurate with a frequency response that reaches down to around 48 Hz without a subwoofer. But at $1,800 a pair, the A-20s would put me over budget, so I'll compromise and choose the less expensive A-10s. Their specs aren't quite as good as those of the A-20, but they share many interesting features, including a two-way acoustic-suspension design with inward-angled front baffles for improved spatial imaging.

The A-10 powered monitors also employ a dedicated, rackmountable, dual-mono, 150W (RMS) amplifier that attaches to the speakers with a set of proprietary cables. That modular approach offers a centralized connection point for audio cables and removes the heat source from the speaker cabinets. It also provides several front-panel controls for optimizing the speaker output for different room configurations and input levels.

I also need headphones for overdubbing acoustic instruments and vocals.



Tascam's GigaSampler has become so popular that Mac users sometimes buy PCs just to run the Windows-only sampler. This hybrid studio is built for video scoring and includes twin ViewSonic LCD monitors, a VCR deck, and a 13-inch TV in addition to the audio and MIDI gear.

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Microphones. I need at least two mics so I can record tracks in mono or stereo. I'd like a pair of mics that are well suited to recording acoustic instruments, which are the sources I'll most likely encounter. Personal preferences have a lot to do with selecting mics, and several budget-level mics are worth considering. For this studio, I'm choosing the attractively priced Røde NT3. It's a medium-diaphragm hypercardioid condenser that is well suited to my needs, and its price tag is hard to beat. The NT3's older sibling, the Røde NTK, won an Editors' Choice award this year and would make an excellent upgrade to my studio when my budget expands in the future.

Digital audio sequencer. In the final analysis, any computer-based studio is only as good as the software that drives the heavy machinery. As I mentioned earlier, in my studio, the ringleader is MOTU's Digital Performer 3.1. This powerhouse audio sequencer has won multiple Editors' Choice awards and continues to impress me with its sophisticated interface design, intuitive architecture, and sheer depth of features.

Digital Performer is optimized for dual-processor Mac G4s; offers versatile 5.1-surround mixing; supports 24-bit, 96 kHz recording; imports and exports Pro Tools projects; and includes excellent tools for working with picture. What's more, Digital Performer comes packed with more than 40 audio plug-in effects, so you can get started processing your tracks right away. The combination of the 828, the MTP AV, and Digital Performer makes for a highly integrated and powerful workstation.

Audio editor. Digital Performer includes an audio-editing window, but a full-service desktop studio should also have a separate high-end audio-editing program. For the Mac, the choice is clear: BIAS Peak 3.0 is the best available stereo-editing, recording, and processing application. With Peak you can record and edit MP3 files, convert audio file formats, import and edit audio-CD tracks, prepare loops, create playlists, and sync to QuickTime movies. Moreover, Peak comes with dozens of plug-ins and digital signal processing effects, in addition to offering extensive recording and editing features. Furthermore, Peak comes bundled with Vbox SE, which lets you combine VST plug-ins in various configurations.

Notation software. Although I now do most of my composing with MIDI samplers and sound modules, I still occasionally work with live musicians. I therefore need to create professional-looking scores and parts for a variety of musical styles with specific requirements.

There are several excellent high-end notation programs, including the intuitive and innovative Sibelius 2.0. For this system, however, I'll use the ever-popular Coda Finale 2002. The award-winning Finale just keeps getting more and more amazing as Coda adds exotic features and refines its user interface. Finale 2002's layout capabilities and printed output are excellent, and the program includes the handwritten-style Jazz font in addition to the engraver-quality Maestro font.

Best of all, Finale 2002 comes with 12 algorithmic composition plug-in tools (developed at IRCAM) for generating rhythms, morphing chords and melodies, and performing additional musical tricks. A new Band-in-a-Box Auto Harmonizer from PG Music even generates multipart block harmonies in a variety of styles. With all its extra tools, Finale 2002 has become much more than a program for notating music; you can now use it as a primary tool for creating music, as well.

File translation. For the PC, most of my basic software needs are covered: as I mentioned earlier, the UltraSampler 160 system comes with GigaStudio 160 2.5 and Sound Forge XP preinstalled. However, one other piece of software is a must: Chicken Systems' Translator 2.5. Translator lets you convert a wide assortment of hardware and software sampler formats into Giga format, which offers access to a potentially huge pool of instrument samples, loops, and sound effects.

VCR and TV monitor. One of the most important goals in setting up this studio is to create an effective environment for producing film and TV scores. That means I'll need a few extra pieces of video-related gear. For starters, I'll add a VHS recorder and a 13-inch television for video playback and monitoring.

THE $15,000 MACINTOSH HYBRID STUDIO

ITEMS	PRICE
Apple Power Mac G4/dual 1 GHz CPU; 512 MB RAM; 80 GB ATA hard drives (2); SuperDrive; Nvidia GeForce4 MX dual-display video card; Apple iMovie	$3,249
BIAS Peak 3.0 audio-editing software	$499
Canopus ADVC-100 video converter	$299
Carillon UltraSampler 160; Pentium 4/1.7 GHz CPU; 512 MB RAM; 40 GB ATA hard drive; 80 GB ATA hard drive; CD-RW drive; Windows XP. Bundled with Tascam GigaStudio 160 and Sonic Foundry Sound Forge XP; Frontier Dakota audio card; Matrox G550 dual-output video card; ViewSonic VE-170mb LCD monitors (2)	$5,140
Chicken Systems Translator 2.5 sample-format conversion software	$150
Coda Finale 2002 music-notation software	$600
Dr. Bott MoniSwitch USB	$139
Gefen Systems ADC-to-VGA video adapter	$49
Kurzweil SP88 MIDI keyboard	$995
MOTU 828 FireWire audio interface	$795
MOTU Digital Performer 3.1 digital audio sequencer	$795
MOTU MIDI Timepiece AV-USB interface/patch bay/synchronizer	$595
NHT Pro A-10 audio monitor system	$800
Røde NT3 condenser microphones (2)	$398
Sony MDR-7506 headphones	$125
VCR and 13" television	$450
TOTAL	**$15,078**

IT'S THE NEW SOUL OF MY STUDIO

PHOTO: DENNIS SHIRLEY ©2002

> RAY CHARLES

When recording legend Ray Charles and Grammy-nominated engineer Terry Howard (Barbara Streisand, Stevie Wonder, Fleetwood Mac) decided to upgrade Ray's recording studio, they chose SONAR as their central production technology. Ray and Terry could have had any software they wanted. And they both agreed that SONAR could do it all.

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- Multi-port drum editor
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Film composers used to work exclusively with ¾-inch video work prints. However, in recent years, ½-inch stereo VHS work prints have become increasingly popular (particularly with low-budget productions). SMPTE time code is recorded on one track, and production sound, dialog, and other reference sounds are recorded on the other.

You could invest in an expensive commercial-grade video deck and a high-quality video monitor, but you can probably get through most projects just fine with a decent consumer-grade VCR and TV. Be sure to choose a hi-fi stereo VCR with RCA output jacks and select a TV with RCA inputs (mono audio is fine). Connect the audio cable carrying the time code to the audio input on the MTP AV; connect the cables carrying the reference audio and the video output to the TV. Digital Performer can then lock to the time code as a slave device and record or play in sync with the picture.

Working directly with a VCR is handy if you just want to slap in a tape and watch something, especially if you don't have to do much shuttling. But fiddling around with videotape is not the most elegant or efficient way to compose to picture. Now that FireWire and digital video are all the rage, why not take advantage of the latest technology? Digital Performer and Peak can import QuickTime movies and synchronize to them with subframe accuracy.

A/D video converter. In Digital Performer, you can record your multitrack score, scrub forward and backward, drag soundbites, and cut and paste audio, all while locked to video. For example, you can move the cursor to a cymbal crash and view the exact frame where it will occur. Alternatively, you can drag a harp-gliss soundbite to the first frame of a visual transition. First, however, you must convert your VHS work print into a QuickTime movie.

For that you need an analog-to-digital video converter, such as the Canopus ADVC-100. The ADVC-100 takes the output from the VCR, converts it into digital format, and sends it to the computer through a FireWire cable. The new Mac G4s come bundled with Apple's easy-to-use iMovie software, which records the video as a QuickTime movie on your hard drive. Several companies, including Formac, Sony, and Miglia, offer affordable converters, and like the Canopus box, the converters work in both directions (A/D or D/A). You can also use most digital video camcorders as a converter, but that's a much less convenient solution, and it may not offer the best results.

With my work print digitized as a QuickTime movie, I can view Digital Performer's Movie window on the left monitor, which leaves the right monitor available for the recording and editing displays. However, a new feature in version 3.1 of Digital Performer offers an

even better plan. In the Movie window mini-menu, under Video Output, you can choose FireWire as an option. That streams the QuickTime movie back out to the Canopus box, which converts it to analog in real time and sends it to the TV. I can then use the TV to monitor the QuickTime movie while displaying GigaStudio on the left monitor and Digital Performer on the right. That really makes the most of my three-monitor setup and minimizes the competition for screen space.

Keep in mind that streaming video from the hard drive consumes a fair amount of processing power, so if you are piling up so many audio tracks and plug-ins that it affects the video playback, you may have to revert to using the VCR for playback. With careful planning, though, you should be able to avoid problems, especially with a high-end G4 Mac.

MIDI keyboard. At this point, my desktop system is nearly complete; I just have to fill in a few missing pieces. To begin with, I need a MIDI keyboard controller to enter music. Several manufacturers offer excellent keyboards, but for this system, I must have an 88-note keyboard with pitch and modulation controls, because GigaStudio often uses key switches and controller routings in its patches.

To keep costs down, I'm choosing Kurzweil's affordable SP88, with its semiweighted action. Although it's not without its shortcomings, the SP88 is lightweight (only 30 pounds) and compact, and its low profile helps it fit comfortably on the desktop in front of the monitors without covering their controls. The SP88 uses short ribbon controllers for pitch bend and modulation; they're a bit awkward to use, but they get the job done. As an added bonus, the SP88 provides 32 onboard patches (mostly pianos, strings, and organs).

Future expansion. That completes my high-end Macintosh desktop studio, and amazingly, I managed to stay reasonably close to my budget limit. If I had a bit more cash to work with, I'd certainly consider adding more goodies to boost productivity. Home studios are universal in their insatiable need to grow, and this setup is no exception.

A good place to start expanding my studio might be the addition of a MIDI control surface to provide a hardware interface for mixing. The Radikal Technologies SAC-2K would make an excellent choice; it integrates especially well with Digital Performer, providing transport controls, knobs, and motorized faders. If my sound sources start to proliferate, I might also consider adding a small digital or analog mixer to serve as a submixer.

Speaking of sound sources, among my first additions would be one or two MIDI sound modules to expand my palette of sounds. Although it has been around for a while, E-mu's Proteus 2000 is still a great choice, delivering 128-note

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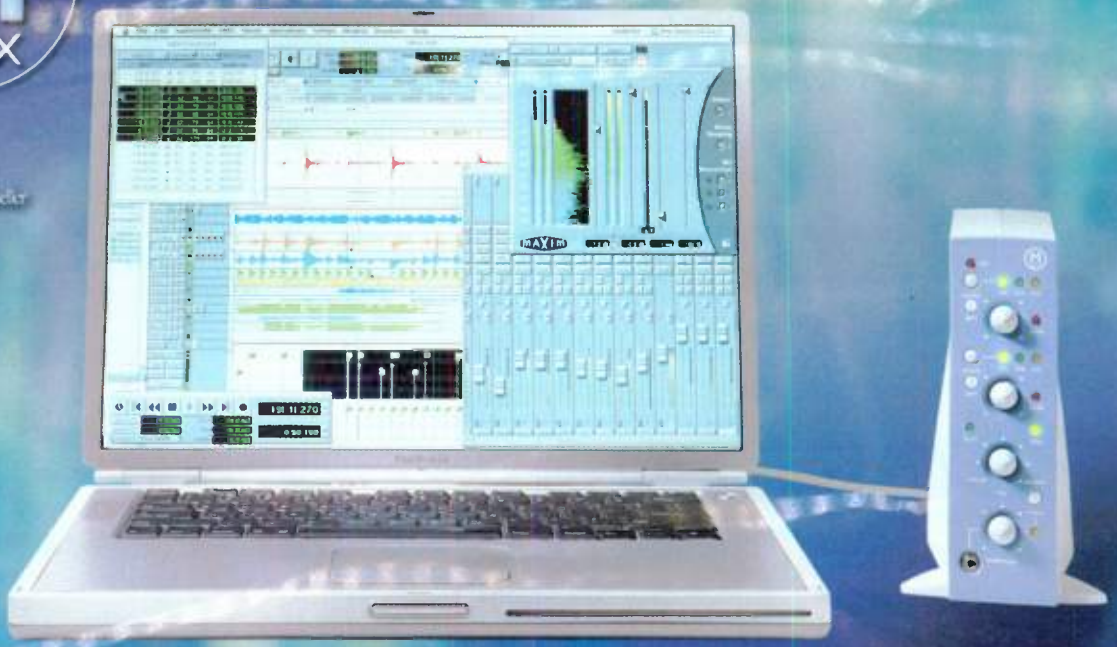

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- *Award-winning Pro Tools LE software included*
- *2 analog inputs and outputs with 24-bit signal path*
- *24-bit stereo S/PDIF digital I/O*
- *2 analog TRS inserts*
- *File compatibility with Pro Tools TDM systems*
- *Headphone output with dedicated volume control*
- *Zero-latency monitoring*
- *100% USB powered*

Bomb Factory's plug-ins recreate the sound of vintage audio gear with such sonic precision it's uncanny. It's just like the real thing!

Digidesign offers plug-ins for mastering and processing of the highest quality, and creative tools that can take your sound to a whole new level.

DUY plug-ins are made for the creative artist in you, not the computer technician. Shape your sonic landscape the way you see fit.

Prosoniq offers a wide variety of plug-ins for your computer, including the Orange Vocoder, perhaps the best analog vocoder effect you've ever heard.

Synchro Arts offers excellent, easy-to-use plug-ins for music, multimedia and more. Their VocAlign Project has become a studio staple!

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Renaissance Collection

From one of the world's most popular and respected plug-in developers comes the Renaissance Collection, offering excellent emulation of vintage analog hardware with simple intuitive controls. The Renaissance Collection puts the three most-needed processors into your studio: equalization, dynamics, and reverb, all with classic interfaces and profound power "under the hood." Incredible power for an unbeatable price.

Renaissance Equalizer
Two to six bands of audiophile EQ. Its selectable filter types respond like classic analog/tube hardware adding air and smoothness while maintaining clarify and space. *"For hard singers like Michael Jackson, Blackstreet, and My Town, the RenEQ gives me the warm sound I am looking for." – multiplatinum and Grammy Award winning producer/artist Teddy Riley*

Renaissance Compressor
Recreates the warm sound and simple operation of classic analog hardware. Features Adaptive Release ControlTM, and Opto/Electro modes with brickwall limiter on the output. *"The most forgiving and transparent compressor I use. It's the only plug-in I trust with the all-important lead vocal."– Technical Grammy nominee Juan Patino*

Renaissance Reverberator
The classic sound of professional reverb with intuitive controls. Finally, a pro reverb that eliminates the need for outboard hardware. *"Hands down, one of the best reverb plug-ins available today." - MIX*

McDSP

McDSP plug-ins have been called the best thing to happen to Pro Tools since Pro Tools. Each plug-in package offers both mono and stereo versions. Analog Channel emulates the sounds of high-end analog tape machines, analog tape, and analog channel amps in 2 plug-ins.

Vintage and modern compressors. CompressorBank is 6 plug-ins: basic compression (CB1), compression with pre-filtering (CB2), and compression with pre-filtering and static/dynamic EQ (CB3).

Practically every great EQ ever made! FilterBank emulates the sound of vintage and modern equalizers/filters. FilterBank is 20 plug-ins with 2, 4, and 6 band configurations.

The MC2000 multi-band compressor plug-in offers the sounds of vintage and modern compressors in two, three, and four band configurations. The MC2000 is 6 plug-ins: the CompressorBank (CB1) is configured in 2, 3, and 4 bands.

kantos 1.0

From the company that revolutionized vocal intonation processing comes kantos 1.0, a software-based synthesizer that finally liberates you from anything that stands between you and the music you hear in your mind.

ANTARES

kantos 1.0 is controlled by audio — any pitched monophonic audio, like your voice, or a musical instrument — live, in realtime. kantos 1.0 analyzes incoming audio and instantaneously extracts pitch, dynamics, harmonic content and formant characteristics. This information is then used to control the kantos 1.0 sound engine in ways never before possible with a conventional MIDI synth.

Whether you are looking for an alternative to traditional controllers, or are looking to produce electronic music with a level of sonic innovation and dynamic expression that's simply not otherwise possible, kantos 1.0 will, quite literally, change the way you make music.

Wave Mechanics

FilterFreak & Mbox– Audio with Attitude™

Though Wave Mechanics has only been around a few years, their world-class professional plug-ins for Pro Tools have already garnered heaps of praise from audio engineers and producers — not to mentioned a TEC Award nomination! The company was founded by the engineering team that created the legendary H3000 Ultra-Harmonizer and the DSP4000 line of hardware signal processors from Eventide.

FilterFreak is the first in the brand-new SoundToys line of studio processors created by the DSP Gurus at Wave Mechanics. Using carefully crafted analog filter models with a super fat 8-pole design, FilterFreak is a truly killer filter plug-in. The amazingly versatile modulation section includes a tempo-locked LFO, enveloper follower, ADSR, and a random generator. With single, dual, and quad versions, FilterFreak is built to be abused. Crank up the input gain to add dirt, or turn up the resonance until the filters self-oscillate. You won't be disappointed.

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Unity Session

BitHeadz has combined the functionality of hardware samplers, analog synthesizers, and physically modeled instruments into one fully integrated environment.

- Fully Mbox compatible
- No additional hardware required
- Outstanding 32-bit, 96 kHz sound quality
- Up to 256 note polyphony (CPU dependent)
- FreeMIDI, OMS, PC-300 & OS X CoreMIDI compatible
- RTAS, DirectConnect, & ReWire support

Over 2 gigabytes of content are included along with the famous Black & Whites stereo Steinway samples. Unity Session plays 24-bit Gigasampler files from RAM or hard disk. Play Retro AS-1, Unity DS-1, Sound Designer II, AIFF, SampleCell II, DLS, SoundFont II and Physical Models at the same time! Working in both OS9 and OSX environments, Unity Session is an instrument so pure in sound and so dedicated to the art of creating music that it has united the acoustic past with the electric present to bring you the virtual future of sound generation and creation.

IK's Music Creation Powerhouse

IK's suite of Pro Tools plug-ins offer a total solution for creating fully-mastered music anywhere.

IK MULTIMEDIA

Thanks to **AmpliTube's** unique Pre, EQ, Amp, Cabinet and Mic emulation you can produce a mind-blowing 1,260 amp combinations in real-time crafting your preferred guitar tone from tons of physically modeled vintage and modern amps! Plus, you'll have a complete selection of stomp boxes and post-effects.

A full-featured expandable sound module, **SampleTank** gives you access to thousands of high-quality multisampled sounds in a flash. Work with an unlimited number of sound modules with 16 multitimbral instruments each, 128 notes of polyphony, 4 effects per voice, 28 DSP effects, a search engine, 15 native sound libraries, AKAI CD conversion and much more...

The **T-RackS** plug-in has what you need to create superb, tube-toned masters and remixes. Its rich ,warm sound starts with algorithms based on true analog circuitry. A familiar interface makes it easy to control its EQ, compressor, limiter, soft-clipping output stage, and a complete mastering suite. Enhance frequencies in a mix, stereo image, dynamic range and more. Plug-in T-RackS and feel the power of analog mastering.

TrakMaster

Focusrite

TrakMaster is a single-channel multi-functional processor designed with the project-studio owner in mind.

The "master" starts with a phantom powered Class A mic/line/instrument preamp and a high pass filter. Next up is the optical compressor for getting those tight, punchy tracks that are critical in any recording — the compressor not only sounds great but is incredibly simple to use. Three rotary pots (Compression, Release and Makeup) let you quickly dial in the compression you're after while a "Comp In" switch allows the compressor to be bypassed. If required, the compressor can even be moved in signal flow to follow the EQ.

The newly designed 3-band EQ is clean, quiet, and musical, and can be optimized for vocal or instrumental work at the touch of a button. Boost/Cut controls are provided for the mid- and high-bands and switches are included to alter the frequency selections for instrument or vocal tracks. Add the unique Tube Sound technology that simulates tube based devices and the option of adding a 24-bit/96kHz digital output to connect to your S/PDIF gear and TrakMaster is a great complement to any Mbox studio.

GLYPH

Portable Storage Solution for Mbox™

Glyph's new Companion™ sets the standard in storage solutions for micro studios. It's been engineered specifically for Digidesign's Mbox. Companion is a high performance hard drive system with a dual port, 6-pin FireWire interface in a small, portable case that couples with the Mbox. The Companion's reliability and ease of use allows you to unleash the full potential of your micro studio.

- Available in capacities of 40GB, 80GB and 120GB.
- Seamlessly record, overdub, mix and edit 140 to 420 minutes of 24 track, 24 bit audio at 48kHz.
- Equipped with state of the art high performance, 7,200 RPM hard drives, quieted by advanced composite metals technology to reduce vibrational noise.
- Featuring self-monitoring, analysis, and reporting technology (S.M.A.R.T.) - protecting your data with predictive failure analysis to warn you of issues with your storage subsystem before it's too late.
- Engineered with thermal sensing cooling to prolong the life of your Companion.
- Stylized form and functionality with the speed and ease of FireWire connectivity.
- Comes complete with Glyph's outstanding 24 hour advance replace warranty at no additional charge, along with our unrivaled tech support and service.

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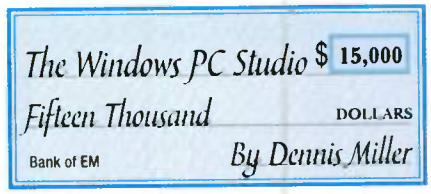
polyphony and more than 1,500 patches.

With the Translator software, I can convert many of my old sample libraries into Giga format, but as soon as possible, I'll want to build my library of sampled instruments. At the top of my wish list is the *Garritan Orchestral Strings* collection, with its lush string sections and extensive assortment of performance techniques. For wind instruments, I'll turn to the *Dan Dean Solo Woodwinds* and *Dan Dean Solo Brass* libraries. However, those are only a few of several excellent choices. The Giga format is acquiring new libraries at a surprising rate, and of course, the samples that interest you will depend on the styles of music that you compose.

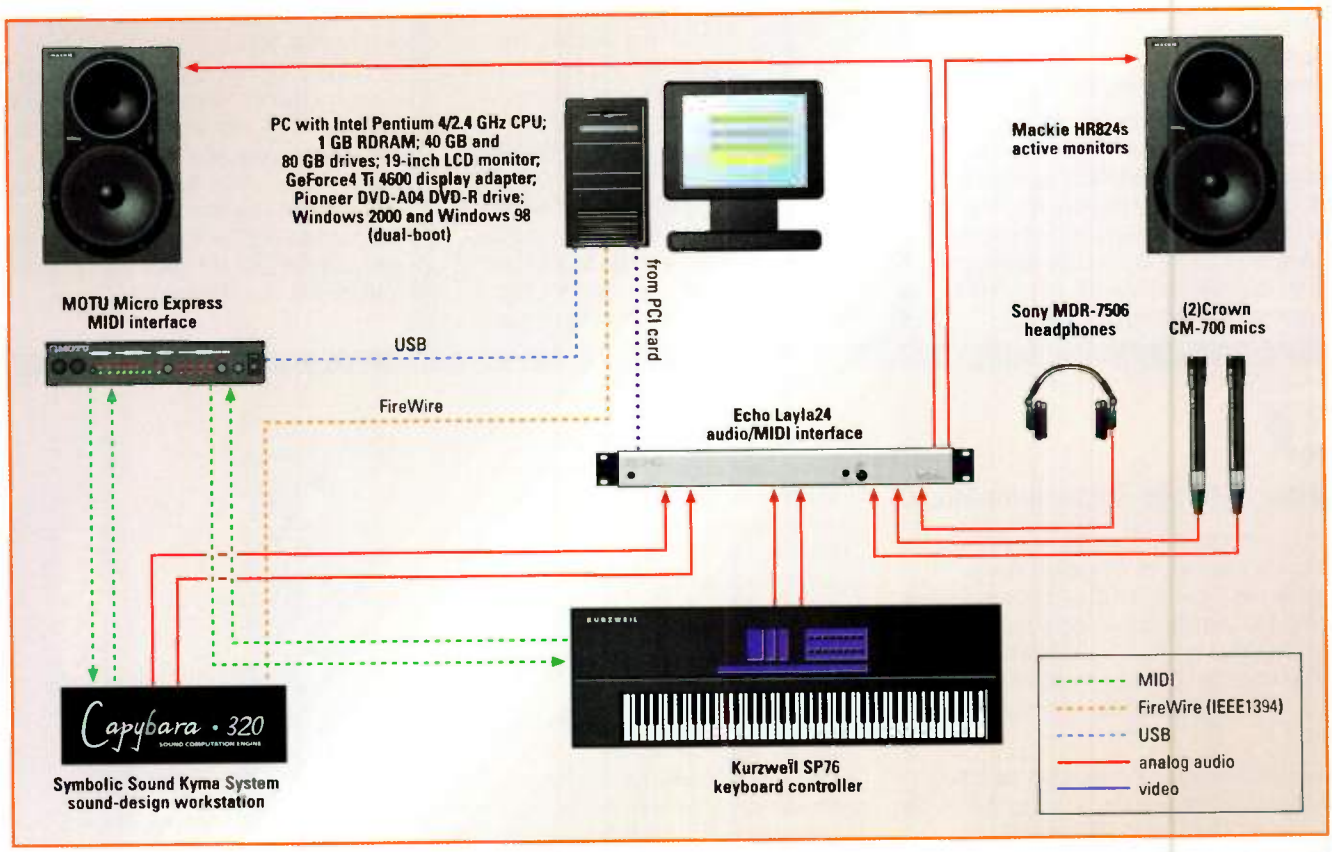
You can also expand your musical palette by adding software synths and samplers such as Unity DS-1 and Retro AS-1 from BitHeadz and Reason from Propellerhead Software. Adding a sequencer (such as Steinberg Cubase VST) to the PC can also open new possibilities for sequencing and audio production, and as a supplement to GigaStudio 160, Steinberg's Halion software sampler can greatly expand your options. Because the Carillon PC has a dual-monitor video card, you could even work with the PC alone and spread out across both monitors. You could then create complete sequences on the PC and record them on the Mac or vice versa.

Finally, all desktop studios should have an uninterruptible power supply (UPS), such as the APC Back-UPS Pro 650. A UPS provides several minutes of emergency power so that you can save your work and shut down your system in the event of a power failure. It can save you much grief, and you're tempting fate if you don't have one.



Ah, what a pleasure it is to spend *EM* editor in chief Steve O's play money! With a $15,000 budget, I can buy top-of-the-line components and outfit my studio for a wide range of tasks. I'm well equipped to create music for games or any type of film or video production, and some little-known features in my sequencer let me explore algorithmic composition in distinctive ways. More traditional tasks, such as songwriting and building dance tracks, are also possible, and I am ready to tackle the challenge of DVD authoring. Live recording is also no problem, assuming I can keep the studio environment free of sonic interruptions.

As with my $5,000 PC-based studio, I'm starting with the computer and



Symbolic Sound's Kyma (which includes the Capybara card cage) and Steinberg software are key tools in this high-end Windows studio. Audio hardware includes Mackie's HR824 monitors, Crown CM-700 mics, and an Echo Layla24 audio and MIDI interface.

Articulations:
Long Tones Legato
Long Tones Expressivo
Bowed Tremolo Ordinaire & Ponticello
Bowed Half Step & Whole Step Trills
Con Sordino (Mutes)
Staccato Light, Martele, Marcatto, Frog Spiccato
Pizzicato Loose & Tight
Pizzicato Harmonics
Bowed Harmonics Natural & Artificial
Col Legno Tight & Loose
Sound Effects & Glissandi

Methods:
24bit-48k recordings. B&K 4011 front microphones with Schoeps CMC-6Ug and Neumann U87 spot microphones capture a rich balance of space and instrument detail. Up to 4 velocities per articulation with down & up bows. Release samples included to preserve natural instrument resonances and subtle ambient decay.

Musicians:
Sections include 1st Violins, 2nd Violins, Violas, Cellos & Basses. Unparalleled musicianship, technical proficiency and beautiful sounding instruments from members of the Boston Pops and Boston Ballet Orchestras.

Available:
Full release in Gigasampler format. CD or DVD Box Set. Complete Documentation. Please call or visit website for details and demos.

Recording Notes:
Recorded by 2001 Emmy award winning engineer Antonio Oliart and RIAA award winning engineer John Bono at Sonic Temple Studios, Roslindale, MA. (pictured) Programming done exclusively in-house. Designed for the utmost in expressiveness and playability; a joy to create with.

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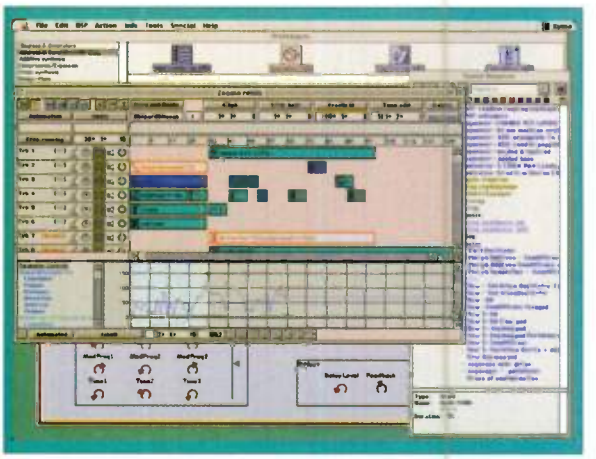
then moving through the different types of hardware and software I'll want to have on hand.

Computer. I'm sparing no expense in my high-end system. My music machine has a 2.4 GHz Intel Pentium 4 processor and 1 GB of RDRAM, a 40 GB system drive, and an 80 GB drive dedicated to audio (or video, as the case may be). I'm also springing for a 19-inch LCD monitor. For burning CDs and DVDs, I'm buying a Pioneer DVR-A04 DVD-R drive, (a recent replacement for the popular A03), which includes enough bundled software to get me going in the DVD-authoring business.

The computer has an Ethernet card and an Iomega Zip 250 drive, and it runs Windows 2000 and Windows 98 in a dual-boot configuration. (Windows 98 is required for the Kyma System, which I'll discuss shortly.) I'm asking my vendor for an Nvidia GeForce4 Ti 4600 display adapter, which is one of the hottest new video cards on the market. I made a few calls and received quotes for this system ranging from $4,000 to $4,500. I'm budgeting $4,500 just to be on the safe side.

Audio and MIDI interfaces. My audio will be pumping through Echo Audio's Layla24 interface, which has drivers for just about every Windows version and audio protocol you can imagine. Its eight balanced analog ins and outs, ADAT I/O, headphone out, word clock, and MIDI I/O provide an all-in-one solution, which is just what I need. Furthermore, it includes a free copy of Steinberg's Cubasis, which will save me a bunch of money when I purchase my sequencer (more on that later). Although the Layla24 provides me with a MIDI interface, I'm also grabbing a MOTU Micro Express for patching MIDI around the room.



Symbolic Sound's Kyma 5.0, a reconfigurable hardware-accelerated sound engine, is controlled though a graphical user interface. It can be used for nearly any synthesis method imaginable in addition to a vast range of signal-processing functions.

Speakers. On the receiving end are a pair of Mackie HR824s (can you say *flat*?), which provide rich detail through a thumping 8-inch woofer and 1-inch tweeter. The Mackies conveniently accept XLR and balanced TRS cables and are powered, so I don't need a separate power amp. For headphones I'll go with the ever-popular Sony MDR-7506s.

Microphones. I have a modest budget, so I'm going for a pair of Crown CM-700 small-diaphragm cardioid condensers for stereo miking. The CM-700s give me live-recording options and plenty of flexibility when I take them into the field for sampling. (Of course, I can't take this desktop PC-based system into the field with me, so a portable DAT or hard-disk recorder is on my wish list for future purchases.)

Sound-design workstation. Having the right tool for the job means having lots of tools. But one component I'm buying is so versatile that it saves me from purchasing dozens of different programs. That's the Kyma System from Symbolic Sound, and no high-end desktop studio should be without it. Kyma combines a box full of Motorola digital signal processors that can be reconfigured to serve nearly any audio purpose imaginable. Do you need an FM synth, a granulating sample player, or an audio-to-MIDI converter? It's in there. Do you want to pull out every odd partial in a vocal sample and morph it with the even partials of a violin? No problem—that's a preset, in fact.

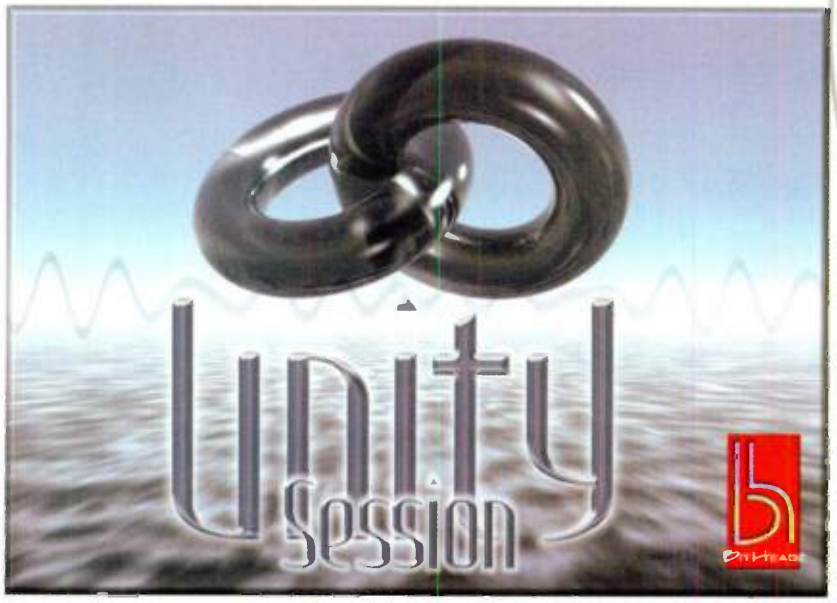
For processing live audio, controlling the playback rate of a disk file with your voice, or building complex, polymetric step sequencers, the Kyma is just right. All that power doesn't come cheap, but the $3,570 for a base system and high-speed FireWire interface are well spent.

Digital audio sequencer. Of course, there will be times when I'll need more basic audio tools, and as always, I need a good digital audio sequencer to serve as the backbone of my studio. In this rig, I'm choosing Steinberg's Cubase

THE $15,000 WINDOWS STUDIO

ITEMS	PRICE
Crown CM-700 microphones (2)	$598
Echo Layla24 audio/MIDI interface (bundled with Steinberg Cubasis)	$995
Kurzweil SP76 keyboard controller	$800
Mackie HR824s active monitors (2)	$1,598
MOTU Micro Express MIDI interface	$295
PC with Intel Pentium 4/2.4 GHz CPU, 1 GB RDRAM, 40 GB and 80 GB drives, 19-inch LCD monitor, Nvidia GeForce4 Ti 4600 display adapter, Pioneer DVR-A04 DVD-R drive, Windows 2000 and Windows 98 (dual-boot)	$4,500
Peavey PC 1600x MIDI fader box	$399
Sonic Foundry Acid Pro 3.0 loop sequencer	$499
Sony MDR-7506 headphones	$125
Spin Audio VST-DX Wrapper Lite DirectX shell for VST plug-ins	free
Steinberg Cubase VST 5.1 (upgrade from Cubasis) digital audio sequencer	$225
Steinberg GRM Tools, vols. 1 and 2, effects plug-ins	$398
Steinberg WaveLab 4.0 audio editor	$599
Symbolic Sound Kyma System sound-design workstation with FireWire interface	$3,570
Waves Native Power Pack 3 effects plug-ins	$500
TOTAL	**$15,103**

Obsession.



Unity Session is the cumulative effort of over a decade of planning. Even back when a Mac could barely beep, we knew this day would come. A day when you could hold a super-computer in one hand and score films with the other.

Unity Session combines the functionality of hardware samplers, analog synthesizers, and physically modeled instruments with the operational and visual ease of a Mac.

Unity Session is so pure in sound, and so rich in texture because it's a tool totally dedicated to the art of creating music. BitHeadz has united the acoustic past with the electric present to bring you the virtual future of sound generation. Let our obsession become your inspiration.

- Plays Unity 2, Retro 2, Gigasampler™, DLS, WAVE, AIFF, SoundFont 2.0, 24-bit Sound Designer II, and SampleCell II on the fly
- Imports CD-Audio, Akai™, 'live' audio, and Roland™
- True phase-locked stereo signal path throughout
- Full synth engine with multiple filters & modulation routings
- 2 insert effects per channel, plus two send, & two global FX with multiple effects types
- Gigabytes of sounds including physical models, loops & GM
- Stream samples from disk or from RAM as you define
- Built in sample editor/recorder
- Mac OS 9 and OS X
- $649.00 suggested retail price

Built for Mac OS X

Optimized for G4 with Multiple Processors and Velocity Engine

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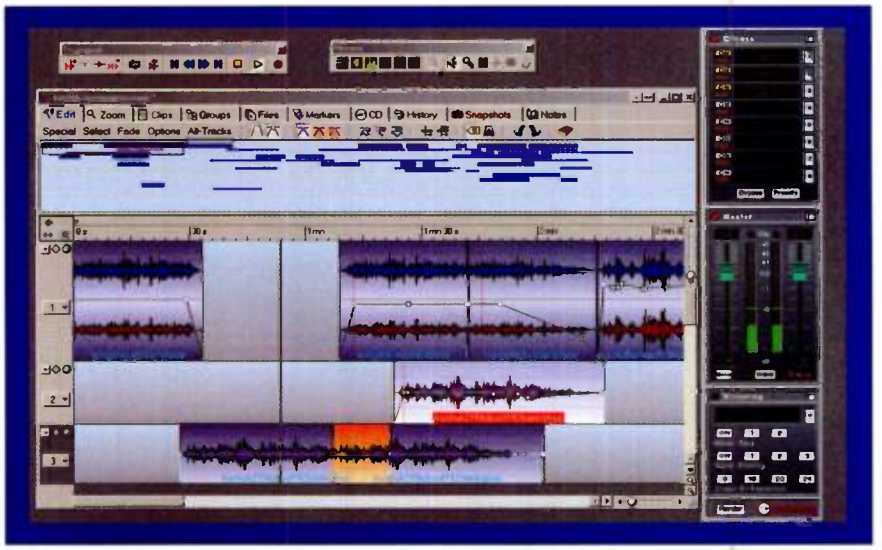
BitHeadz



Steinberg's WaveLab 4.0 is an audio-editing powerhouse that combines a stereo wave editor with a multitrack production environment. A revamped and enhanced interface provides access to a wide range of features, and built-in CD burning allows you to finish a production and prepare it for delivery without ever leaving the software.

VST 5.1, which has continued to evolve during the past few years, including ever more software synths and high-quality effects and offering a streamlined and refined user interface. The program's enormous range of MIDI-processing features (for example, the Interactive Phrase Synthesizer) is able to produce hours of variations on even the most basic MIDI phrase. I am very much looking forward to the release of Cubase SX, which should be out by the time you read this.

Loop sequencer. What will I do in all of my spare time? Play with Sonic Foundry's Acid Pro 3.0, for one thing. Acid Pro is a great way to create music with loops and now includes support for MIDI and a single video track. The 18 DirectX plug-ins that ship on the distribution CD-ROM can be used with Cubase or any other DirectX host software, and Acid's internal CD-burning feature complements the other capabilities of my system.

Audio editor. Although I have lots of ways to work with digital audio, a standalone multitrack program is always handy. I think highly of Magix's Samplitude Producer Pro, and version 6.0 is the most intuitive and powerful version of the program yet. Nevertheless, I'm buying Steinberg's WaveLab 4.0, which I consider to be the fastest and most intuitive program on the market. I only wish it had a true multitrack mixer so that I could manipulate the volume of many tracks at once.

Plug-ins. What about special effects? My audio can't leave home without them. Though the Kyma System allows me to create a vast range of audio-processing functions, it never hurts to have other options available directly from within my audio software. For that reason, I'm adding the first two volumes of Steinberg GRM Tools VST plug-ins to my list, and I'm using Spin Audio's free VST-DX Wrapper Lite to ensure that the GRM Tools show up in Acid and any other DirectX host I end up with. I'll also pick up a copy of Waves' Native Power Pack 3, which not only has a beautiful reverb and excellent EQs but also offers the one tool that I've used on nearly every piece of music I've ever created on a computer: the L1 Ultramaximizer.

MIDI fader box. I'm buying a Peavey 1600x MIDI fader box so I don't have to mix audio using my mouse. The 1600x provides 16 faders and 16 buttons—each of which can be separately programmed to send any MIDI message, including System Exclusive strings—so I can use it to edit MIDI devices as well as to control my sequencer. A pair of control-voltage (CV) inputs enables me to use CV footpedals to control anything MIDI. To top it off, I can save complete setups as Scenes.

MIDI keyboard. A Kurzweil SP76 keyboard will serve nicely as my MIDI keyboard, with its 2 ribbon controllers, 32 internal patches, and 32-note polyphony. The SP76 can transmit on two channels at once, which will be handy when I use it with some of the more complex Kyma sounds I'm exploring.

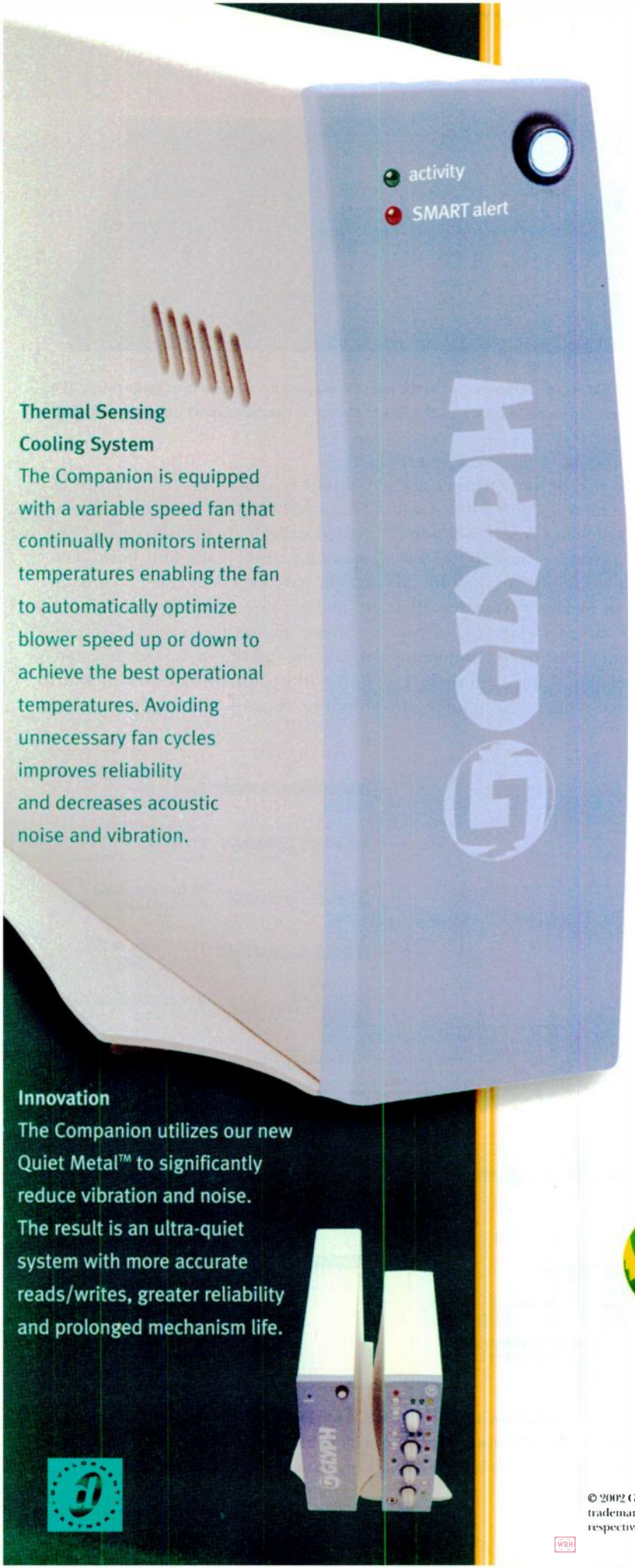
With my $15,000 studio, I can look forward to many years of productivity.

The Studio without Computer $ 30,000
Thirty Thousand DOLLARS
Bank of EM *By Brian Knave*

Thirty grand may sound steep for a studio these days, especially considering the powerful computer-based rigs Miller and Rubin put together for half that amount. By my calculations, though, $30,000 is roughly the minimum required to outfit a traditional-style studio with enough decent gear to record and mix bands.

Taking recording and mixing bands as my cue, I have put together a high-quality but straightforward recording studio, complete with a slamming mic cabinet, a rack full of outboard gear, mixer buses directing the flow of electrons rather than bits, and even some big knobs to turn. If you're the type who prefers the simplicity, immediacy, and more visceral, hands-on approach afforded by a traditional studio environment, then you've come to the right place.

Three overriding concerns guided my gear selections: pristine signal capture and flow, maximum system versatility, and component reliability. Furthermore, I designed with an eye toward



Thermal Sensing Cooling System

The Companion is equipped with a variable speed fan that continually monitors internal temperatures enabling the fan to automatically optimize blower speed up or down to achieve the best operational temperatures. Avoiding unnecessary fan cycles improves reliability and decreases acoustic noise and vibration.

Innovation

The Companion utilizes our new Quiet Metal™ to significantly reduce vibration and noise. The result is an ultra-quiet system with more accurate reads/writes, greater reliability and prolonged mechanism life.

The perfect companion is smart, quiet, cool and portable.

Glyph's Companion™ is the perfect match for your micro-studio. Designed specifically for Digidesign's Mbox, it is a high performance FireWire storage solution that is loaded with new technology. Equipped with state of the art 7,200 RPM hard drives, the Companion features S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology). S.M.A.R.T. protects your data with predictive failure analysis. This system warns you of issues with your storage subsystem before it's too late. The Companion also features advanced composite metal technology to reduce noise to help keep your studio quieter.

To prolong the life of your Companion, we've installed thermal sensing cooling. Available as 80GB or 120GB, this is a FireWire storage system you can't afford not to own.

As an artist you should store your art (data) on the highest quality medium you can afford. Totally portable and easy to use, the Companion is a partner you will discover you can't live without. Call us or contact your Authorized Glyph Dealer today to learn more about the Companion.

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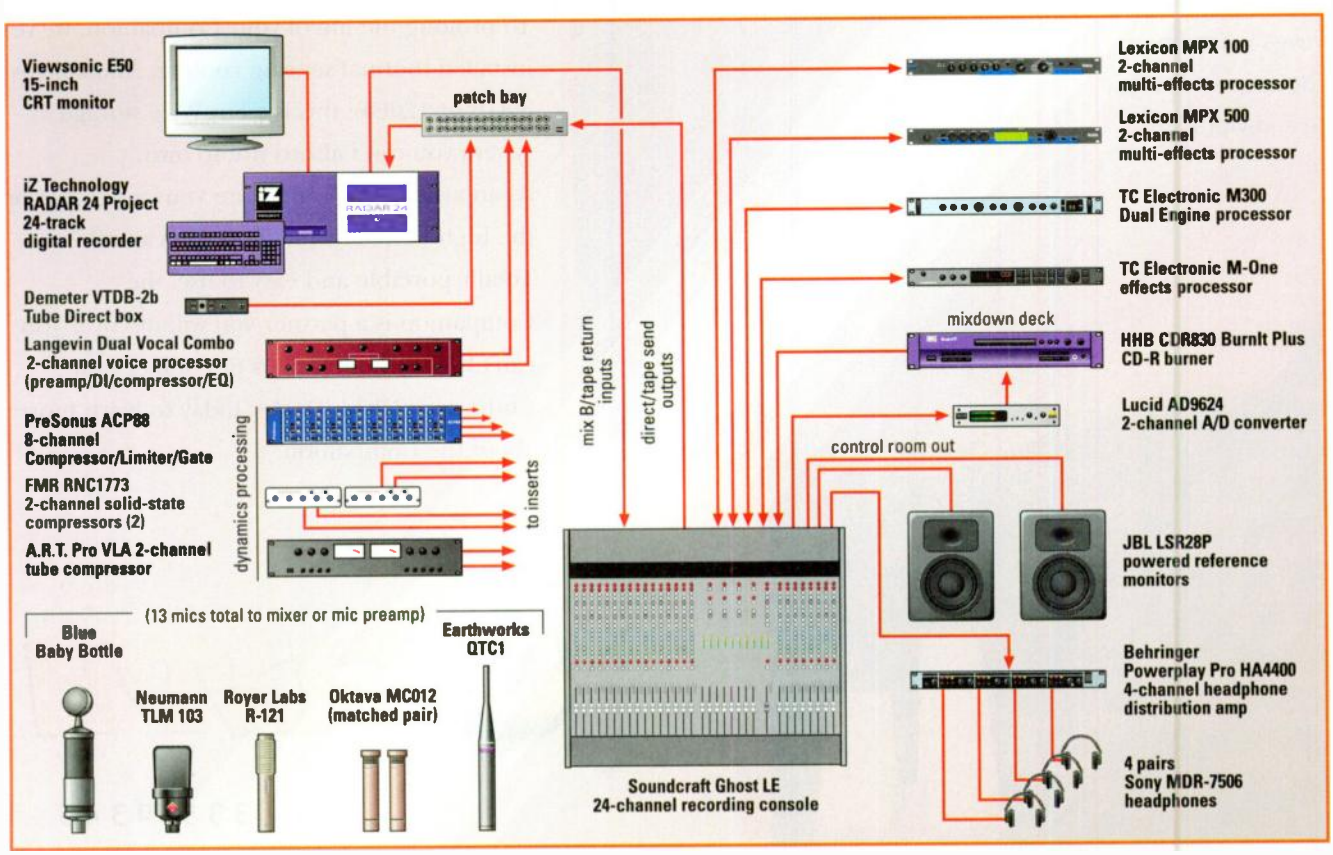
The Soundcraft Ghost is widely regarded as the finest analog mixing console in its price range. The Ghost LE has all the same features as the Ghost except for the transport controls and MIDI implementation.

growth: this setup readily accommodates expansion.

In short, this system is built to rock. It's also built *like* a rock, simple and solid, and therefore should provide consistent, trouble-free operation for years to come. You may even find—dare I suggest it?—that this studio offers a level of sound quality not quite within reach of the other systems profiled in this article. The truth is, were I actually given $30,000 in real money for the purpose of putting together a studio from scratch, this is precisely how I would spend those dollars.

The core. Though I could easily have enlarged my system by economizing on core components (mixer, recorder, and reference monitors), I decided that was not the place to cut corners. The wiser course is to invest foremost in the core stuff, which I am doing to the tune of nearly half my budget. Fortunately, that approach enables a marriage of two units I consider to be the best sounding and most reliable available in their respective price ranges: the Soundcraft Ghost LE analog mixer and the iZ Technology RADAR 24 Project digital recorder. Both are open to expansion, upgrades, and repair, and both companies have excellent track records in terms of customer service and support.

Mixer. Naturally, I would have preferred the full-blown, 32-channel standard Ghost, which features onboard machine control, MIDI support, mute



The $30,000 studio without computer is a traditional setup maximized for recording and mixing bands. It employs a Soundcraft Ghost LE 24-channel mixer, a RADAR 24 Project 24-track modular hard-disk recorder, JBL LSR28P active monitors, a quality 2-channel preamp and voice processor, a first-rate tube DI, 16 channels of dynamics processing, four multi-effects processors, and a versatile, high-quality mic cabinet.

HOT SOFTWARE PROGRAMS FROM PG MUSIC!

BAND-IN-A-BOX (for Windows® & Macintosh®)

INTELLIGENT MUSIC SOFTWARE FOR YOUR PC OR MAC* IS HERE!

Version 11 for Windows® is here—Automatic Accompaniment has arrived!

** NOTE: Band-in-a-Box for Macintosh® is currently available at version 8.0*

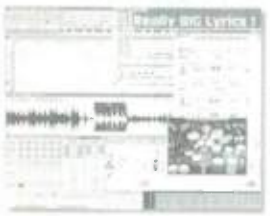
The award-winning Band-in-a-Box is so easy to use! Just type in the chords for any song using standard chord symbols (like C, Fm7 or C13b9), choose the style you'd like, and Band-in-a-Box does the rest... automatically generating a complete professional quality five instrument arrangement of piano, bass, drums, guitar and strings in a wide variety of popular styles.

"One of the few music products that sits in the 'must-have' category."
Sound On Sound, July 2000

Band-in-a-Box Pro Version 11...$88
Includes Version 11, Styles Sets 1-3, Harmonies Set 1, Soloist Set 1, Melodist Set 1 & bonus software SlowBlast! (Windows® version only)

Band-in-a-Box MegaPAK version 11...$249
The MegaPAK contains "the works" – version 11 PLUS Styles Sets (1-29), all Soloist Sets (1-9), Melodists (1, 2), The MIDI Fakebook, PowerGuide Instructional CD-ROM, & bonus software SlowBlast! (Windows® version only)

NEW! PowerTracks Pro Audio 7.0... $29



PowerTracks Pro Audio 7.0 now harnesses the power of the popular **DirectX audio plug-in format with DirectX support**. With **48K sample rates, improved resolution** in the audio edit window and a new **CD-R burning feature** you can easily make edits and overdubs of any audio track, and when you're ready to let others hear your composition, you can **"burn"** it directly to an Audio-CD with your CD-R or CD-RW drive. You can even save your composition in **Windows Media Format**, leaving you with a file all ready to be uploaded to your **web site** and played over the Internet, with great fidelity over a wide selection of streaming rates. **New Notation Options** allow you to **highlight any section of the notation window**, quickly change the pitch of any MIDI note, and **Print-preview** your composition before you print it using **sizable fonts**. You can even save each page as a **graphics file** to post to the Internet or e-mail to a friend. PowerTracks Pro Audio 7.0's mixer has been enhanced with a **New Master Volume** control that lets you change overall levels without affecting individual tracks, keeping your mix intact. Individual track names are now displayed as you move your cursor over any channel strip. There is also **Improved Resolution for precise audio editing. It's like having a 48 track recording studio on your computer!**

- **PowerTracks Pro Audio 7.0 for Windows®**... $29
  PowerTracks Pro Audio 7.0 + PowerGuide CD-ROM video training, 2 CD-ROMs
- **PowerTracks PowerPAK**... $49
  PowerTracks Pro Audio 7.0, PowerGuide CD-ROM video training and MultiTracks Volume 1, 5 CD-ROMs
- **PowerTracks PowerPAK Plus**... $59
  PowerTracks Pro Audio 7.0, PowerGuide CD-ROM video training, MultiTracks Vols. 1 & 2, Bonus software ***SlowBlast!*** *included, 8 CD-ROMs*

"Solid sequencing at an unbelievable price"
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Jazz piano legend Oscar Peterson brings an exciting new level of artistry to the Multimedia experience in this signature CD-ROM. This rich treasury integrates interactive audio/visual performances with on-screen piano display and notation. You can see and study exactly what the master is playing! Join Oscar for a musical journey through his life and career. There's also a comprehensive Multimedia autobiography loaded with audio and video clips **PLUS** exclusive photographs from Oscar Peterson's private collection.

OSCAR PETERSON NOTE FOR NOTE
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Transcriptions of Classic Recordings: Over 200 pages of music PLUS performances on audio CD!

Masterclass & Guitar Solos SRP $49 per volume

Jazz Piano MasterClass CD-ROM: Vols. 1 & 2... $49
Master jazz pianist **Miles Black** is your teacher in a multimedia software program designed to illustrate basic skills to the beginning pianist while enhancing the skills of more advanced pianists. You'll study over 60 topics such as Roots and Shells, Block Chords, Stride Piano, Playing the Blues, Scales, Common Progressions, Improvisation and more. All lessons are accompanied by practice exercises, backing tracks, further illustrated with 11 tunes included in the program. Interactive audio lessons with on screen piano display and notation let you see and hear exactly what Miles Black is playing.

Jazz Guitar MasterClass CD-ROM: Vols. 1 & 2... $49
Master jazz guitarist **Oliver Gannon** is your teacher in this software program designed to illustrate basic skills to beginning guitarists while enhancing skills of more advanced guitarists. Study over 60 topics such as Chord Voicings, Inversions, Right Hand Techniques, Comping, Scales, Modes, Arpeggios, Common Progressions, Improvisation and more. All lessons are accompanied by practice exercises, backing tracks, further illustrated with the included 10 tunes. Interactive audio lessons with on screen guitar display and notation let you see and hear exactly what Oliver Gannon is playing.

Master Jazz Guitar Solos PAK Volumes 1, 2 & 3... $99
This interactive program is designed to help you learn to solo like a professional jazz guitarist. Musicians studying improvisation frequently learn by copying other soloists' performances. Since guitar is a "visual instrument", it is often easier to learn to play by watching the fretboard than by reading the music from a staff. The on-screen guitar fretboard in **The Master Jazz Guitar Solos PAK** shows you exactly which notes and chords are being played, in real time as you hear the music. We've even included "guide notes" for common fretboard positions that are displayed on the on-screen guitar fretboard to help you learn the note names, string and fret positions. **The Master Jazz Guitar Solos PAK** contains over 150 songs designed to illustrate basic skills to the beginning guitarist while enhancing the skills of more advanced guitarists.

Master Jazz Guitar Solos Volume 1... $49
Full featured program includes over 50 tunes with jazz guitar solos in the style of the great Jazz Guitarists (Joe Pass, Pat Metheny, John Scofield and others). What a great way to learn jazz guitar soloing! Let a master show you solos in the styles of the greats. All tunes are done in MIDI format with a complete band arrangement (drums, piano, bass, guitar). Watch and learn the tunes as they play on the guitar fretboard, notation and tablature. Slow the music to the tempo you want, or step through the solo note by note.

Master Flatpick Guitar Solos Volume 1... $49
Full featured program including 50 tunes with guitar flatpick solos in styles similar to Doc Watson, Jerry Reed and others. Since guitar is such a visual instrument, it is easiest to learn by watching the on screen guitar as a flatpick master plays these great solos. Slow the music to the tempo you want, or step through the solo note by note. View or print out the material in notation and tablature.

Pianist Performance Series

The Blues Pianist Volume 1 & 2... $49 per volume
Volume 1: *50 selections, older styles*
Volume 2: *50 selections, newer styles*

We've recorded great down-home blues piano stylings by top professionals, 100 selections in all. A wide variety of blues piano styles are included – Boogie Woogie, Slow/fast boogies, New Orleans style, Chicago blues and more.

The Latin Pianist... $49
The Latin Pianist is a music software program containing over 50 Latin and Salsa pieces recorded live to MIDI by popular Latin pianist Rebeca Mauleon-Santana (editor of Sher Music's Latin Real Book) in a wide variety of Latin Piano styles. The Latin Pianist includes authentic piano songs and styles.

The Modern Jazz Pianist... $49
The Modern Jazz Pianist is the software that makes it too easy to learn how to be a great Jazz pianist. Top studio musicians Renee Rosnes, Miles Black, Ron Johnston, and Brad Turner perform over 50 tunes in a wide variety of modern Jazz styles.

The New Age Pianist... $49
This program includes over 70 "New Age" and "New Age-Jazz" style piano pieces, performed by top New Age Artists. This is a beautiful collection of solo piano compositions inspired by the natural world. Learn all about New Age piano music, where it came from, and how it's played.

Multimedia Performance Series CD-ROMS (for Windows®) $49 per volume

THE ROCK SAXOPHONIST
Multimedia Instrumental Program

Fully featured professional music program containing studio recordings of great Rock 'n' Roll saxophone music. Hot session players perform great sounding Rock music, while you learn the riffs and tricks! Seamlessly integrated MultiTrack audio, MIDI, chord symbols, and music notation and chord progressions.

THE JAZZ SAXOPHONIST
Multimedia Instrumental Program

Listen to hot session players perform great sounding Jazz music, while you learn the riffs and tricks! This interactive program has great "chops" – nearly an hour of hot Jazz plus tips and techniques. Seamlessly integrated MultiTrack audio, MIDI, chord symbols, and music notation for your sound card equipped PC.

THE BLUES GUITARIST
Multimedia Guitar Program

Professional fully featured music program containing studio recordings of great electric Blues guitar music. Listen to hot session players perform great sounding Blues music, while you learn the riffs, licks and tricks! This interactive program has great "chops" – nearly an hour of hot Blues plus tips and techniques.

THE BACH CHORALES Volumes 1 & 2
Multimedia Vocal Program

Inspiring performances of J.S. Bach's famous four-part Chorales by a professional choral ensemble, complete with a detailed multimedia history of the composer's life and times. On-screen notation, lyrics and chord progressions in perfect time with the singers.

THE ROCK GUITARIST
Multimedia Guitar Program

Listen to hot session players perform great sounding Rock music while you learn the riffs, licks and tricks! Multimedia features give you the ability to mute or solo any audio track independently and study or play the part yourself. On-screen notation, tablature and chord progressions scrolls by with the band.

THE BARBERSHOP QUARTET Volumes 1 & 2
Multimedia Vocal Program

All-time favorite Barbershop songs and an interactive multimedia history of barbershop singing in America. Made with the assistance of **SPEBSQSA** (Society for the Preservation and Encouragement of Barbershop Quartet Singing in America).

THE SOR STUDIES FOR CLASSICAL GUITAR
Multimedia Guitar Program

Superb professional classical guitar performances of all 121 of Fernando Sor's celebrated studies for guitar (Opus 6, 29, 31, 35, 44 and 60 complete). This interactive program contains hours of music on 3 CD-ROMs **PLUS** complete Sor biography, historical timeline, and more powerful multimedia features.

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grouping, and even mute automation (when connected to a sequencer). However, it would simply eat up too much of my budget. So I settled for the pared-down, 24-channel Ghost LE, which has the same audio components but does away with the transport control and MIDI facilities.

At this point, given the obvious control and feature advantages of digital mixers (automation, onboard effects and dynamics processing, and so on), you're probably wondering why I'm choosing an analog console. One reason is user-friendliness; you know what's going on at a glance with the Ghost, which cannot be said of most digital boards. Another reason is ease of servicing: the Ghost's vertical circuit boards allow the unit to continue functioning even if an individual channel is removed for repair, whereas if something goes wrong with a digital mixer, you normally have to return the whole unit. I also considered overall system integrity: analog mixers are simply more mature as a technology than their digital counterparts.

The main reason, however, is sound quality. In my opinion, the Ghost is the best-sounding, best-featured, and most versatile midlevel analog mixer available off the shelf today, and it sounds better overall—warmer and more musical—than comparably priced, full-featured digital mixers. Admittedly, the sonic differences may be subtle, but once you start working with the EQ and mic preamps, the Ghost kicks butt on digital mixers. In particular, having 24 high-quality mic preamps simultaneously available—potentially a necessity when recording bands—saves me a bundle on outboard preamps. The smooth, musical quality of the Ghost's 4-band EQ (two bands are fully parametric) is also a big selling point. I could go on to elucidate many other, professional features the Ghost has that comparable digital (and other analog) mixers don't—individually switchable phantom power and phase reverse on each channel, for example—but you get the idea.

MAX CRACE

One of the few urban myths that turns out to be true, the FMR RNC1773 (Really Nice Compressor) actually does provide precision control, accurate metering, and transparent dynamics control across a big range of instruments and settings—all for less than $100 per channel.

Recorder. I have already expressed my opinion that RADARs are the best-sounding and the most reliable digital recorders currently available in their price ranges. But of course, I'm hardly alone in that opinion. Since the first RADAR came out in 1993, countless users have praised it for its analog-tape-like sound, ease of use, bulletproof ruggedness, and crashproof resilience. Not surprisingly, the majority of users have been pro engineers working in major studios—which, until recently, was the only place that you were likely to encounter a RADAR.

But that's changing fast. The price of the RADAR came down substantially a few years ago, from over $25,000 to around $10,000 for a 24-track system. The amazing price breakthrough, however, came just recently (in March 2002) with the announcement of the RADAR 24 Project system. Like the pricier RADAR 24 Classic ($9,995), the Project offers 24 channels of analog I/O on six rear-panel DB25 connectors, and it records at sampling rates up to 48 kHz. The sound quality of the two models is identical. One difference between models is that the Project comes with a scaled-down controller (the KC-24, a simple keyboard remote rather than the sturdier, full-featured Session Controller) and without the meter bridge, which attaches to the Session Controller. The other difference is that the Project records to an internal 40 GB IDE hard drive rather than to a removable 36 GB SCSI hard drive, the standard on the three higher-end RADAR models.

It's worth noting that the primary criticisms the **EM** reviewer leveled against the RADAR only a year ago (see the July 2001 issue)—editing capabilities that were cumbersome and average and no way to exchange file and session data except in real time—have been rectified. Editing capabilities are much improved on the latest RADAR systems, and now you can export WAV and time-stamped Broadcast Wave files.

The 24 Project system offers backup using external SCSI and Ethernet. But

The price of the RADAR has come way down to less than six grand, thanks to iZ Technology's RADAR 24 Project, which records onto a 40 GB IDE hard drive.

The fastest, easiest and smartest way to get into computer audio

US-224 DIGITAL AUDIO WORKSTATION CONTROLLER/USB INTERFACE

US-224:

The affordable, portable solution for computer recording

Feel like everyone in the world is deep into computer recording – except you? There's an easy solution: the **US-224**, co-developed by TASCAM and Frontier Design Group. It's the perfect bridge between your music and your Mac or PC. It connects via USB, so all you have to do is plug in your instrument and plug in your computer. It's USB powered, so you don't even need an outlet to get rockin'. Then start up the included Steinberg Cubasis VST audio/MIDI recording software and boom... you've reached computer recording nirvana, with all of its creative advantages. Plus, with the US-224's faders and knobs, you can control your software's parameters without having to reach for the mouse.

Want a fast, easy and remarkably inexpensive way to take advantage of computer audio? Visit your TASCAM dealer or check out **www.tascam.com** for all the news on the US-224.

TASCAM US-224 by FRONTIER DESIGN GROUP

TASCAM
a whole world of recording

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I am choosing to outfit my system with the optional DVD-RAM backup, a seamless and ultimately more cost-effective solution. Note, too, that I'm selecting a CRT monitor, the 15-inch ViewSonic E50. The monitor plugs directly in to the back of the RADAR 24 Project to provide audio metering.

Thankfully, the 24 Project is compatible with all other RADAR I/O cards and accessories and is fully upgradeable to the highest-level system (RADAR 24 S-Nyquist). That means I can start out at the affordable Project level and move up the ladder as my budget permits. But no matter what rung I'm on, I feel pretty grand with the RADAR.

Speakers. Choosing reference monitors is easy. I and many others I know (including some famous mixers I sort of know) have fallen in love with the JBL LSR28P active biamplified monitors. From all reports, the LSR28Ps are simply the most sonically accurate reference monitors available in their price range. One name mixer conducted his own extensive shoot-out of more than 20 celebrated monitors. He ended up choosing the JBLs and has since mixed on them exclusively. Though I've used them only as a guest in someone else's studio, I was soon hooked, too.

Of course, monitoring isn't restricted to reference speakers. My studio is all about recording bands, so I also need four pairs of headphones—at once the fewest I can get away with and the most I can afford—and a headphone distribution amp. My pick for phones is the Sony MDR-7506. They're comfortable, sufficiently isolated, quite accurate, and—very important—loud and bright enough for rock 'n' roll. They're also fairly rugged. Of the five pairs that have seen regular use (and abuse) in my studio for the past 11 years, only one has bitten the dust.

I am also adding the spiffy new Behringer Powerplay Pro HA4400 distribution amp. This unit is remarkably well featured, especially given its rock-bottom price. In addition to the requisite stereo amp, jack, and level pot, each channel provides 2-band EQ, output-level metering, left and right mute switches, a mono switch, and—get this—a stereo aux input with balance control. The specs are impressive, too, and the back panel sports servo-balanced, gold-plated XLR and TRS I/O.

Microphones. I'll allot my next big chunk of dough—nearly six grand—to mics. Rather than pick two or three superexpensive models, I am going for a generous and varied selection of high-quality, though mostly bargain-priced, units. That gives me a wide palette of colors and responses to work with, increases my chances for optimum capture of different sound sources, and allows for the mic-intensive application of recording a band with everyone playing at once, including a drummer behind a five-piece kit.

To accommodate a range of vocalists, I first need two excellent but quite different-sounding large-diaphragm condensers: the esteemed Neumann TLM 103, which has the characteristic Neumann presence boost and a big low end, and the Blue Baby Bottle, which more emphasizes a warm, full midrange. Both mics are also good on a wide range of other instruments. For those seeking to add a tube mic to the equation, I recommend swapping out the TLM 103 for the lovely sounding Røde NTK—a similarly bright condenser at about the same price but with a silky touch of tube flair.

With its unique design; smooth, unhyped sound, Class A discrete electronics, and exceptionally low price, the Blue Baby Bottle is bound to find favor with studios at every level.

To further extend the sonic palette of my mic cabinet, I am including two distinctive microphones that have come to be all but indispensable to my productions: the Earthworks QTC1 single-point omnidirectional condenser and the Royer Labs R-121 ribbon mic. I love Earthworks mics for their incredible realism and nearly flat response (from 4 Hz to 40 kHz for the QTC1), versatility (they work great on pretty much any source for which you want accuracy of sound capture), and ease of positioning. The omni models are especially useful because there is no bass boost from the proximity effect. You can, for example, shove a QTC1 right up to the sound hole of an acoustic guitar and capture a stunningly lifelike sound with no unwanted low-end buildup.

The R-121 ribbon, on the other hand, is all about smoothly attenuated highs

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and warmly emphasized low mids, making it an excellent choice for guitar amps, bowed strings, harmonica, certain woodwinds and percussion, and lots of other stuff.

Except for one mic, the rest of my cabinet is chosen specifically to accommodate miking a five-piece drum kit. But even here, I am purposely including models, some of which are classics, that are prized in other applications, as well. For overheads I can't find a better value in the small-diaphragm-condenser department than a matched pair of Oktava MC012s. Originally designed to record symphony orchestras, this modular, Russian-made mic comes with a set of three interchangeable capsules (cardioid, hypercardioid, and omnidirectional) and an insertable 10 dB pad, so versatility is a given.

The other small-diaphragm condenser in my cabinet, earmarked for hi-hat, is the Crown CM-700. This accurate yet relatively warm-sounding electret features two built-in highpass filters—handy for dialing out unwanted low resonance from some hi-hat cymbals.

My favorite kick-drum mic, at least among dynamics, is the Electro-Voice N/D868, which captures a beautifully round and fat thump. I know I can't go wrong with the Shure SM57 on snare drum, and it's a good pick for guitar amps, as well. For rack toms, I'll go with my all-around favorite low-cost handheld dynamic, the Audix OM2. This mic has exceptionally good transient response and a warm, natural sound. (Insider's secret: the OM2 employs the same capsule as the more expensive Audix D-2 "tom mic.")

Had there been no budget constraints, I would probably have chosen the Sennheiser MD421 II for all of my tom duties. But at least I can get one

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421 into the mix—for miking floor tom. This is a useful, classic large-diaphragm dynamic mic. In addition to sounding great on toms, it also shines on kick drum, guitar amps, and even certain vocalists.

Last but not least, I am adding another large-diaphragm dynamic, the beyerdynamic Opus 65 (formerly known as the TG-X 50). This mic's superior transient response and unhyped tonality makes it the most natural-sounding large-diaphragm dynamic I've used on bass drum. It makes a great choice for miking compact, open-tuned, double-headed jazz kicks. Here, though, I'm including the Opus 65 for recording bass amps, an application at which it truly excels. (Whenever possible, I record bass guitar on two tracks, with one signal from a DI box and the other from the miked amp.)

Mic preamp and DI. As I said earlier, I'm happy with the sound of the Ghost's ProMic preamps, and I'm confident they will suffice to keep people at a pro level in their recording endeavors. Still, an assortment of top-shelf outboard mic preamps—some tube, some solid state; some with transformers, others without—would help push this studio to greater sonic heights and diversity.

Though my price ceiling prohibits the luxury of an assortment, I think it essential to include at least one high-end mic pre. Most attractive are the multi-functional voice-processor units with onboard EQ and compression for those times when I need to shape the sound going to the recorder. My pick is the lovely Langevin Dual Vocal Combo, a 2-channel, Class A discrete, Manley-made unit that not only adds a touch of class to the studio but also extends its capabilities considerably. In addition to impeccable sonics, each DVC channel provides a front-panel DI input, very musical high and low shelving EQ, and a wonderfully smooth electro-optical compressor that I can turn around and use on the stereo-mix bus after I've finished tracking. Truly, this box is an awesome and versatile performer.

Bass matters tremendously in a mix.

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To ensure fat, ultraclean bass signals, I also specify a premium tube DI, the Demeter VTDB-2b Tube Direct. This unit delivers a mouthwatering balance of deep, focused bottom and clear, overtone-rich highs—the perfect complement to that unruly miked bass-amp signal. Of course, the VTDB-2b also sounds great on guitar, synth, and most any other instrument coming in at line level.

Patch bay. I also need a patch bay to allow direct-to-RADAR recording from the preamp or DI. That way I can keep the Ghost preamps permanently routed to the RADAR and insert outboard units at will. I'm selecting the Ace Products APB48S, a 48-point patch bay with ¼-inch TRS I/O and silver-plated brass contacts. The APB48S also features modular PCB cards that let you change the routing configuration of each vertical channel from half normaled to denormaled (or vice versa) simply by turning the card around.

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Behringer Powerplay Pro HA4400 4-channel headphone distribution amp	$95
Beyerdynamic Opus 65 large-diaphragm dynamic microphone	$349
Blue Baby Bottle large-diaphragm condenser microphone	$649
Crown CM-700 small-diaphragm condenser microphone	$299
Demeter VTDB-2b Tube Direct box	$599
Earthworks QTC1 omnidirectional condenser microphone	$1,000
Electro-Voice N/D 868 large-diaphragm dynamic microphone	$310
FMR RNC1773 2-channel solid-state compressors (2)	$398
HHB CDR830 BurnIt Plus CD-R burner	$649
IZ Technology RADAR DVD-RAM backup option	$695
IZ TechnologyRADAR 24 Project 24-track digital recorder	$5,995
JBL LSR28P powered reference monitors	$2,242
Langevin Dual Vocal Combo 2-channel voice processor	$2,000
Lexicon MPX 100 2-channel multi-effects processor	$299
Lexicon MPX 500 2-channel multi-effects processor	$599
Lucid AD9624 2-channel A/D converter	$899
Neumann TLM 103 large-diaphragm condenser microphone	$995
Oktava MC012 small-diaphragm condenser microphones (2)	$659
PreSonus ACP88 8-channel Compressor/Limiter/Gate	$1,199
Royer Labs R-121 ribbon microphone	$1,195
Sennheiser MD421 large-diaphragm dynamic microphone	$485
Shure SM57 small-diaphragm dynamic microphone	$146
Sony MDR-7506 headphones (4)	$500
Soundcraft Ghost LE 24-channel recording console	$5,495
TC Electronic M300 Dual Engine processor	$299
TC Electronic M-One effects processor	$699
ViewSonic E50 15" CRT monitor	$151
TOTAL	**$29,997**

Dynamics processors. Digital mixers certainly offer advantages, with dynamics processors on every input and output and even on aux buses. For me, however, the really cool thing about using outboard analog compressor/limiters is that each model has its own response characteristics and "sound." This lets the engineer further shape and color the mix by assigning different compressors to different instruments—for example, a VCA-based solid-state compressor to a bass track, an opto tube compressor to a vocal track, and so forth—depending on the mood of the song. Even with sophisticated modeling, that's something you don't quite get with digital. Of course, such luxuries come at a price.

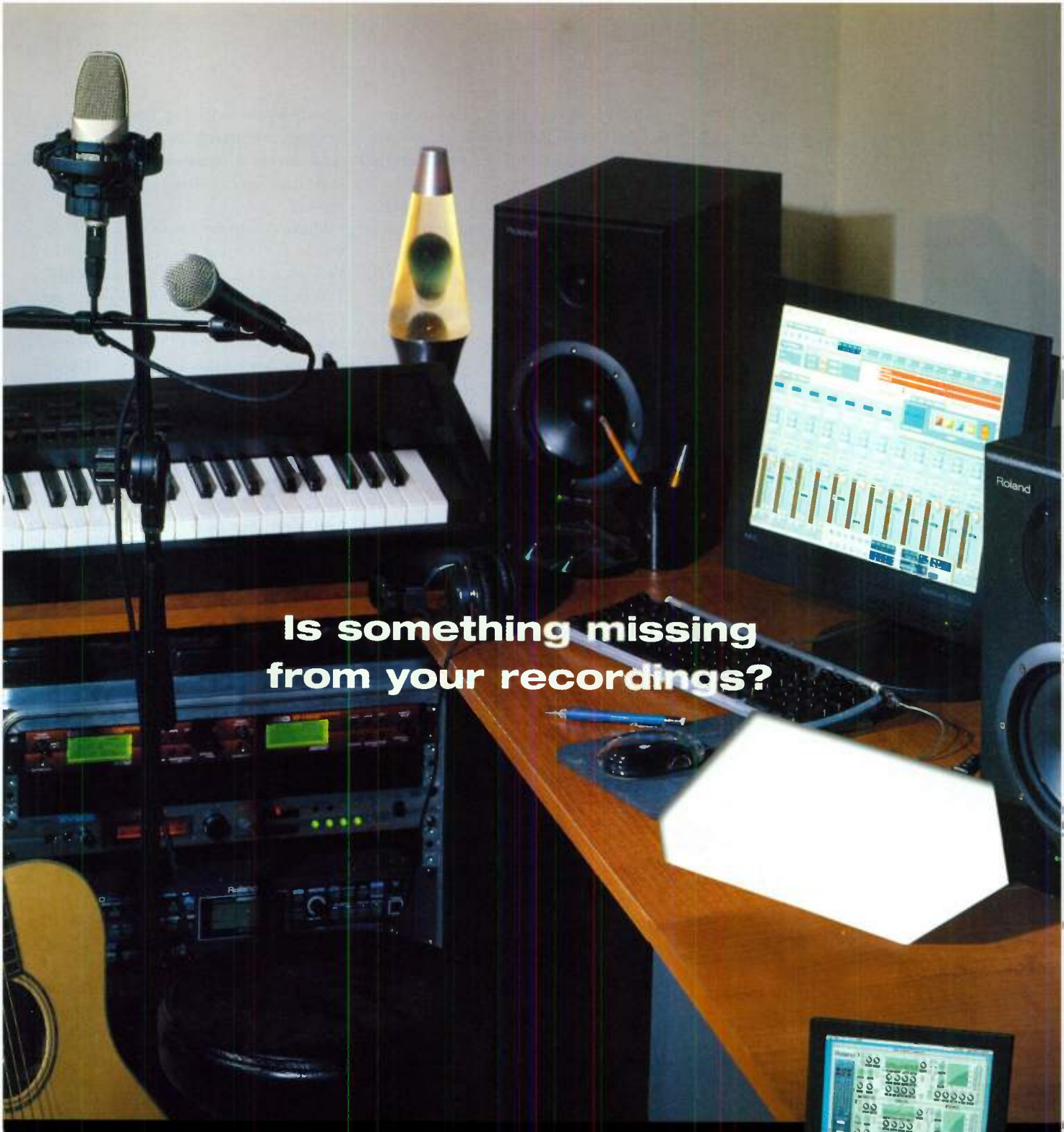
For this studio setup, I can't afford to have a dynamics processor on every channel—at least not with the units I want—nor can I purchase exorbitantly priced boutique compressors. I can, however, nicely cover 16 of my 24 channels (including using the Dual Vocal Combo) with compression or limiting, and I can cover eight of those channels with gates, as well. A single box, the smartly designed 8-channel PreSonus ACP88 Compressor/Limiter/Gate, is doing most of the work, including all of the gating. This straightforward, VCA-based unit is a fine performer with a transparent sound. I am also including two 2-channel FMR RNC1773s, which really are Really Nice Compressors.

I am greatly disappointed to learn that one of my favorite inexpensive compressors, the Joemeek C2, a half-rack stereo unit with optical control, has been discontinued. This puts a hurt on my studio's mix capabilities, as I know of no other unit in the same price range (under $400) that can do what the rad little C2 could. Then again, I'm saving some dollars by not being able to include it.

My other favorite expensive-sounding inexpensive compressor the 2-channel A.R.T. ProVLA, is fortunately still available. This soft-knee-style leveling amplifier uses hybrid tube/solid-state circuitry and optical control to produce smooth, warm compression reminiscent of vintage units but with a flavor all its own. I typically use the ProVLA on vocals but have also received great results on harmonica, pedal steel, synth pads, and bass tracks.

Effects processors. Elsewhere in my studio, I wish to increase sonic diversity by selecting items from a range of manufacturers—each company does things differently, after all, which leads to different sounds. But when it comes time to choose digital effects processors, I proceed directly to two names I have come to trust: Lexicon and TC Electronic. (An Eventide processor would be a great choice, too, but would derail my budget.)

I had a tough time determining whether to go with three or four effects units. Sure, I know it's possible to turn out slamming mixes using only one effects processor—or even none at all if you have killer tracking rooms. But then I remembered the most recent album I mixed and how often I had to compensate for this or that problem (usually



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caused by the sonically screwed-up spaces the tracks were recorded in) and how, even though the music was simple, five or six effects were often run, albeit subtly. Given that the big-name manufacturers have come to market with low-priced, 24-bit gems, four was the right minimum.

From Lexicon I am adding the MPX 100 and the MPX 500, each of which offers 240 great-sounding presets, including some dual programs. The 100, which I love as much for its simplicity as for its palette, is the perfect box for quickly dialing in, say, some ambience behind a row of tracks. The 500 is just as easy to use in its way, thanks to a superintuitive interface, but it gives you far more tweaking power than the 100—important when working with featured tracks.

I have gotten my hands on a TC Electronic M-One just once, but boy, did I love what I heard. This box has "only" 100 presets, mostly reverbs—but of course, it's the handful of algorithms behind those presets that makes the unit so desirable. Until the M-One came along, those coveted TC sounds had never appeared in a unit costing under a grand. Now with the release of the new M300 Dual Engine Processor, TC has opened its doors to the masses. To be honest, I haven't even heard the M300 yet; but based on how it looks and what I know to be inside, I don't hesitate to add one to my studio.

With the M300 Dual Engine Professor, TC has opened its doors to the masses.

Mixdown. I still mix to a primitive DAT recorder in my studio—I know, I know—but for this setup, I'm ready to get with the times and burn right to disc (rather than disk). Problem is, I haven't used any of the standalone CD-R burners out there, so I defer to Robair in my selection of the new HHB CDR830 BurnIt Plus standalone CD-R burner. Based on features and specs, the BurnIt Plus appears to be the best deal going, and Robair loves his.

Still, after all the signal care I've taken thus far, I'm reluctant to entrust my final mixes to the stock converters on an inexpensive CD burner. That's why I'm also choosing a Lucid AD9624 stereo A/D converter. This is a box I've used extensively, so I can vouch for its excellent sound and build quality. The AD9624 supports multiple sampling rates—96, 88.2, 48, 44.1, and 32 kHz—at true 24-bit conversion. And yes, you

really can hear the difference, even when playing back at 16 bit (which the unit also allows, thankfully). Analog input (fed from the Ghost console) is on XLR connectors, and the digital bitstream is output simultaneously through both AES/EBU and S/PDIF coaxial and optical Toslink connectors. I'm going with the AES/EBU connection, thank you, which the BurnIt Plus accommodates.

Future expansion. I realize I'm taking some risks running this studio with no power conditioning, and I'd hate to lose a magic take because of a power problem, so among the first things I'll add in the future (aside from patch bays) are a couple of APC Back-UPS Pro 650AVs.

One whole category I ended up losing, regrettably, was equalizers. The box of choice—or at least, the best one I thought I could afford—was the Nightpro EQ3D, a sweet-as-honey broadband EQ I intended to put just before my A/D converter and secret mix weapon (more on that in a moment). Another unit I had hoped to install near the end of the signal path was a BBE 882 Sonic Maximizer, a box that does a little delay trick I have always liked.

Mics I was forced to leave out include the Lawson L47MP, a versatile and distinctive-sounding large-diaphragm tube condenser; the illustrious Blue Kiwi; and the Shure 520DX "Green Bullet," which I sometimes use as an effect mic on drums, vocals, or what have you.

Other preamps I tried to keep in the mix include the mono Grace Design Model 101, the 2-channel PreSonus MP20, the 4-channel Sytek MPX-4Aii, and the Peavey VMP-2, which remains the best deal in a 2-channel, all-tube preamp/DI that I know of.

As for dynamics processors, I hated losing the Drawmer MX30 and the Drawmer 4-channel MX40 Punch Gate, which is a gem for drum processing. But I really hated not being able to include at least one Empirical Labs ELP8 Distressor—one of the best-sounding compressors I've ever used and certainly the most multifaceted.

I already alluded to one of the other multi-effects processors I wanted: the vast and versatile Eventide Eclipse Harmonizer. Another that I was keen on, though I could hardly justify the thing because it's pretty much a one-trick pony, was the Demeter Real Reverb.

Speaking of analog, and in particular the sound of analog tape, I'll conclude by singing the praises of the "secret weapon" I alluded to a moment ago, a 2-channel mix accoutrement I wanted desperately to install just after the broadband EQ that I also couldn't afford. That box is the Empirical Labs FATSO, also known as the Full Analog Tape Saturation Optimizer. Beyond that acronymic mouthful, it would be impossible to describe in a few words all this unique box can do. All I know for certain is that I mixed a record through one recently, and ever since I've been at a loss to figure out what I'm going to do without one.

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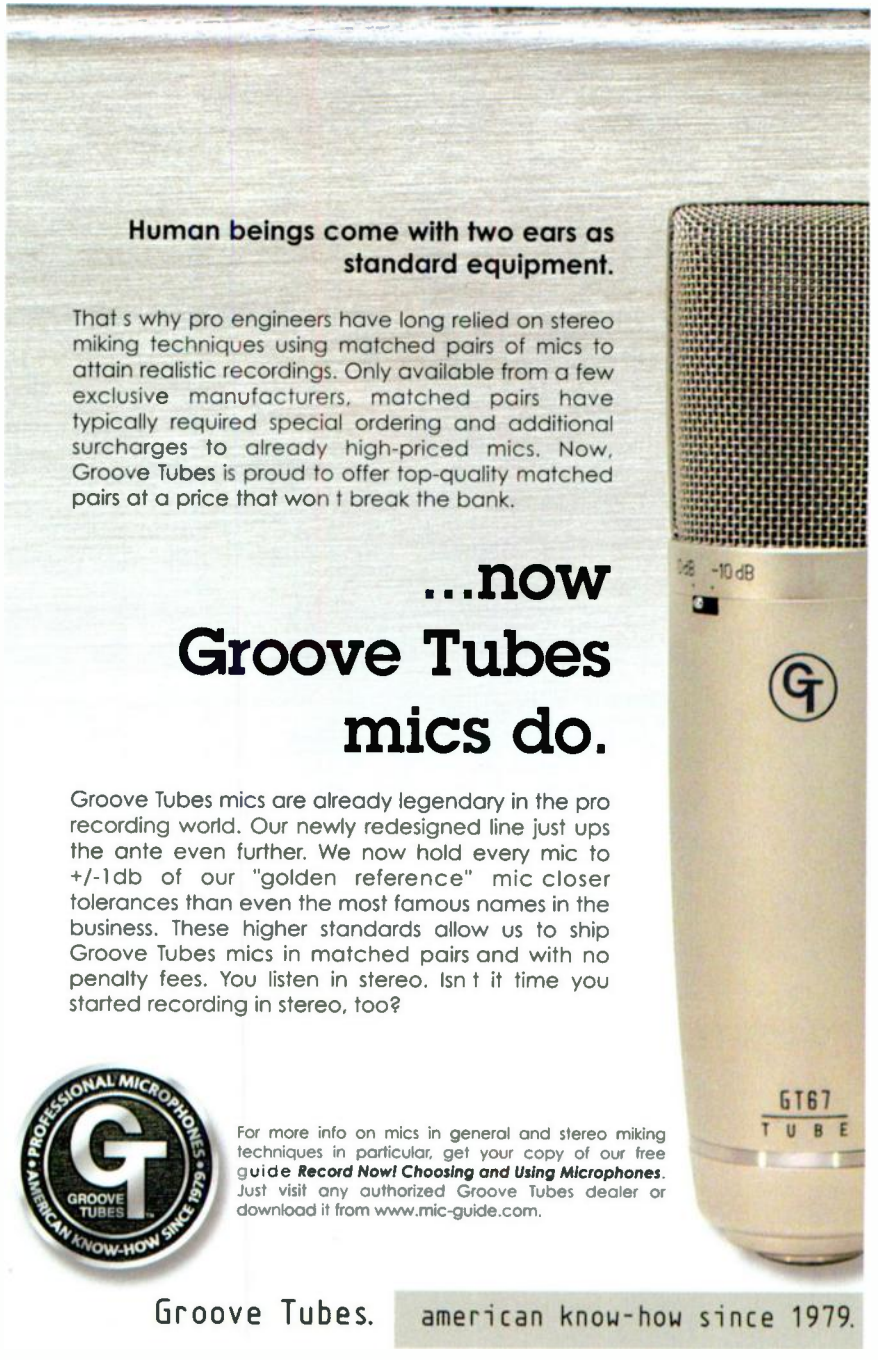
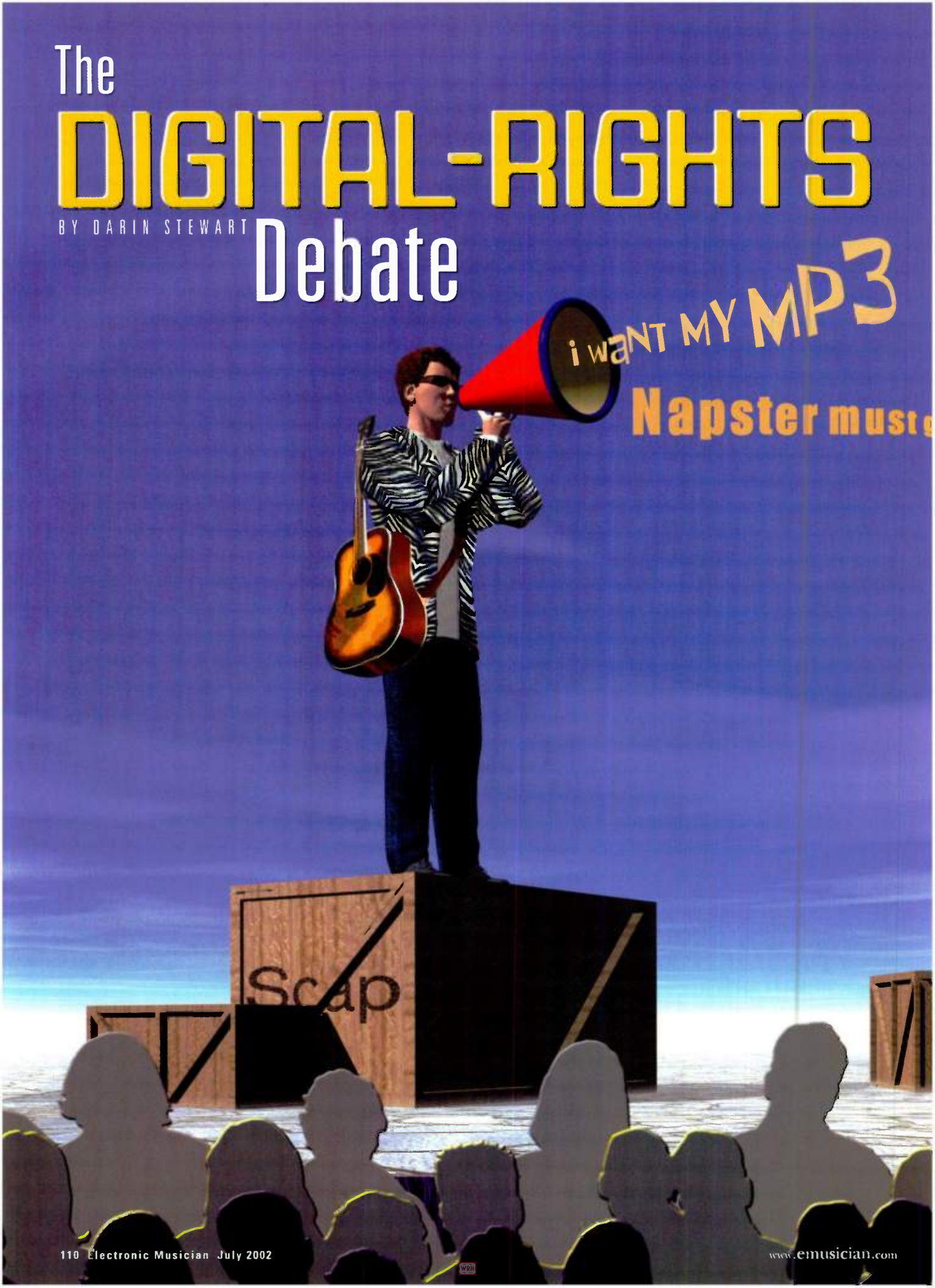


The DIGITAL-RIGHTS Debate

BY DARIN STEWART



Can you protect your digital rights without alienating your audience?

ILLUSTRATION BY LAURA WILLIAMS

Electronic distribution is the future of the music industry. Broadband Internet is rapidly replacing the CD store in the mall as the preferred means of getting music to consumers. This fact is recognized by home enthusiasts and by major market players such as Bertelsmann, Sony, and Warner Brothers. Moving bits across fiber is not only cheaper than shipping jewel cases in trucks, it is vastly more flexible. As with many things, however, flexible can mean complicated.

Labels and content providers are caught in a balancing act: they must try to give consumers what they want while still protecting their own interests. Consumers want simple access to a broad catalog of titles with the ability to move files from player to player regardless of platform or format, burning as many CDs and ripping as many MP3 files as they care to along the way. Artists just want to be fairly compensated for their product and ensure that it is not damaged, distorted, or misrepresented in any way. Artists and labels want to keep track of who is listening to what, when, and how often. That information is the Holy Grail of music distribution. Listeners, on the other hand, generally prefer to remain anonymous.

Pleasing both sides of the market has proved difficult. Solutions favoring the consumer have brought the wrath of the music industry (witness the rise and fall of Napster), whereas efforts to please the industry have turned off consumers (witness the implosion of the Internet music delivery company Supertracks). Haunting both sides of the debate is the specter of piracy, which—whether the listener realizes it or not—deals everyone a loss. Stepping into the gap to bring both sides together are the emerging technologies of *digital-rights management* (DRM).

DRM consists of technologies and techniques for securing digital content. Even though these technologies are still in their infancy, they are emerging as the dominant force shaping the way music is delivered online. Robert McGarvey of MIT's *Technology Review* has predicted that DRM will be "potentially the biggest—and bloodiest—of the many battles that will shape the Internet during the 21st century's initial decade" ("Digital Rights Management," *The Technology Review*, January/February 2001). Like it or not, DRM is coming, and musicians need to understand both sides of the digital-rights-management debate and the technologies involved if their music is to survive those battles.

DIGITAL-RIGHTS Debate

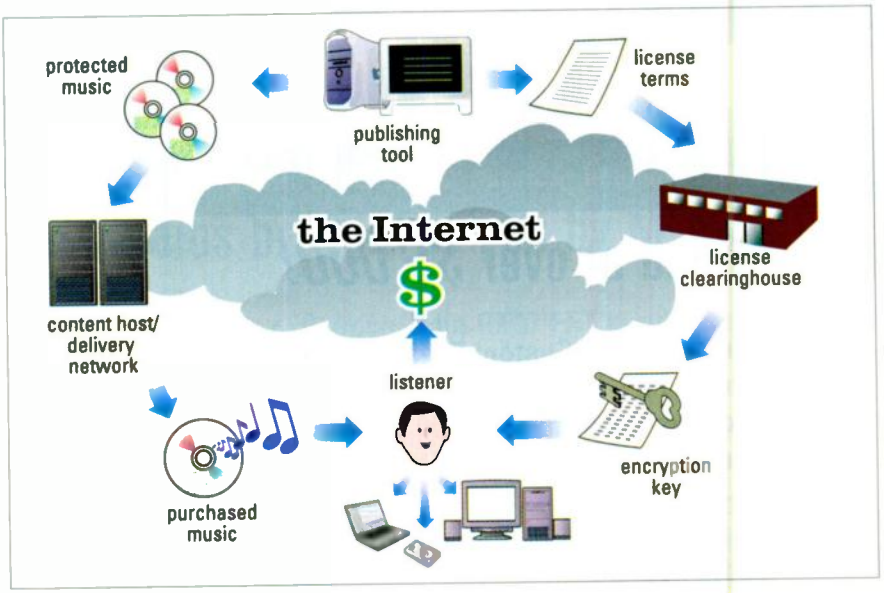


FIG. 2: Shown here is the license delivery process when a license broker is involved.

WHAT IS DRM?

In a nutshell, DRM limits access to the contents of a file to those who have proper authorization (that is, people who legally purchased the track), and it controls how the content can be used once it has been opened. The perception that that's the entire scope of DRM—which would then be more appropriately called digital-rights *enforcement*—has fostered a resistance to DRM on the part of artists and audiences that often borders on open hostility. Late in 2001, Microsoft's DRM solution was cracked by a hacker named "Beale Screamer" who also distributed a DOS utility to strip DRM protection from audio files. The documentation for the tool indicates that the hack was intended as an act of protest against what Screamer saw as an infringement of fair-use rights. In the documentation, Screamer writes, "What is bad is the use of DRM to restrict the traditional form of music sale. When I buy a piece of music (not rent it, and not preview it), I expect (and demand!) my traditional fair-use rights to the material. I should be able to take that content, copy it onto all my computers at home, my laptop, my portable MP3 player . . . basically anything I use to listen to the music that I have purchased. I can't do this at all with Microsoft's DRM scheme."

Consumers like Beale Screamer are rightfully concerned about possible infringement of their fair-use rights by DRM technologies (see the sidebar, "Fair Use in an Online World"), but digital-rights management encompasses much more than mere usage enforcement. It involves not only protection but identification, description, trading, monitoring, and tracking of user rights. Instead of just giving files to users and sending them on their way, DRM lets you manage any aspect of your relationship with your audience, from promotional follow-up to preference feedback.

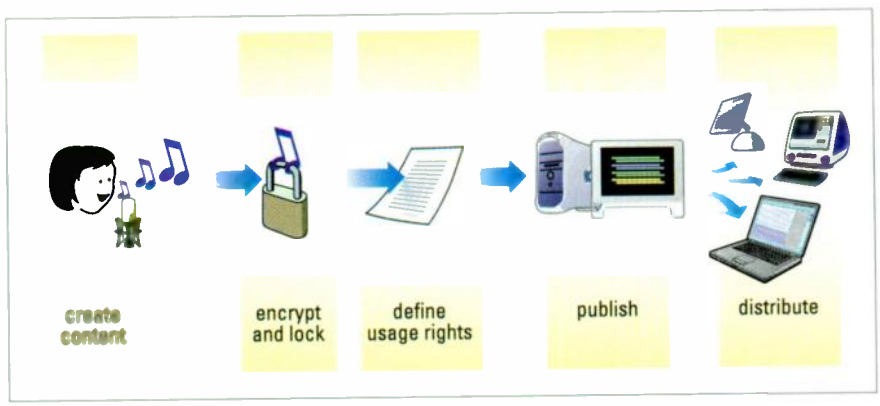


FIG. 1: Publishing music with DRM entails processes such as encryption and unencryption schemes and licensing agreements, making it a bit more involved than merely posting downloadable MP3 files on your Web site.

Under DRM the traditional process for publishing music on the Internet—adding a link to an MP3 file on your Web site—becomes a bit more involved (see **Fig. 1**). Once the music is ready to be released to the public, it is packaged in an encrypted and *locked* form. That prevents anyone from playing the file without first obtaining a *key* from the content owner or authorized distributor. Most DRM solutions use some form of public key encryption, which allows content, keys, and licenses to be transmitted securely across the Internet. That enables you to verify that consumers are who they say they are.

Once the music is packaged, you define the *rights* governing how it may be used. These specify how many times a song can be played, if the user is allowed to burn a copy to CD or transfer it to a portable device, or even a time period during which the track can be played. These rights define the *license* you will grant to the consumer downloading or streaming your music. You may define multiple licenses for each piece of content you publish. For example, one license may allow the user to rent a track for a week or to play it ten times, whereas a different license allows the user to purchase the same song outright. The license will also contain the key to decrypt the song it is associated with.

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DIGITAL-RIGHTS Debate

SERVE IT UP

When you have packaged the content and defined the usage rights, the song is ready to be published to the Internet. This occurs in two parts. The encrypted content itself is hosted by a download server, a streaming server, or both; the key to unlock the file is hosted by a separate license server. Both servers come into play when it is time to retrieve and play the file as described below. With the content and license servers loaded, your music is ready to be consumed by the world at large. Users can download, stream, and e-mail your music to each other, but at this point, they still can't play it. To do so, they must obtain a license.

When a user tries to open your file, his or her DRM-enabled media player will attempt to find a license containing the key needed to decrypt the contents of the file. In most cases, the license will have been "silently" delivered as part of the file-transfer process when the media was first obtained. In this license-*predelivery* scenario, the application transferring the media file to the user's computer will request a license to open the song on the computer requesting the file. The license server generates a license with the rights the user has requested, bundles it with the decryption key, and ships it to the media player. That all goes on behind the scenes and is completely transparent to the user. The license-predelivery approach is the simplest and most user-friendly for your audience, but it also offers the fewest options for managing your content.

The alternative is the *postdelivery* model in which the user must take additional steps, providing any information or payment you may require, to obtain a license after the media has been downloaded. The listener can still obtain a copy of your music from any source—a music-sharing service, an e-mail from a friend, promotional CDs, and so on—but must go to a *license broker* for the license to use it. The license broker can be any license server, set up on your own Web site or with a license clearinghouse, that can collect information about the listener and, if desired, payment (see **Fig. 2**).

SPECIAL DELIVERY

The appropriate license server is usually identified to the media player (or whatever application is trying to access your content) by a URL that was bundled with the media when it was first packaged by the DRM system. That URL directs listeners to a Web site where they can provide information about themselves—such as their e-mail address, age group, and music preferences—and also provide a credit card number to pay for the track they have just downloaded. Once payment is made, the license is sent to the media player and the user is free to enjoy your music within the bounds of whatever rights you have specified.

Some DRM systems can bundle your song with an additional, hidden URL, called the *authorization URL*, that directs the media player to a service that grants or denies the license regardless of whatever information is provided to the license broker. For example, you may have an exclusive contract with Yahoo that makes your music available only to its users. If a customer of a competing service were to obtain a copy of your music and try to buy a license, the authorization agent specified by this URL would deny the license and potentially direct the user to a Yahoo subscription offer.

The best approach is some combination of pre- and postdelivery of licenses. For example, you could post all the tracks from your latest CD to your Web site and predeliver a limited-use license with each track downloaded. This license could allow the user to play the track ten times and only on the computer downloading it. When the ten plays are used up, the media player would be directed to the license broker where the user would have the opportunity to purchase a new license that allows unlimited plays, burn to CD, and transfer to a portable device. The combination of pre- and postdelivery allows for *superdistribution* of your music, making file sharing a marketing dream instead of piracy nightmare.

SAP RISING

In some DRM implementations, the security of the file can be circumvented without having to break its encryption. When a DRM-enabled media player has unlocked a media file, the music still must be transferred from the application to the computer's audio card. During this transfer, your music is unencrypted, uncompressed, and completely unprotected. Third-party tools and plug-ins

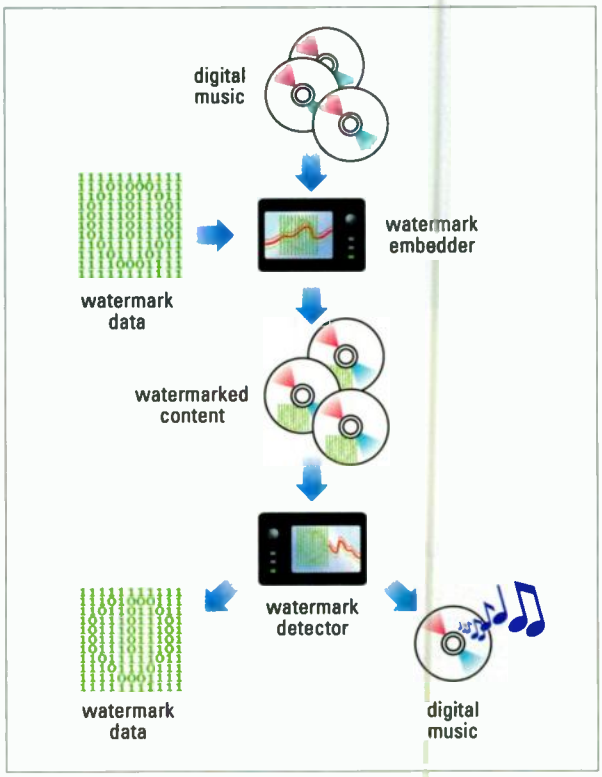

FIG. 3: Digital watermarks in music files are transparent to listeners and allow distributors to track down pirated copies.

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have started to pop up on the Internet that can grab the contents of your file and make a perfect digital duplicate that can be shared without hindrance or compensation.

The first response to this situation is Microsoft's Secure Audio Path (SAP), which was introduced in Windows ME and XP. When a DRM-wrapped file is opened on either of those platforms, SAP adds cryptographic noise to the signal that is removed at the computer's audio subsystem only when all of its components have been authenticated. If a copy of the file has been grabbed between the media player and the audio card, it contains noise that makes playback unlistenable. Playback by an authorized system is noise free, making SAP transparent to the authorized listener.

A limitation of the SAP approach is its dependence on the ME and XP operating systems. Both are relatively new and have somewhat limited installed-user bases. It also completely excludes Mac and Linux users. When a consumer requests a license for a SAP-enabled song, the license server detects the operating system of the PC making the request. If it is ME or XP, all is well and the license is granted. If another OS is detected or appropriate certified drivers cannot be found, the user is out of luck and to a large extent, so are you.

WATERMARK MY WORDS

Another approach to combating fraudulent audio path recording is *digital watermarking*. Like a traditional watermark, a digital watermark is additional information added to your file that is imperceptible to the listener but that can be detected by an application that knows what to look for. One advantage of audio watermarking is that most current solutions will survive translation from analog to digital, compressed to decompressed, and encrypted to unencrypted.

The process of digital watermarking involves inserting data packets containing additional information about the file directly into the content signal. Like the noise added in SAP, this additional information is removed from playback and is completely imperceptible to the user (see **Fig. 3**). The watermark information can be audio, text, or multimedia and can contain copy and usage rules, information about the artist, or any other information you wish to provide or retrieve.

One current use is assigning a unique watermark to a music file for each distribution channel to which it is released. If a watermarked copy of your music is pirated and you locate an unauthorized copy on, say, a music-sharing site, you can trace the source. Contractual agreements are emerging between artists, labels, and content delivery networks that hold the provider responsible for such security breaches. A verifiable watermark can be the smoking gun that validates your complaint.

DIY NOT?

Despite the proliferation of do-it-yourself audio tools ranging from plug-in effects to PC-based mastering suites, full DRM may still be beyond the capabilities of most independent artists. Even though many DRM technology offerings are available free of charge (provided certain licensing requirements are met) or as features of emerging operating systems, the requirements for an infrastructure on which to run them remain costly. To establish a viable DRM-enabled music-distribution service, you need substantial programming and system administration skills, a fair amount of beefy hardware, and a wide Internet pipe. In most cases (barring recruiting your closest geek friends), that demands a greater investment than many musicians are prepared to make.

The alternative is to turn to a DRM service provider such as CenterSpan (the company that I work for), Digital World Services, InterTrust, or Liquid Audio. Such companies serve as license clearinghouses and as content-delivery channels. That greatly simplifies your role in protecting your music, but there are drawbacks as well as benefits to signing on.

Beyond giving artists an easy entrée to digital-rights management, the main advantages of DRM service providers are flexibility and exposure. A full-service clearinghouse provides a range of business models to choose from and an infrastructure capable of supporting them. Your audience can go the rent-to-own route if they are just discovering your music, or they can become subscribers to your new releases if they are die-hard fans.

Most services also let you bundle your music in different combinations for "special offer" promotions. There are also distinct advantages to being a part of an established catalog with a ready-made listener base. Your promotional efforts are automatically piggybacked onto those of the service provider. Providers usually charge for the service based on the number of bytes delivered and the number of licenses generated.

The downside of clearinghouses is that they lock you in to whatever DRM solution they have selected. That can eliminate a large chunk of your audience if they happen to be on an incompatible platform. The lack of cross-platform compatibility is perhaps the biggest hurdle DRM has yet to clear before gaining mainstream acceptance.

At this stage of the game, there is virtually no interoperability between competing DRM solutions. Even within a single vendor, problems can (and have) arisen. A file encoded in a standard format, such as MP3, can generally be opened by multiple applications from various vendors across multiple platforms. When it has been DRM encoded, however, it may be locked across those platforms even if the tools on both sides are from the same vendor. In this circumstance, your listeners would need multiple copies of a single song, each encoded for a particular platform, if they wanted to move it from their laptops to their desktop computers or portable players.

NEW STANDARDS

This untenable situation has arisen because every DRM solution describes and implements the rules governing content usage in its own way. What is needed is a standardized way of describing how content may be used. Such a standardized language would enable all DRM solutions to come together on the back end and exchange information in a manner completely transparent to the listener. That would

FAIR USE IN AN ONLINE WORLD

The primary objective of copyright is not to reward the labor of authors, but "[t]o promote the Progress of Science and useful Arts." To this end, copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work. This result is neither unfair nor unfortunate. It is the means by which copyright advances the progress of science and art.

—Justice Sandra Day O'Connor *(Feist Publications, Inc. v. Rural Telephone Service Co.*, 499 U.S. 340, 349 [1991])

"Fair use" has been a popular rallying cry of Internet music aficionados hoping to preserve the freewheeling world of online music. As appealing as this may sound, defending the rights of the consumer has never been the intention of the fair-use provisions of copyright law. The provisions are intended only as a limit on the exclusive rights of copyright holders. Fair use attempts to balance the rights of the artist with the interests of society in a manner that promotes the furtherance of the art. Justice David Souter has described fair use as "the guarantee of breathing space for new expression within the confines of copyright law" (*Campbell v. Acuff-Rose Music, Inc.* 114 S.Ct. 1164, 127 L. Ed. 2d 500 [1994]). The individual consumer is rarely under the protective wing of fair use.

The fair-use doctrine evolved in the judiciary during the course of numerous court decisions and was eventually codified in the Copyright Act of 1976 (17 USC 107). The Copyright Act specifies four criteria for determining what constitutes fair use. Even with these guidelines, what is and is not allowed is far from clear-cut and can be determined definitively only by a judge on a case-by-case basis. Here are the fair-use factors specified in section 107 of the Copyright Act.

The purpose and character of the use, including whether it is intended for commercial or nonprofit use. Fair-use rulings have overwhelmingly favored nonprofit endeavors, but several commercial applications have also been accepted. For example, a paid critic is allowed to quote or excerpt from copyrighted works to facilitate a commercial review. Generally, this provision is intended to allow duplication of copyrighted works to facilitate scholarship, research, and teaching.

The nature of the copyrighted work. Being unpublished strengthens a copyright claim. Historically, greater copyright protection has been awarded to unpublished works than to published works. Similarly, fair use is more protective of creative works than of factual ones.

The amount and substantiality of the portion used in relation to the copyrighted work as a whole. There is no hard-and-fast rule to determine how much of a copyrighted work may be duplicated under fair use. In ruling, judges have generally weighed this factor when considering purpose of use and the potential impact on the copyrighted work.

The effect of the use upon the potential market for, or value of, the copyrighted work. The potential for negative impact on a copyrighted work takes several factors into account, including when the work was published, how accessible it is currently, and its expected economic life span and value. Taken together, these factors will help determine if the duplicate, quote, or excerpt supports a replacement for the copyrighted work. If it does not, fair use is more likely to be granted.

While seemingly straightforward, these factors can lead to ambiguous or conflicting interpretations of the law. For example, a 3-second bass riff sampled from a 5-minute song represents only 1/100th of the copyrighted work and so would seem to be covered by the third fair-use criterion. When this riff is incorporated into a commercially released song, however, the first factor, nature of use, trumps amount and substantiality, pushing the sample outside the bounds of fair use.

Judicial precedent has settled some general case issues. The seminal example is "time shifting" as approved by the Supreme Court in 1984 (*Sony Corporation of America v. Universal City Studios,* 464 U.S. 417). That decision defined home taping of television programs for noncommercial, private viewing at a later time as fair use. Most online music users assume that *space-shifting* songs—moving music from one format to another such as ripping a CD to an MP3 file—is covered under the same decision. It isn't. Space-shifting, even for personal use, has not been definitively determined to fall under the rubric of fair use.

Like most things in the online world, copyright law and fair use are still being defined. Although many lawyers believe that space-shifting and other duplication for personal and noncommercial purposes constitutes fair use, the ultimate decision still comes from a judge's bench. In its current state, fair use is by no means a right.

DIGITAL-RIGHTS Debate

not only simplify life for everyone involved but would also dramatically reduce costs for publishers. With a common DRM language available, content providers could package content just once to the standard's specifications rather than once for each potential DRM platform.

Two efforts to provide such a language have recently appeared: the Extensible Rights Management Language (XrML) from Xerox offshoot ContentGuard, and the Open Digital Rights Language (ODRL), which is being developed by a coalition of industry players including Adobe, Accenture, Napster, and IBM. Both approaches are open, XML-based descriptive languages promising a transparent, standardized method for specifying rights and licenses associated with the protection and use of digital content. Both standards are available on a royalty-free, licensed basis.

The primary difference between the two initiatives is a matter of scope. ODRL focuses on the description of business rules, whereas XrML encompasses the entire DRM process, from beginning to end. The industry must choose between simplicity and comprehensiveness. This decision should be settled in the DRM market during the coming year.

FINDING A BALANCE

Online distribution of your music is a mixed blessing. It expands your potential audience beyond what you could have imagined just a few years ago while putting you much closer to that audience. Internet distribution puts you in control of how your music is distributed but also makes you responsible for protecting it.

Any restriction placed on how a listener accesses your music has the potential of alienating some part of your audience. The challenge is finding a compromise between your needs as an artist and the audience's demands as consumers. Listeners want to be able to enjoy the music they have legitimately purchased whenever, wherever, and however they like. Keeping your music protected while protecting the interests of your audience is the central struggle of online music. Digital-rights-management technologies, though still in their infancy, are the solution the industry has put forth for this phase of the Internet's evolution. Whether or not it can balance the scales remains to be seen.

Darin Stewart *is the principal information architect of the C-star Content Delivery Network produced by CenterSpan Communications. He is also a Chapman Stick player in the Portland, Oregon, area. He can be reached at darin@centerspan.com.*

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DESKTOP MUSICIAN

Snappy Chips

Overclock your way to better performance.

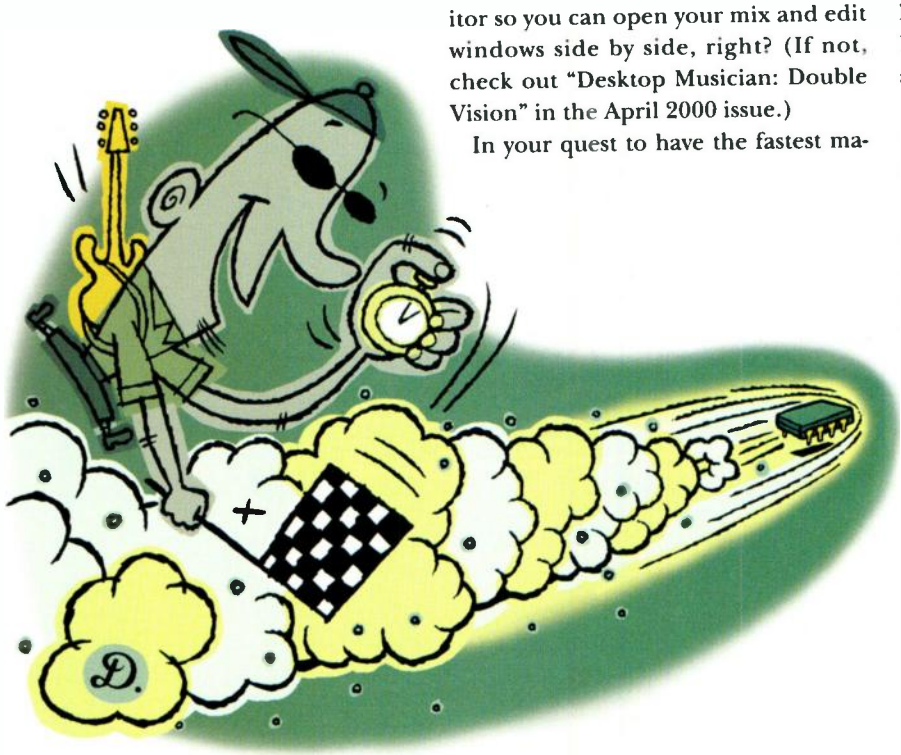
By Brian Smithers

Admit it: you're power-mad! No matter how zippy your computer is, you're always looking for ways to squeeze a few extra tracks or plug-in effects out of it. You've maxed out your machine's RAM, added a lightning-fast audio drive, and tweaked your OS so it's optimized for audio performance. You've even added a second video monitor so you can open your mix and edit windows side by side, right? (If not, check out "Desktop Musician: Double Vision" in the April 2000 issue.)

In your quest to have the fastest machine on the block, you may have come across the term *overclocking*, a technique reputed to make your Pentium II run like a Pentium 4 without costing you a dime. No doubt your too-good-to-be-true alarm screamed when you read the breathless tales of miraculous performance gains in various newsgroups. Before you toss overclocking into the urban-legend bin, take a look at the truth behind the hype. Overclocking *can* buy you some extra megahertz, at little or no cost.

Note, however, that every discussion of overclocking (including this column) begins with a disclaimer such as the following: NOTICE! Overclocking your computer can damage or destroy your hardware, cause erratic behavior (by the computer, not you), scramble data, and aggravate your ulcer. It will almost certainly void your computer's warranty (assuming it lasted longer than the trip home from the computer store). The author and publisher assume no responsibility for any dire consequences arising from your use of the information provided herein. Proceed at your own risk!

Though Intel Celeron chips (see **Fig. 1**) get the most press when it comes to overclocking, you can also overclock Intel Pentium and AMD Athlon chips. Mac users may be surprised to know that some PowerPC chips are overclockable.



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COURTESY INTEL

FIG. 1: Intel's Celeron processor is popular among overclockers for the relatively high degree to which it can be accelerated.

We'll take a look at the theory, the techniques, the pitfalls, and the limitations of overclocking. We'll also try to put some perspective on the sort of gains you can achieve.

ON THE EDGE

Overclocking is made possible by a simple fact of chip manufacturing: not all chips in a batch turn out the same. The process of mass-producing a semiconductor with electron pathways only a few atoms wide is understandably precarious, and only the most perfect chips are capable of the highest clock speeds.

According to Intel, only after processors have been assembled and tested can you know their individual capabilities. Otherwise-identical chips are therefore "binned" based on their clock speed.

Overclockers take advantage of this by buying the cheaper, "slower" chips and second-guessing the manufacturer. Whereas a chip maker might err on the side of caution to ensure that a chip doesn't fail in a customer's machine, a determined end-user might be willing to throw caution to the wind for a few more bands of native EQ. The overclocking process at its most basic involves running your own tests for stability as you gradually raise the clock speed.

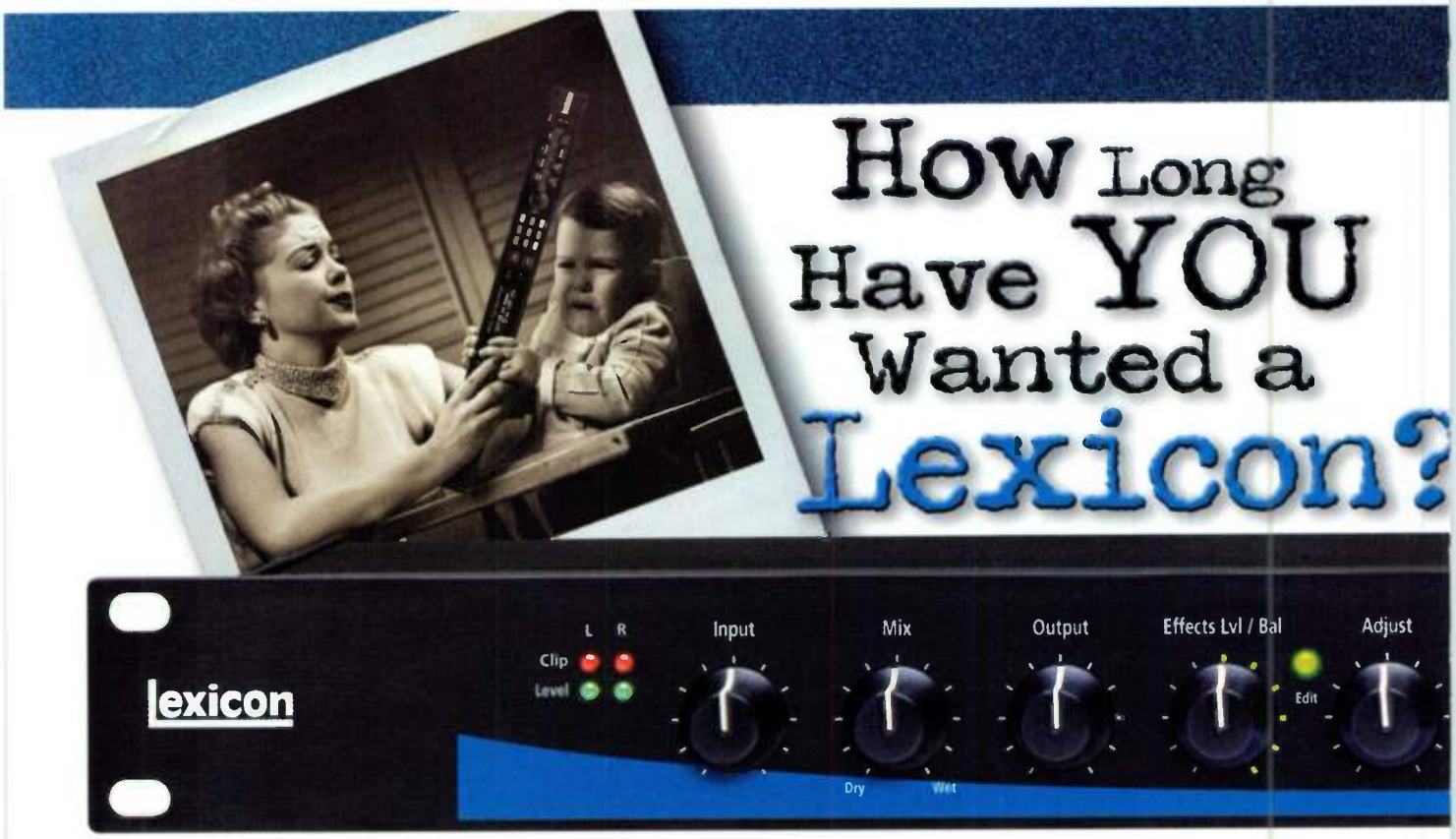
That's why Intel, AMD, and Apple all officially discourage overclocking. If you run their chips "out of spec," you're on your own. It's your machine, of course, so do with it as you see fit. Just don't come crying to them if things go badly.

Of greater concern to manufacturers is the nefarious practice of *remarking* CPUs. Unscrupulous computer makers have been known to overclock a machine without telling the buyer. It's one thing to squeeze your own CPU for extra cycles; it's quite another to get squeezed for the price of an 800 MHz machine when what you get is officially a 700 MHz chip. Unfortunately, some of the steps chip makers have taken to prevent remarking have made life tougher for tweak-head overclockers, too.

CHIPS AND DIPS

The rated speed of a CPU is a function of the speed of the *front side bus* (FSB) and the *clock multiplier*. The FSB is the connection between the CPU and the motherboard. Like a digital-audio device, it has a clock that determines the rate at which commands are executed. The faster the rate, the faster the processing.

Modern processors are fast enough that



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the CPU can run several times faster than the rest of the system; that's the clock multiplier's role. An 800 MHz AMD Athlon processor has an FSB clock speed of 100 MHz and a clock multiplier of 8 (100 MHz × 8 = 800 MHz), for example.

BEAT THE CLOCK

At one time, overclockers adjusted the FSB speed and the multiplier settings until they found a zippy but stable combination. Unfortunately, the multiplier is the most obvious casualty in the war on remarking. Intel took steps first to prevent the clock multiplier from being manipulated; AMD followed suit. As a result, overclockers these days must ordinarily settle for changing only the FSB speed, though aggressive overclockers seem to have found a way to pick AMD's locks. The Mac's multiplier is not locked; in fact, in most cases changing the multiplier is the only way to overclock a Mac.

Not all motherboards allow that sort of manipulation, so overclockers must select their motherboards carefully. Indeed, because the PCI bus gets its clock speed from the FSB, serious overclockers need to choose all of their system components for their ability to get along with nonstandard clock speeds. Interestingly, a whole subcategory, overclocking video cards, has developed, largely to serve the graphics needs of gamers. I've even seen references to overclocking Palm devices.

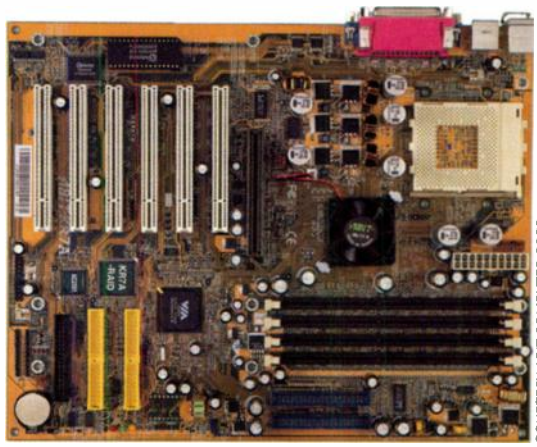

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FIG. 2: ABIT makes no bones about the features its motherboards offer to overclockers, including the ability to increase FSB speed in 1 MHz increments without physically moving jumpers.

As anxious as CPU manufacturers are to prevent overclocking, some motherboard manufacturers actually promote their products as being overclocker-friendly. For example, motherboards from ASUS and ABIT (see **Fig. 2**) allow the end-user to adjust the FSB clock speed in 1 MHz increments for dialing in the best setting. Another boon to overclockers is the ability to set FSB speed directly from the BIOS instead of by manually moving DIP switches on the motherboard.

Of course, Mac users get whatever motherboard Apple decides to use, and

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Apple is no more interested in making life easier for overclockers than Intel is. As a result, bumping the clock speed on a Mac requires carefully and cautiously resoldering certain jumpers.

BURN WITHOUT BURNING

The No. 1 risk to overclocked computers is heat. If you've ever looked inside your computer case at that big heat sink with its own dedicated fan on your processor, you already know that CPUs generate a lot of heat. (If you haven't ever looked inside your computer case, please think twice before attempting overclocking!)

The harder you push your CPU, the hotter it gets; melting and burning are possibilities. With proper cooling, however, you can keep the temperature within safe limits. For mild-to-moderate overclocking, you can get away with minor modifications, such as using a specialized CPU cooler and upgrading or adding case fans. It's also worthwhile to

HOT-RODDERS IN CYBERSPACE

This is a partial list—the tip of the iceberg, really—of online resources for overclocking. Keep in mind that all of these groups disavow any responsibility for your melted CPU. So does **EM!**

www.anandtech.com
Current news on and analysis of PC hardware. Lots of overclocking information, although much of it is more than a year old.

www.tomshardware.com
Arguably the granddaddy of hardware sites, with boatloads of reviews and insights into PC hardware issues. One to bookmark even if you're not overclocking.

www.sysopt.com
Dedicated to helping you optimize your PC. It has very active forums and maintains a database of which CPUs and motherboards have been overclocked by users, including what performance gains they achieved.

www.overclockers.com
The name says it all. For PC users.

www.tweak3d.net
Although targeted at gamers, a great and timely source of PC system-tweaking information. It also includes information on Palm overclocking.

www.xlr8yourmac.com
Lots of good information for Mac users. Think overclocking is a PC thing? A search for "overclock" on this site turned up 353 pages!

www.voelker.com
At this site, some authorized Mac-hardware guys disseminate unauthorized techniques, like the one that bumps a 400 MHz PowerBook to 500 MHz.

www.bekkoame.ne.jp/~t-imai/maine.html
A Japanese site that offers information on a slew of different Mac overclocks, dating back to a Power Mac 4400. This is only for people with refined soldering skills and nerves of steel.

www.macspeedzone.com
The name says it all. For Mac users.

http://mbm.livewiredev.com
Home of Motherboard Monitor.

www.kezer.net
Home of Thermograph.

www.sisoftware.demon.co.uk
Home of SANDRA.

www.abit.com.tw
The main site for motherboard manufacturer ABIT Computer Corp.

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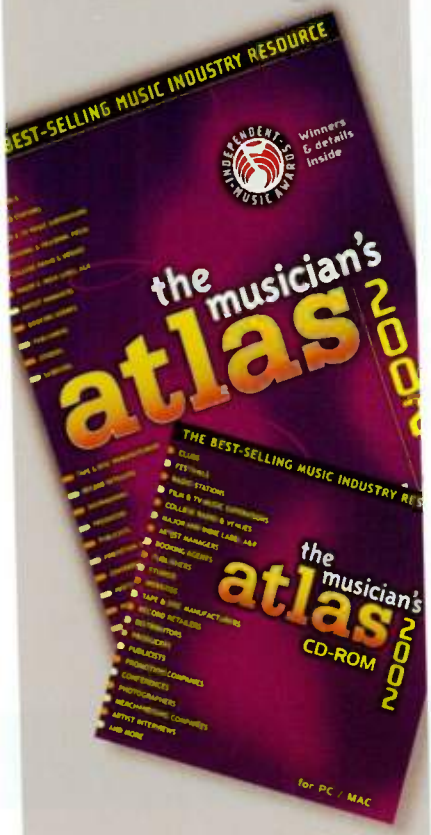

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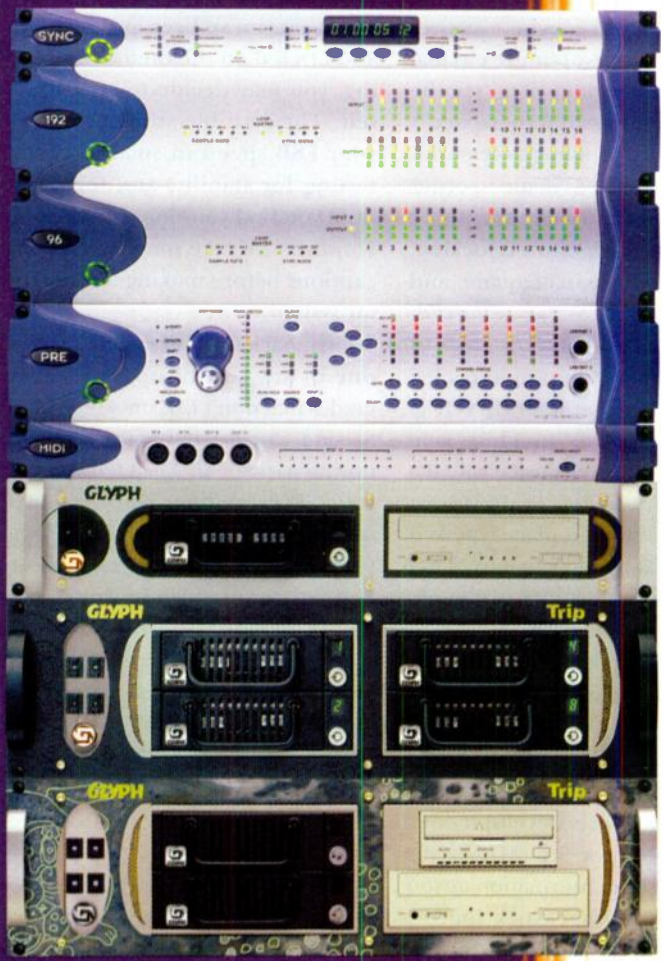

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check airflow in your computer's interior, bundling cables and maybe even rearranging PCI cards to optimize circulation. The CPU hot-rodder sites (see the sidebar "Hot-Rodders in Cyberspace") are rife with ads for cooling accessories and related items such as made-to-order cases with multiple fans built in.

At the extreme edge of overclocking, though, such fixes are inadequate, and more drastic measures are required. Lunatic-fringe members trade tales of submerging components in supercooled fluids and building computers in refrigerators. More realistic technophiles generally use a heat-transfer device called a *Peltier*, which is designed to draw heat away from the CPU to a place where it can be carried away by your fan. That process can cause condensation, though, so you may need insulation to prevent water from shorting out your system.

So how do you measure the temperature of your CPU? On some motherboards, a hardware sensor provides information about the CPU. With a program such as LiveWire Development's Motherboard Monitor 5.1 (MBM), it's possible to track that information as you experiment with higher clock speeds. One such utility for Mac users is Jeremy Kezer's Thermograph 1.3.4.

HIGHER AND HIGHER

Now that you've been properly warned and briefed on the theory of overclocking, you may decide to try it for yourself. The sensible strategy is to bump your FSB speed in small increments, testing for stability and temperature, until you find your highest stable speed. However, I'd take some additional precautions before making any changes to my system.

First, back up your system. That's step one in any sort of upgrade, even upgrades that don't risk smoking your CPU. Second, install MBM or some other monitoring package that can tell you how hot your CPU is getting. Third, for anything more than the tiniest changes, upgrade your cooling system. Upgraded heat-sink-and-fan combos are in the $40 range, and Peltiers are available for even less.

Of course, you shouldn't even consider undertaking such an adventure if you have a client coming over or a production deadline looming. Give yourself enough time to mess up and recover before you put your cash flow and reputation at risk.

Now the fun starts. Read your motherboard manual and find out exactly how to change the FSB clock speed. That's typically accomplished on a PC by setting

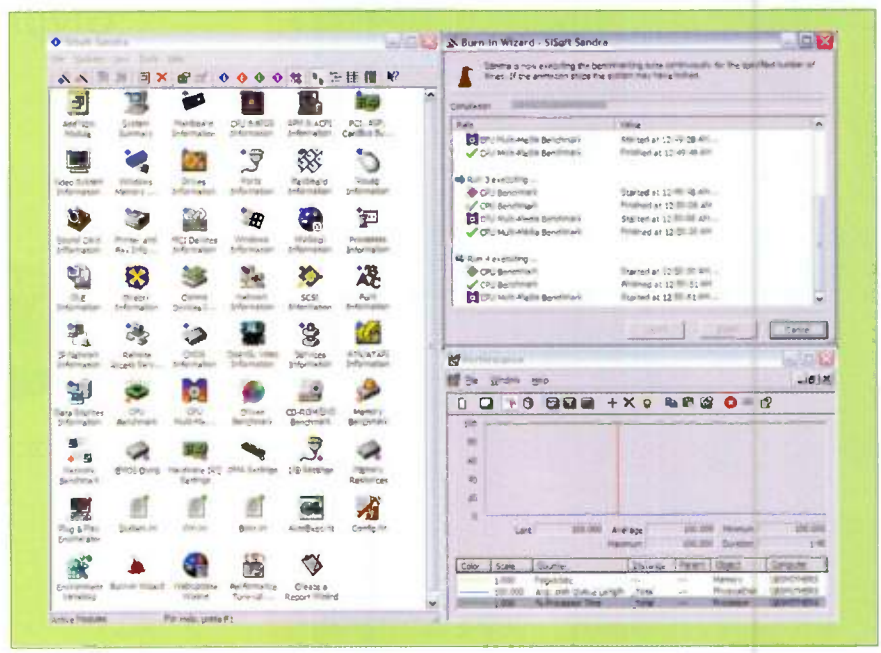

FIG. 3: SANDRA from SiSoftware features a burn-in wizard (upper right) that runs a series of benchmarks. Windows XP's Performance Monitor (lower right) confirms the CPU is operating at 100 percent.

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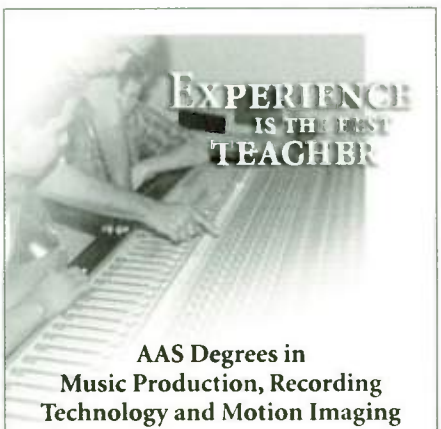

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motherboard DIP switches or by changing system BIOS settings. On a Mac it's done by resoldering the jumpers. There may also be a setting to downgrade the memory clock speed so the memory doesn't have to run out of spec, and a similar setting to put the PCI bus back in spec. That's where an overclock-friendly motherboard pays off.

Adjust the FSB clock speed upward slightly. If you're using something like the aforementioned ABIT motherboard with 1 MHz increments, try bumping it no more than a few megahertz; remember that it's being multiplied! Save your settings, restart the computer, and test your new configuration. Having to resolder jumpers to change multiplier settings makes the incremental bump-and-test process much less convenient on a Mac.

STRESS TEST

You have two main goals in testing your overclocked computer. First, you want to put it under stress to see just how hot the CPU gets. Heat puts the chip at risk, and it can cause data errors. In general, your goal should be to keep the temperature at or near its "stock" level. Your second goal is to be sure the system is stable and reliable. A faster computer that crashes more frequently is hardly a step forward.

There are numerous benchmarking programs available; one that seems to be popular with PC overclockers is SiSoftware's SANDRA (see **Fig. 3**). SANDRA is available in a freeware version capable of putting your system through its paces while monitoring its behavior, including CPU speed and temperature. Use its CPU benchmarks to keep your system running at or near 100 percent processor usage for an hour or more. If it doesn't crash and the temperature stays within the safety zone, you have a successful overclock. Mac users can turn to Symantec's Norton Utilities or Micromat's TechTool Pro.

If you're greedy, you can go through this process several times until you find the point at which your system no longer works properly. Sometimes additional CPU cooling can stabilize such a system and allow you to get that last megahertz, or you can simply back off to your highest reliable speed. One other high-risk step to consider is raising the voltage to your CPU if your motherboard supports that. It's usually recommended that you raise the voltage a total of no more than 10 to 15 percent, but even small amounts can stabilize the behavior of an overclocked chip.

Before you stake your reputation on your overclocked speed demon, I'd recommend further testing with the music software you use most often. Throw some hefty real-world demands at it, such as tracking as many audio inputs as you expect to need, mixing with as many plug-ins as you can pile on, and applying complex file-based processes such as noise reduction or sample-rate conversion. Remember, the whole point of overclocking is to second-guess the chip manufacturer's tested speed limit, and that means the burden of reliability/stability testing is entirely yours.

GREAT EXPECTATIONS

Overclocking depends on minor variations in microprocessors, so the performance gains you can expect will vary as well. You may have no luck at all, or you may get a 25 percent increase in processing. Most likely, you'll get a modest gain somewhere in the middle. With processors constantly dropping in price, only you can decide whether overclocking is worth the time, trouble, minor expense, and major risk. It may be hard to make a case for pure "economic" overclocking, but if you simply love tweaking your hardware, it's easier to justify.

If you're thinking of taking the leap, avail yourself of the resources of the online community. Given the "official" stance against overclocking, it's your best source of information on which chips, motherboards, and other components are the best candidates. Online forums and newsgroups are the cyber equivalent of your local Classic Corvette Club, and just the sort of support a chip hot-rodder needs. Just remember: keep it cool.

Brian Smithers *is a musician, conductor, and writer in Orlando, Florida. He teaches at Full Sail Real World Education.*

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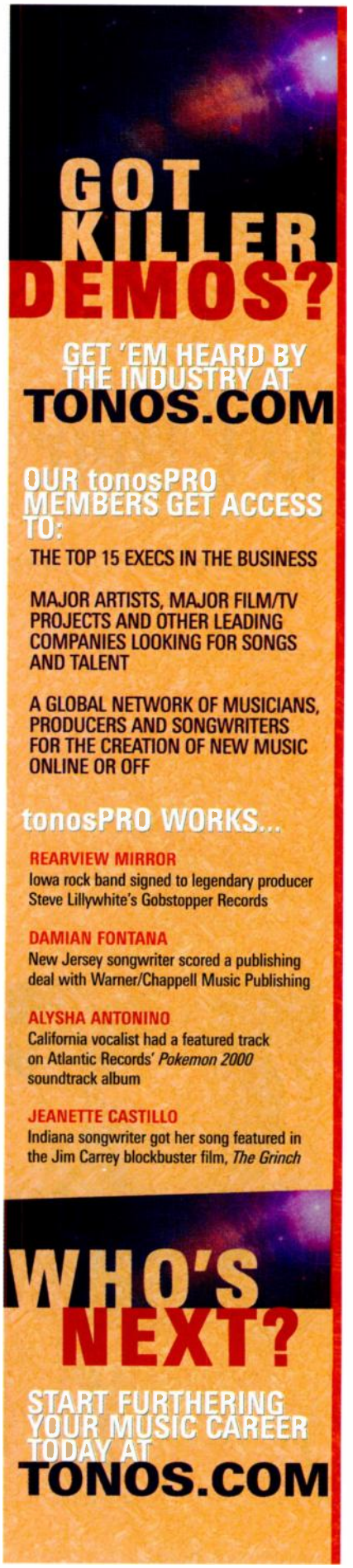


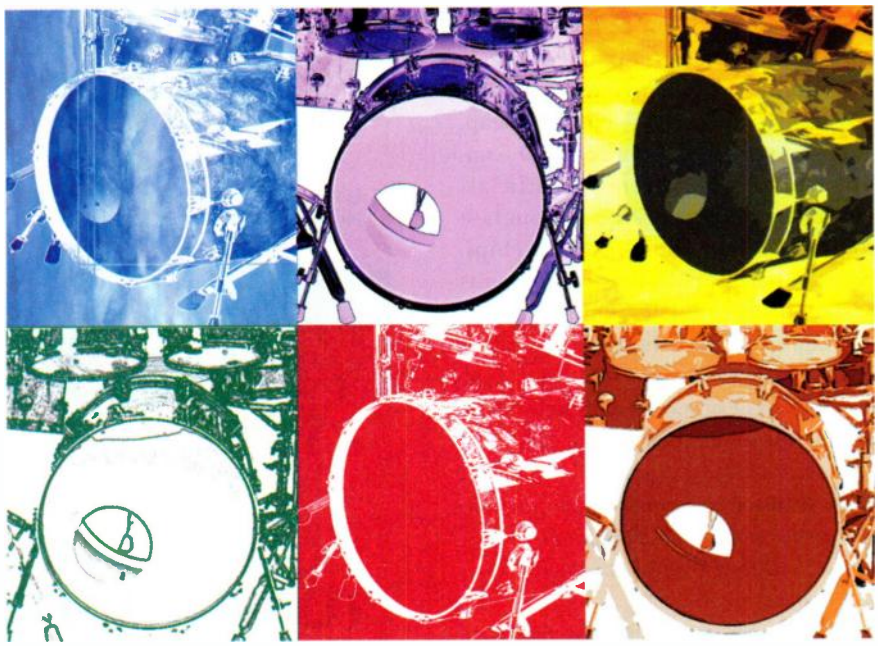
RECORDING MUSICIAN

Get Your Kicks

Tips and techniques for recording bass drums.

By Richard Alan Salz

Although bass drum is rarely the defining element of a song, quite a few classic hits just wouldn't be the same if they had a different kick sound. Try to imagine, for instance, Led Zeppelin's "When the Levee Breaks" with a dull, thuddy, disco-type bass drum. Or at the other extreme, how about the Commodores' "Brick House" with a huge, boomy kick? Clearly, such changes would make either song sound and feel very different.



MIKE CRUZ

The fact is that the sound of the kick is often critical to the success of a mix, particularly in rock, dance, and other types of music for which the bass drum plays a foundational role.

But what's the best way to record bass drum? One challenge is the big range of bass-drum sizes that today's engineer is likely to encounter, from tiny 16-inch boppers to 26-inch behemoths. Various tunings, head configurations, and types of heads can also affect how the recording engineer approaches capturing this bottom-dwelling instrument.

In this column, I'll offer some tips and techniques for recording kick drums. Of course, my prescriptions are meant only as guidelines; your own results will necessarily vary depending on the recording space, drum heads, tuning, muffling, mics, preamps, recording medium, and so on.

MAY I SUGGEST?

For obvious reasons, it can be difficult to suggest changes to setups when working with drummers who bring their own kits into your studio. Still, some scenarios may warrant polite intervention from the recording engineer.

A relatively common problem is worn-out or "dead" drum heads. Note that a head can look okay and still be

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sonically dead. Worn-out heads will almost always lack a strong fundamental tone—a thin, one-dimensional sound coming from an otherwise decent drum should send up a quick warning flag. Another telltale sign is a head that must be tensioned tightly just to produce a tone. That usually means the head has been beaten so long and hard that the material (typically Mylar) has stretched or is pulling loose from the collar.

For engineers who record lots of different bands, it makes sense to have a few new replacement heads on hand. For kick drum, the most common sizes are 20 and 22 inches. One of each size should suffice.

Unwanted noise from kick-drum pedals can also present problems. Though the sound of John Bonham's squeaky pedal may be an endearing feature of some Led Zeppelin songs (at least to Zep heads), the usual goal is a silent pedal. Solo the kick and overhead mics and listen carefully for any squeaks, scrapes, clicks, or other unwanted sounds coming from the pedal. If the pedal is making noise, applying a drop or two of lightweight oil to moving parts—springs, bearings, hinges, or what have you—will usually take care of it.

Finally, a word about *attack*, the "click" of the beater striking the bass-drum head. For pop-oriented drum tracks, as well as many others, a well-defined attack is an important part of the composite sound of the kick drum. A mushy felt beater is not going to make the job easier. Therefore, you might also consider keeping on hand a hard plastic or wooden beater, which will help emphasize the attack.

LITTLE BOPPER

The jazz kick—think early Elvin Jones—is traditionally a small drum, typically 18 inches in diameter, fitted with single-ply heads front and back, with little or no damping. The heads are often tensioned fairly tautly, which, combined with the lack of damping, can result in the drum sounding more like a low tom than a standard kick. (The playing style adds to the effect: rather than be relegated to timekeeping and low-end syncopation duties, like a rock bass drum, the jazz kick is more an equal voice in the drum kit, often with as much say in accents, rolls, and phrases as the snare and toms.) Some players tame a bit of the resonance with one or more felt strips stretched across the head or heads and secured beneath the hoops; others prefer to leave the drum "wide open." Either way, the traditional bebop kick produces a resonant tone, making it quite a different beast from the usual thumpmeister.

Jazz drummers tend to be particular about tuning and the overall sound of their kits, so accuracy of sound capture is usually key. In multimic setups, I have achieved my best results using a high-quality large-diaphragm condenser mic positioned anywhere from six inches to two feet back from the kick drum, with the capsule (in cardioid mode) parallel to and facing the resonant head (see **Fig. 1**). One of my favorite mics for this application is the Neumann FET U 47; I have also gotten excellent results using my Microtech Gefell M71KMT.

Up to a point, the farther back you position the mic from the kick, the more natural the drum will sound, because the low-frequency sound waves have more time (space) to develop. Because this approach captures not only the sound of the kick drum but the sound of the rest of the kit as well, mic placement is critical. Most importantly, make sure the signal coming from the kick-drum mic blends in well with the other drum-mic signals.

In the case of a jazz kick that is too resonant for the track, a quick and easy fix is leaning a pillow against the resonant head. The larger the pillow is—and the more contact it makes with the head—the more damping will result.

BRIAN KNAVE

FIG. 1: For a natural sound when miking a double-headed jazz kick, position the mic back a bit from the drum to allow space for the low frequencies to develop. The mic will pick up considerable bleed from the kit, so a high-quality, large-diaphragm condenser is the mic of choice. Here a Blue Mouse captures the punchy tones of an 18-inch bopper.

HOLE IN THE FRONT

The double-headed kick drum with a hole or port in the resonant head is popular among drummers in many styles because of its versatility. Generally preferred for pop, rock, and funk, double-headed-with-port kick drums are usually in the 20- to 24-inch range. Often these drums will have batter heads that are double ply (possibly oil filled) or fitted with a semiperforated edge muffler. Depending upon the application, the drummer may have fitted the drum with some form of extra muffling to further damp the heads. Mufflers come in all shapes and sizes, ranging from felt strips to pillows or blankets to

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purpose-built contraptions. In general, a muffled double-headed kick with a port provides a nice balance of attack and some resonance.

The port opens up (pun intended) some options when it comes to miking the drum, allowing you to position a microphone fully or partially inside the drum or even to use two mics (more on that in a moment). A single-mic setup that has worked well for me has been to place a large-diaphragm, unidirectional dynamic mic—for example, an AKG d12e or EV RE20—just inside the port and facing the batter head. That gives you the archetypal "basketball bouncing" kick-drum sound, which is often desirable for pop, rock, and funk tracks. As always, small changes in mic positioning can yield very different results, so make sure to experiment. For more attack, you can aim the mic toward, or move it closer to, the point where the beater strikes the head; for more resonance, pull the mic back or aim it more toward the shell of the drum.

The double-headed-with-port kick drum is a good candidate for using two microphones, one inside the drum and the other outside. The internal mic is used primarily to capture the attack transient while the external mic picks up the overall ambient sound of the drum. If you are adding a second mic, it is customary to use a large-diaphragm condenser; however, good results can also be had with other types of microphones, most notably boundary-layer mics such as pressure-zone microphones (PZMs), which can be placed on the floor directly in front of the drum.

When using two microphones, pay particular attention to ensure that the two mics are not significantly out of phase with each other, which can lead to a deterioration of the sound—thinness or hollowness, typically—when the two channels are combined. To check for phase problems, solo the two channels with one fader up and the other down and then listen carefully as you bring up the second fader. Simply put, the sound should get better—fuller, clearer, better defined—not worse. Another way to test for phase problems is to reverse the polarity on one of the mic channels (whether at the preamp or channel strip) and listen for changes in the quality of the sound. Then, choose the polarity configuration that sounds best.

Even when you use just one microphone, the ratio of initial transient to fundamental tone can be modified significantly with compression. If you want more attack, slow down the attack time; if you need more sustain, set a longer release time. One of my favorite units for altering the ratio of transient to fundamental tone is the SPL Transient Designer 4, a unique dynamics processor that allows you to emphasize or smooth the attack and extend or shorten the sustain without introducing other compression characteristics (see **Fig. 2**). (SPL also offers the Transient Designer 2, a lower-end version of the same processor.)

ONE-HEADED WONDER

If you're after the ultimate in smack and dryness, the single-headed kick is the way to go. Generally, single-headed kick drums are at their best when muffled, typically with a blanket or large pillow resting snugly against the lower portion of the batter head.

On single-headed kicks, a good, if slightly retro, sound can readily be captured with the ubiquitous Sennheiser MD 421 dynamic microphone (see **Fig. 3**). If you want a sound that's even more bandwidth limited, try deploying a Shure SM57. A condenser microphone can serve up a great kick sound, too, especially if you are looking to emphasize attack. Do some research first, though—not all condensers can handle the high SPLs a kick drum delivers.

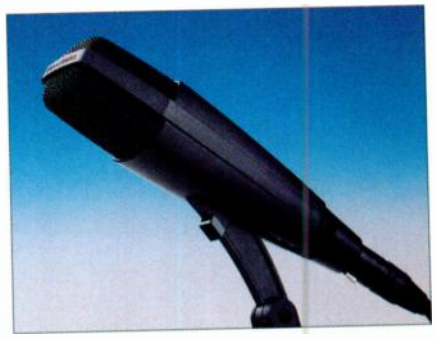


FIG. 3: Though highly regarded as a tom mic, the Sennheiser MD 421 also excels at recording kick drums, especially when you want to emphasize attack. Shown is the MD 421 II, which replaced the original MD 421.

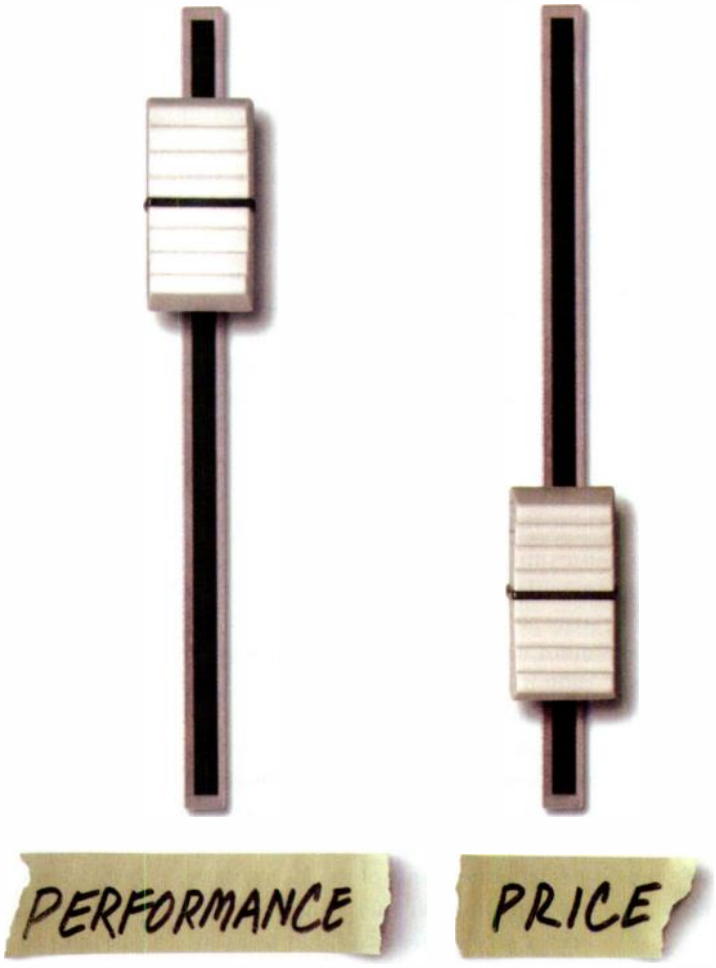
Because the drum is open to the studio, you can expect more leakage of the bass drum into the room microphones and other mics used on the kit. There are several ways to get around that. One is to apply a gate to the drum track. However, that is almost always better done during the mixdown stage—after all, you can't "ungate" a sound after the fact.

A good way to treat the problem at the source is by walling off the sound, either with thick blankets draped around the drum and mic (which also attenuates the loudness of the drum somewhat; see **Fig. 4**) or through some kind of tunnel that fits around the drum and channels the sound to the kick-drum mic. The tunnel approach is especially helpful because it lets you move the mic back from the drum, thus bolstering resonance (by allowing the bass waves to develop) while minimizing leakage from the rest of the kit.

One way to build a tunnel is by bending a fairly stiff rectangular piece of carpet into a semicircle and then fitting it around the drum, using tape, clothespins, or whatever to secure it in place. A quilt or thick blanket draped

FIG. 2: The SPL Transient Designer 4 provides exacting control of a signal's attack and sustain characteristics, effectively allowing you to change a drum's damping after the recording.

PERFECT MIX.



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over the top of the carpet tunnel will provide even more isolation. Because the front of the tunnel remains open, any leakage that does get through to the other mics will sound relatively natural (as opposed to the more muffled sound that results from simply draping the drum and mic with a thick blanket).

My favorite thing to use for a tunnel is a Sonotube—one of those heavy cardboard tubes used as a form to pour cement into. They can be purchased from building-supply stores or lumberyards for $10 to $15 apiece. Diameters vary considerably. I have some 24-inch-diameter tubes in several lengths—2, 4, and 8 feet. The 2- and 4-feet ones get the most use in my studio (see **Fig. 5**).

You can also use smaller-diameter tubes—an 8-inch-diameter PVC pipe, for example—to capture more unusual bass-drum sounds. This technique is most effective on double-headed-with-port kick drums. If possible, match the diameter of the tube to the diameter of the port. Position the tube flush with the head at the port and mic the drum at the other end of the port. This typically provides a *whoosh* sound and resonance from the pipe, which can sound really cool—or really bad, depending.

TWO-HEADED MONSTER

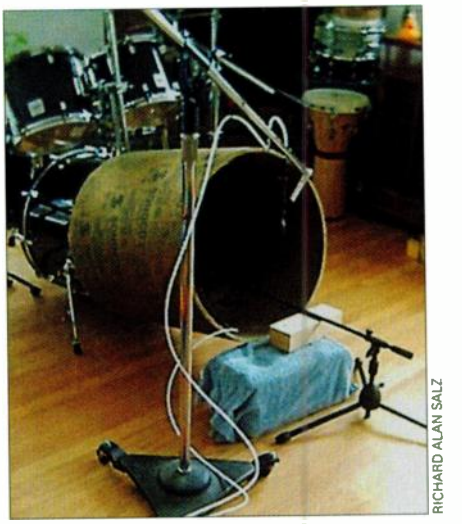
The late John Bonham had a penchant for oversize drums, but it wasn't the size of his drums alone that resulted in his typically monstrous kick-drum sound. A large component of Bonzo's sound came from the massive rooms the songs were tracked in—something to keep in mind if you're trying to get a similarly huge sound.

RICHARD ALAN SALZ

FIG. 4: A simple way to reduce bleed from other drums going into the kick mic is to drape a thick blanket around the bass drum and the mic.

Still, a 24- or 26-inch kick with two heads, no port, and little or no muffling is going to make a big sound in almost any room. Like the open-tuned bop bass drum, it is usually better treated as part of the kit rather than as a separate instrument, meaning that you should get some distance between the drum and the microphone. Not only does that allow the low-frequency waveforms to develop, but it also helps avoid picking up any resonant "flub" from the movement of the resonant head. A high-quality large-diaphragm condenser microphone placed a couple of feet away from the kit and aimed toward the kick drum is probably your best bet. This positioning also allows for capture of room resonance—again, a critical part of the sound if you're after a huge Bonzo-type kick. Experiment with positioning to find just the right balance of direct drum sound and reflected room resonance.

Insufficient attack is a shortcoming that is not uncommon with this setup. In that case, try positioning a second mic—a Shure SM57 is a good pick—on the batter-head side of the kick with the capsule aimed at the point where the beater strikes the head. However, because this mic is aimed in the opposite direction of the large-diaphragm condenser out in front of the kick, the signals the two mics pick up will naturally be out of phase—around 180 degrees out, in fact. Conventional wisdom holds that it is therefore necessary to reverse the polarity on one of the mic channels. Though this is often the case, try all the possible permutations of polarity settings between the two channels—sometimes what should sound best in theory doesn't do so in practice. After determining which settings yield the best sound, the two signals can be mixed to one channel during tracking or, better yet, recorded to two separate tracks and blended together during mixdown.



RICHARD ALAN SALZ

FIG. 5: When recording kick, the author often uses a Sonotube to construct a tunnel around the drum. A close dynamic mic grabs the attack while at the tube's end, a large-diaphragm condenser (shown is a Microtech Gefell M71KMT) captures enhanced resonance.

MIXING IT UP

Unless you are truly blessed, some EQ or other signal processing will often be required to make the kick-drum sound "fit" into the track. Although it is possible to process the sound before it hits your recorder, it's usually best to concentrate on capturing a clean representation of what is coming from the drum. On the other hand, occasionally a bizarre sound can inspire similar madness in all subsequent tracks—if that's where you want to go, by all means, print the processed track as is.

However, try to limit premix processing to minor EQ adjustments—after you've exhausted the possibilities for tonal improvement by way of drum positioning in the room, drum tuning, and mic selection and positioning, of course. Rather than boosting specific frequencies, try cutting. Usually, a cut in the 400 to 600 Hz region will remove tubbiness and make for a tighter, more powerful sound. If you aren't getting enough attack, try boosting somewhere between 2 and 5 kHz.

As for compression, the primary reason I compress a kick drum when tracking is to bring out the low-frequency ring and boom—components of the sound that happen after the initial tran-

sient. A good compressor can really bring out the resonance yet maintain or even enhance the desirable click from the beater. Note, however, that I record primarily to 2-inch tape. For those recording to digital media, it may be advisable to use a compressor or limiter also as a means to avert digital clipping.

In addition, noise gates can be effective for removing sounds (snare, hats, or whatever) that occur in the spaces between kick-drum hits. If the decay of the drum starts to sound odd, try using less than the maximum dynamic range the gate offers.

FINAL SAVES

No matter how carefully you record a kick drum, it's always possible to discover (usually after the drummer has packed up and gone home) that the kick is too thin sounding or just isn't working for the track. In the case of it sounding too thin, you can beef up the sound by means of a low-frequency oscillator used in conjunction with a noise gate that features a key input. To do this, first split (mult) the kick-drum signal and insert one signal into the noise gate's key input. Next, insert a low-frequency tone from a synthesizer or another oscillator into the gate's input. Experiment with the length of time that the gate stays open and the frequency of the tone. Long gate times will yield a booming, Roland 808–type kick. (By the way, the sound used by Roland in the 808 is actually a floor tom tuned way down.)

As a last resort, a drum module with trigger inputs can mean the difference between saving a track and rerecording it. Most models will have a gate and sensitivity control that allow the unit to reject unwanted sounds on the kick-drum track. If not, it may be necessary to insert a gate between the tape output and the drum module. Of course, for those working on computers, drum tracks can readily be replaced, either manually (one hit at a time) or with the help of automated software such as Digidesign's SoundReplacer for Pro Tools.

IT'S ALL RELATIVE

When recording drums, keep in mind that most any drum will sound good if monitored loudly enough. Therefore, monitor at low levels, at least during the initial setup, to limit the "flatter effect" caused by sheer volume.

Another thing to be aware of is that your impression of the drum sound will change once the rest of the instruments are added to the mix. Thus, in addition to soloing the kick and other drum channels, make sure to audition the drums along with the other instruments. That way you can ensure that the sound is working for the song.

Richard Alan Salz *is a producer, an engineer, and a composer living in southern Vermont.*

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

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ALESIS

ADAT HD24

Look, Ma, no tape: the ADAT takes a big leap forward.

By Nick Batzdorf

The Alesis ADAT was undoubtedly one of the most influential and successful recording products of all time. Today, though, hard drives and computer processing are so inexpensive that digital tape makes less sense as a recording medium. Not only do hard disks permit instant random access and much easier editing and backup, but they also require less maintenance and have no mechanical tape mechanisms to get stressed.

Tape-based ADATs are still in Alesis's product line—a good thing, considering the millions of ADAT tapes that have been recorded. But digital multitrack tape's days of dominance as a recording format are probably over, and the folks at Alesis know it. With the ADAT HD24, Alesis joins the movement toward hard-disk recording.

Given the appeal of the ADAT's familiar tape-recorder-style operation, it makes sense that Alesis made the ADAT HD24, ADAT's successor, a standalone recorder that records onto inexpensive IDE hard drives. This new 24-track ADAT brings its ancestors' good points to a much better recording format. The ADAT HD24 uses the ADAT's 9-pin sync interface to lock multiple machines with single-sample accuracy and to synchronize their transports. The new unit even has the same

FIG. 1: The 24-channel Alesis ADAT HD24 modular hard-disk recorder promises to breathe new life into the ADAT series. The stock unit supports a word depth of 24 bits and sampling rates as high as 48 kHz, but you can record at a rate as high as 96 kHz with an optional I/O board.

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3U rackmount form factor, enabling it to directly replace or augment tape-based ADATs (see **Fig. 1**).

One interesting feature carried over from the original ADATs is the ability to slip tracks backward or forward by as many as 17 ms. (This subject could make a short article of its own, but time-aligned tracks often make a surprisingly large difference to the sound in multimic drum setups.)

Like previous ADATs, the unit comes with an Alesis Little Remote Control (LRC), which includes transport control and the essential recording and location functions. You can also control the recorder remotely using MIDI Machine Control (MMC). The MIDI I/O is also used for MIDI Time Code (MTC) output and for updating the firmware.

LIGHTPIPE DREAMS

The ADAT HD24 has 24 channels of balanced ¼-inch TRS analog I/O, which operate at +4 dBu. You also get 24 channels of ADAT Lightpipe digital I/O (see **Fig. 2**). That makes the unit an exceptional value by eliminating the need for additional cards.

The ADAT HD24's analog converters operate at 44.1 or 48 kHz, and Alesis has announced an optional 96 kHz I/O board. You can run the stock unit as a 12-track, 88.2 or 96 kHz recorder using the Lightpipe I/O and external A/D and D/A converters (you need both, and I was unable to test this feature). To accomplish high-rate sampling, the machine uses a sample-splitting scheme that sends alternating samples to two channels. Each channel sounds normal when played back on 44.1 or 48 kHz equipment. Unless the receiving device is capable of reuniting the split 88.2 or 96 kHz track, however, you cannot use external signal processing that will change the data. That includes crossfades, EQs, and, in some cases, gain changes.

On the other hand, you can copy and move the audio data in a digital audio workstation (DAW) and transfer it back into the ADAT HD24 via FTP, using the recorder's built-in 10Base-T Ethernet port. If you take that approach, the 88.2 or 96 kHz track is automatically reunited, so you can edit the data and transfer it back to the HD24.

DRIVE-TRAY CHIC

The ADAT HD24's IDE hard drives are mounted in removable caddies that slide into its two bays. One caddy comes with a 20 GB drive; the other is empty. Installing hard drives into these caddies takes approximately 90 seconds; you can use any 4-inch IDE (or compatible variants, such as the Ultra ATA/100) drive with a spindle speed of 5,400 rpm or greater, and the drives are hot-swappable. The maximum drive size is an impressive 2 terabytes (TB); that's 2,000 GB! The review unit's stock 20 GB disk performed reliably during the few weeks I tested it.

At the time the ADAT HD24 was being developed, the inexpensive IDE hard drives that were available weren't always up to handling 24 tracks of 24-bit, 48 kHz audio. So Alesis came up with a patent-pending Alesis *FST* hard-drive format to improve disk performance.

FST writes data sequentially rather than at random points across the drives, cutting seek time dramatically and eliminating the need for disk defragmentation. Alesis claims that this eradicates problems that have allegedly plagued other manufacturers' recorders and reduces wear and tear on the drives. A nice plus is that the system works with any currently available drive. On the other hand, this proprietary format can't be read by standard computers.

However, one could reasonably debate the degree to which the performance of other 24-track hard-disk recorders is impeded by their hard-disk formatting, and 7,200 rpm Ultra ATA/100 drives that outperform standard IDE drives are inexpensive. Furthermore, with certain notable exceptions, most hard drives have remained in service for years when formatted the old-fashioned way. Using standard PC formatting also allows you to swap drives between desktop computers and DAWs, something you can't

ADAT HD24 Specifications

Physical Tracks	24 (at 44.1/48 kHz)
Virtual Tracks	0
Simultaneous Record Tracks	24
Editing Features	cut, copy, paste, move, insert
Analog I/O	(24) balanced ¼" TRS
Digital I/O	(3) 8-channel ADAT Optical (24 ch. total)
A/D/A Converters	24-bit, 128× oversampling
Recording Resolution	24-bit
Sampling Rate	44.1, 48 kHz (stock); 88.2, 96 kHz (with optional I/O)
Additional Connections	(1) MIDI In; (1) MIDI Out; (1) BNC 75Ω word-clock input; (1 pr.) DB9 ADAT sync I/O; (1) 10Base-T Ethernet; (1) unbalanced ¼" footswitch (punch in/out); (1) unbalanced ¼" for LRC remote
Internal Storage	(2) hot-swappable drive bays, configured as (1) 20 GB IDE drive and (1) empty bay; maximum addressable drive size 2 TB
Effects Processors	0
Frequency Response	22 Hz–22 kHz (±0.5 dB), analog in to out
Signal-to-Noise Ratio	103 dBA, analog in to out
Total Harmonic Distortion + Noise	<0.003%, analog in to out
Nominal/Max. Operating Level	+4 dBu/19 dBu
Displays	(1) 24 ch. × 10-segment LED peak-level meter; (1) multipurpose LED status display
Dimensions	3U × 13.5" (D)
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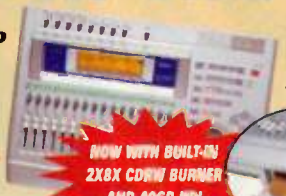

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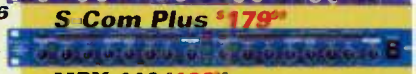

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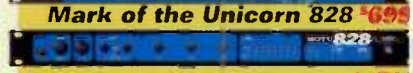

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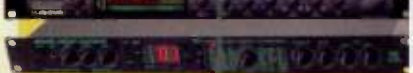

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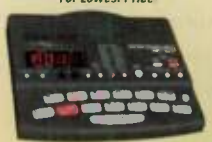

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WRH

do with an HD24. Given all that, it's reasonable to question FST's significance.

At the least, the proprietary format indicates that a serious development effort went into this recorder; it isn't just a computer and sound card in a box with some buttons and the ADAT name. Certainly, most studio owners will be delighted with not having to defragment their hard drives.

SUCCESSFUL OPERATION

In giving the HD24 a once-over and going through its menus, I learned that it is easy to use. In addition, the manual is clear and complete. Anyone familiar with recording gear could walk in and use this machine.

Of course, you still have to read the manual to learn a few things—for instance, that the machine can store 64 songs on a drive, and that you hold Stop and Rewind/Fast-Forward on the machine (not on the LRC) to scrub audio for editing. But even deeper functions such as the MIDI and sync features and disk housekeeping are obvious.

Buttons are grouped logically by function; they may be related to file or name, editing, location, digital sync, or digital I/O. You navigate through a selection using a set of four arrows. The display guides you clearly, even when you've done something that makes no sense, such as trying to make the machine play before it has loaded a song.

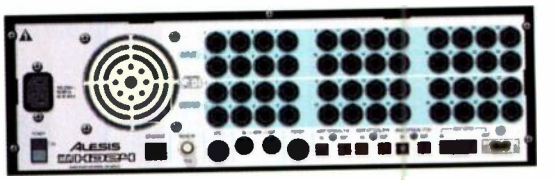


FIG. 2: The HD24's stock 24 channels of quality analog I/O and three Lightpipe digital-audio ports help make the unit a bargain buy. But that's just the beginning.

Except for the lighted transport buttons, all of the ADAT HD24 buttons are made of the type of rubbery plastic found on other Alesis products over the years. In my experience, they stand up well to repeated stress.

You set levels using dedicated ten-stage peak-reading meters for each channel (the meters are calibrated at –15 dBFS). Like most recorders made today, the HD24 has no input controls, so gain must be adjusted at the source.

The unit provides 20 autolocation markers and offers dedicated buttons for seven of them. Some markers are dedicated to the in/out points for loops, punches, and edit points. One surprise is that the name in the display doesn't necessarily reflect the current location. Instead, it's set up so you can scroll to the location you want to go to before hitting the Locate button.

The ADAT HD24 doesn't provide *virtual tracks*—the popular "take" or "playlist" feature that lets you record and store several alternate takes for each of the 24 physical tracks. The standard auto punch-in/out and rehearsal features are included, and you can control them with a footswitch for hands-free operation.

NET GAINS

The ADAT HD24's answer to people requesting more features is to make it simple to transfer audio into a DAW. One way of doing that is by using its built-in 10Base-T Ethernet port, which allows you to set the unit up as an FTP server on your network and transfer files to another computer for editing or processing. If you have a fast Internet connection with a static IP address, it would even be practical to share files on the Web.

Setting up the machine for networking is easy, though in practice it's probably easier and usually faster just to transfer the files in real time over the Lightpipe interface. That's especially true when you're moving lots of tracks back and forth, because 10Base-T isn't all that fast, and the ADAT HD24 sends tracks that extend the length of the song, not just selected regions. I'd love to see 100Base-T or even gigabit Ethernet in a future version of the machine.

HOOK, LINE, AND SYNC'ER

The sync features all work reliably on the ADAT HD24. Like every ADAT, the HD24 supports Alesis's standard ADAT 9-pin sync. In addition, thanks to its MIDI Out port, the ADAT HD24 can send MTC directly to another MIDI device, such as a computer MIDI interface. It also can receive MMC—but not MTC—through its MIDI In.

Therefore, if you only want to sync your sequencer and HD24, you can do so without an external synchronizer, although the synchronization won't be sample accurate. In contrast, most tape-based ADATs require an external synchronizer to accomplish that feat. (The exceptions are the Alesis M20, the Fostex RD-8, and the Otari V-Eight, all of which have been discontinued.)

Integrating the ADAT HD24 with MMC-compatible sequencing software is satisfying, and it isn't difficult to get it working with Emagic Logic Audio and Mark of the Unicorn (MOTU) Digital Performer. The HD24 simply appears as three ADATs in the Digital Performer Machine Control window, for example, letting you record-enable all 24 tracks.

In this setup, the MIDI sequencer uses MMC to tell the ADAT HD24 to find a given location and then play back; after that the sequencer locks to incoming MTC from the ADAT HD24.

PRODUCT SUMMARY

Alesis
ADAT HD24
modular hard-disk recorder
$2,495

FEATURES	3.5
EASE OF USE	4.5
QUALITY OF SOUNDS	4.0
VALUE	5.0

RATING PRODUCTS FROM 1 TO 5

PROS: Solid construction. Easy to operate. Networkable. Built-in analog and digital I/O. Good sync features. Better than original ADATs. Excellent value.

CONS: Editing functions are basic. No virtual tracks. FST drive format incompatible with PCs. Ethernet port is relatively slow 10Base-T. No effects option.

Manufacturer
Alesis Distribution LLC
tel. (800) 5-ALESIS or (201) 225-3222
e-mail info@alesis.com
Web www.alesis.com

The effect is much like having the digital-audio tracks in the computer alongside the MIDI tracks: go somewhere in the sequencer, and the ADAT HD24 is right there with you. That also works with tape-based ADATs, but it's much slower.

Depending on your setup, however, you might need an external synchronizer. Fortunately, any standard synchronizer that can provide ADAT 9-pin sync can be used with the HD24, including the original Alesis BRC. I tested the unit with a MOTU MIDI Timepiece AV and a MOTU Digital Timepiece synchronizer.

Except during some of the converter listening tests, I tried out the HD24 while it was connected by Lightpipe to a Panasonic DA7 digital mixer. It's usually better to clock multiple digital-audio devices from a common source, and in my case, the DA7 mixer is the clock master; its word clock drove a MOTU Digital Timepiece, which in turn sent word clock to the HD24.

SLICE AND DICE

For those who do more than the most basic editing, the HD24's destructive cut, copy, and paste editing features are probably best viewed as handy extras. Using them is certainly easier than assembly editing using offset tape machines, but you need to transfer the audio to a computer for serious editing.

Using the onboard editing features is simple. Select the tracks to be edited and then define the in and out points with the aid of the HD24's scrubbing function. An Edit Preview function with a fixed 5-second preroll is useful for fine-tuning the edit points. Then, you can cut or copy the audio between the edit points to the machine's clipboard, answering, "Yes, I'm sure," a few times along the way. Next, define the new in point and paste the data from the clipboard to replace the previous track contents. If you don't like what you've wrought, 99 levels of undo are available from backups that are automatically written to disk.

A 10 ms crossfade is applied automatically to both ends of the edit region. That's a good one-size-fits-all setting to hide edits, but it would be useful to be able to adjust the length or even disable the crossfade feature. You don't always want to crossfade into a big crash, for example, because it can smooth out the attack.

Alesis plans to release a new Medium Remote Control (MRC) that will include a jog wheel. That will be useful; scrubbing on the ADAT HD24 is difficult to control.

CONFIDENT CONVERTING

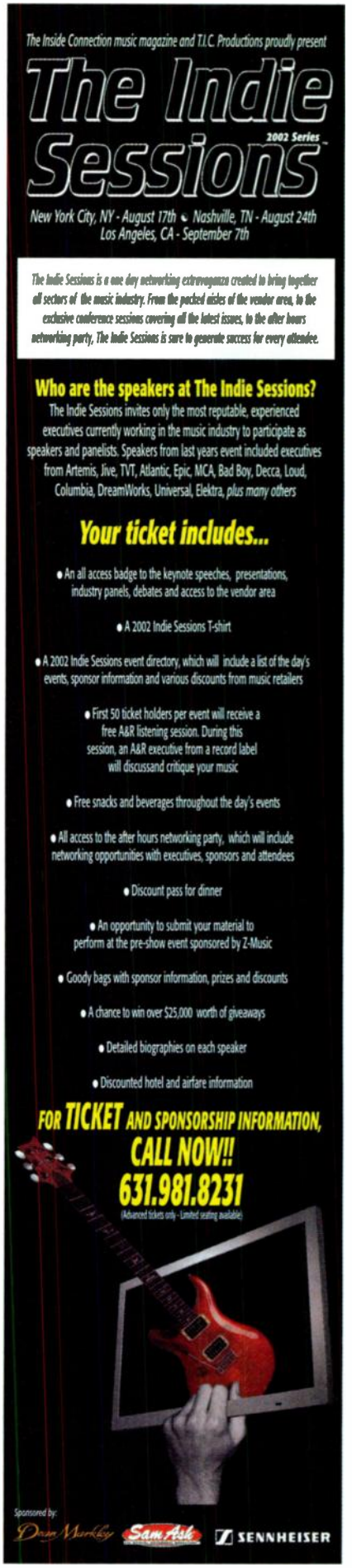
In a setup with a digital mixer doing the A/D/A conversion, the ADAT HD24 obviously has no sound of its own. But it has onboard converters. Judging their quality called for recording several instruments directly through a high-end signal path (using Millennia Media STT-1 channel strips) and recording several CDs. I compared the ADAT HD24's converters to several other converters in various price ranges, using the HD24's internal clock and an external clock (which didn't make any difference worth mentioning). Frankly, it's confounding that Alesis is able to include 24 pairs of converters of this quality. Subjectively—highly so—what you get back is pretty much what you put in.

Do they sound as good as converters that cost several times the price? Of course not; at least, not in all cases. Each A/D and D/A conversion is likely to cause some audible loss, especially with highly dynamic material. But the HD24's converters stand up surprisingly well. There's no reason to be afraid to use them.

DOES IT ROCK?

Yes, the HD24 rocks. Alesis has done an excellent job of carrying forward what made tape-based ADATs so appealing—simplicity, clean sound, and value—into a workhorse hard-disk recorder. The ADAT HD24 is a viable, solid, ready-for-prime-time performer that integrates well into any studio setup right out of the box.

Nick Batzdorf *writes articles, composes and plays music, and works as a general project-studio and audio rat.*



EMAGIC

EMI 2|6

Computer musicians, take your act on the road.

By Brian Smithers

Emagic's EMI 2|6 USB audio interface is a nifty and convenient solution for notebook-toting recording musicians. Despite its diminutive size, the EMI (Emagic Multichannel Interface) provides computer-based recordists with two analog inputs, six analog outputs, and stereo S/PDIF I/O. One feature that makes it unique among USB interfaces is its ability to output 6-channel surround. In combination with the right software, the EMI 2|6's latency is sufficiently low to make it especially useful for use with virtual instruments.

TAKE IT WITH YOU

Not only is the EMI 2|6 portable, but it's equally at home with a Mac or a PC. It's approximately the size of a videocassette, only slightly heavier, and much sleeker in its transparent blue shell (see **Fig. 1**). The analog inputs and outputs are provided on RCA jacks, and another pair of RCA jacks provides the coaxial S/PDIF I/O. I was concerned that the recessed ⅛-inch jack for stereo headphones would be inaccessible to the ¼-inch-to-⅛-inch adapter for my headphones, but it worked fine despite the fact that the connector was at least a 16th of an inch away from being fully inserted.

Two switches let you select between analog and digital input and between internal and external clock reference. A row of clearly labeled LEDs indicates the status of those choices as well as power, sampling rate, signal present, and whether input or output is 24-bit. A rotary volume control varies the headphone level independently of the analog outputs.

Ordinarily, the EMI 2|6 is powered by the USB connection. If your computer can't provide adequate power, however, a jack for an optional power supply is available ($14.95). Often I've thought, "It would have been so easy for the manufacturer to anticipate the problem and build in a solution." I have to give credit to Emagic for seeing to it that a small additional expense could make life happier for a few of their customers (not to mention their technical support crew).

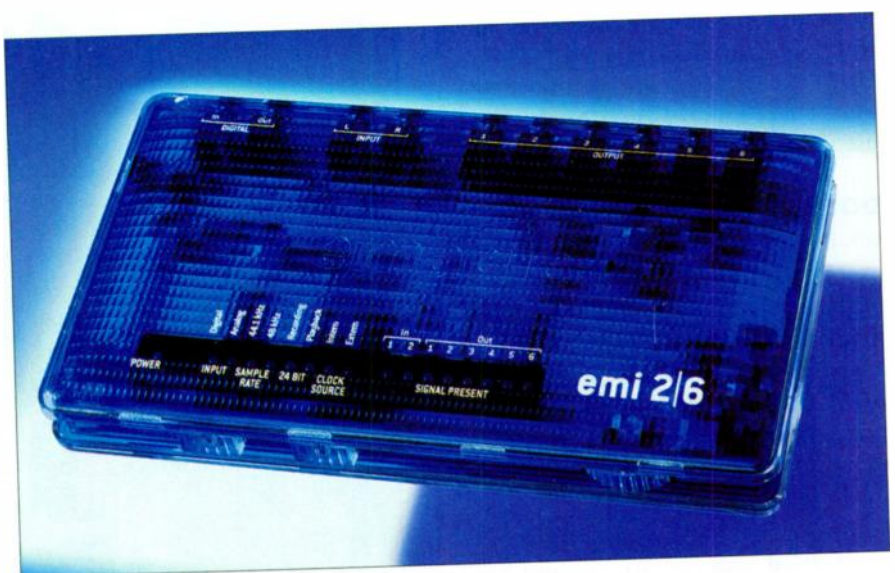


FIG. 1: The EMI 2|6 is a convenient and portable USB audio interface. In addition to stereo input, it offers six output channels, providing a lightweight option for surround-sound monitoring.

Minimum System Requirements

EMI 2|6

MAC: G3/266; 64 MB RAM; OS 9.1; USB port

PC: Pentium/233; 64 MB RAM; Windows 98SE/ME; compatible sound card; USB port

CATCH-22 KHZ

When I read Emagic's online information on the EMI 2|6, I interpreted the phrase "six playback and two recording channels at professional 44.1/48/96* kHz, 24-bit audio quality" to mean that I would be able to record and play back 24-bit audio at the same time. I was disappointed to discover that that wasn't the case. (The asterisk in the quoted phrase refers the reader to a note indicating that 96 kHz resolution is limited to stereo I/O. Note that 96 kHz support is not yet implemented on the Mac, although it may be by the time you read this.)

You're required to choose either 24-bit playback with 16-bit recording or 24-bit recording with 16-bit playback (see **Fig. 2**). According to Emagic, the problem is a result of USB 1.1's limited bandwidth. Stereo 24-bit operation in both directions is theoretically possible with the EMI 2|6 hardware, but the current drivers don't support it. Fortunately, such limitations aren't catastrophic; for most musicians, making the choice doesn't represent a major sacrifice. Users who understand exactly what they're buying will find the EMI 2|6's advantages to be well worth the compromise.

Using Steinberg Cubase VST/32 5.0 and Emagic Logic Platinum 4.8, I was able to get the EMI 2|6 operating in its 24-bit-one-way/16-bit-the-other-way modes. I'm willing to accept its limitations because recording and monitoring are rarely mission-critical at the same time. When you're tracking at 24-bit resolution, 16-bit monitoring is usually more than adequate for judging whether microphone placement is correct and performances are good. If you can't hear the bass player make a mistake at 16 bits, you're not going to notice it at 24 bits.

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Aardvark

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ZOOM

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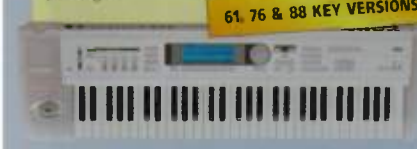

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KORG

WITH 40 GB HD & 2X8X CD BURNER

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ALESIS

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MACKIE.

Avalon VT-747SP

AVALON DESIGN

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Presonus Digimax 8 Channel Microphone Preamp

PreSonus

The Digimax combines 8 channels of pristine mic preamplification with 24 simultaneous digital and analog outputs.

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MindPrint DTC 2-Channel Dual Tube Preamp w/48 volts phantom power and more!

Mark of the Unicorn 896

Mark of the Unicorn, Inc

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MENTION CODE WEM1

WRH

UP AND AWAY

Installing the EMI 2|6 drivers on my Celeron/1 GHz notebook (running Windows XP) couldn't have been easier. I downloaded the latest drivers from Emagic's Web site and ignored the drivers on the CD. (The documentation stated that that was the correct procedure.)

The only significant problem I encountered with the EMI 2|6 presented itself immediately. I was unable to achieve any form of 24-bit operation under Cakewalk Sonar, because Sonar doesn't support ASIO or EASI drivers. (According to Emagic, I should have used the Windows MME driver.) For a remote recording session the morning after I made that discovery, I had to opt for normal-bandwidth mode, meaning 16-bit stereo input and output. Although I was disappointed to have to settle for a lower bit depth, many fine recordings have been done with 16-bit resolution. If the recording was terrible, it would be my fault, not the interface's.

EMI 2|6 Specifications

Audio I/O	(2) RCA analog inputs; (6) RCA analog outputs; (1) S/PDIF coaxial I/O; (1) ⅛" stereo headphones output (with Volume)
Driver Support	ASIO, EASI, MME, DirectSound/WDM, Apple Sound Manager (16-bit only)
Bit Resolution	24-bit input with 16-bit output; 16-bit input with 24-bit output
Sampling Rates	Mac/Win: 44.1, 48 kHz (2 input/6 output); Win: 96 kHz (2 input/2 output)
Dimensions	4.49" (W) × 7.56" (L) × 1.34" (H)
Weight	1.19 lb.

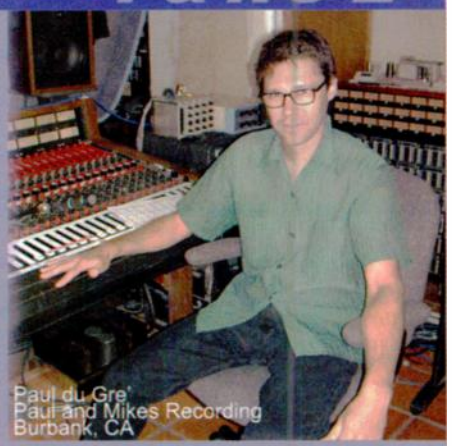
The gig was recording a talented flutist in a downtown church, and the EMI 2|6 captured the best and the worst of the situation. The combination of the flutist's tone and the church's acoustics made for moments of exquisite beauty, and the interface quietly and accurately reproduced every nuance. Later that night as I edited the session through headphones, I could also make out the distant but startlingly realistic sound of a transit bus that passed the church every 12 minutes.

As I worked, I was surprised that I had to relaunch Logic Platinum every time I switched from 24-bit playback

Artists With Ears—Take 2

Paul du Gre' Discovered That Solid Silver Cables Really Do Make A Difference...

Tracking in analog is truly an art and Paul du Gre' is considered one of the masters. He has recorded Bad Religion, Los Lobos, Rosie Flores, Dave Alvin and the seminal guitarist Leo Kottke. Having recently added DB digital conversion in his studio to archive & master 24 tracks at 96K, he knows what he hears—what works and what doesn't.


Paul du Gre'
Paul and Mikes Recording
Burbank, CA

Currently, Paul is tracking Leo Kottke and Mike Gordon of Phish on their duet CD. The entire front end in Paul's studio uses Zaolla Microphone, Instrument, S/PDIF and Clock cables. Leo, has added the G Series Silverline cable to his live rig because "...[Leo] no longer has to EQ the highs of his 12 string and can't wait to take this cable on the road."

Paul knows Zaolla Silverline cables outperform what he considered to be the best copper cables around and believe it, he simply is not easily impressed. "I like the completely open sound, without coloration of the highs and more definition in the bass and mids, these cables articulate the sounds I record, as I actually hear them."

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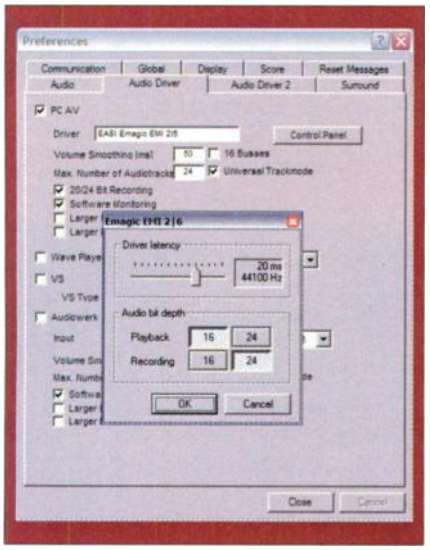

FIG. 2: The EMI 2|6 offers either 24-bit input with 16-bit output or 16-bit input with 24-bit output.

to 24-bit recording. In fact, even changing the latency settings required me to relaunch Logic, but that should be less of a problem for you once you've settled on your optimum settings.

SIX CHANNELS, NO WAITING

One of the EMI 2|6's selling points is its low latency. It is theoretically capable of a delay as short as 4 ms between input and output at 48 or 96 kHz, and as short as 8 ms at 44.1 kHz. A software synthesizer's response should be half that amount, because it requires no audio input. On my computer, though, the lowest usable latency was 12 ms. Because that's acceptable for most applications, I don't regard it as a significant shortcoming.

If latency lower than 12 ms is critical to you or if your computer can't get even that low, the EMI 2|6 offers hardware monitoring, reducing latency to virtually zero at the cost of being unable to use your software's mixer to add effects and balance the input signal. Hardware monitoring doesn't help anyone using software synthesizers, however.

It's important to note that the latency figure cited in the EMI 2|6 configuration window is a *one-way* figure (as it is with other software), and that it only refers to the driver's latency. That best-case scenario of 4 ms cited earlier, then, is achieved at the 2 ms setting. Many other factors contribute to total latency, from A/D/A conversion to the behavior of the host program. Those other factors are probably the reason that the latency I achieved was slightly longer with Cubase (under ASIO) than with Logic Platinum (under EASI).

As in all things related to recording, you should let your ears, not your eyes, be your guide. What my ears told me is that with my setup, I can use the EMI 2|6 quite successfully to play software synthesizers at a latency setting that feels snappy and responsive. When recording sax or vocals, I *might* choose software monitoring; when I am working with a client, though, I am far more likely to depend on the tried-and-true method of direct hardware monitoring.

THE LIZARD OF OS

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Emagic
EMI 2|6
multichannel audio interface
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FEATURES	4.5
AUDIO QUALITY	4.5
EASE OF USE	4.5
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Sounds good. Lightweight, portable, and convenient. Multichannel output. Headphone output with volume control. Low latency.

CONS: 24-bit operation is input only or output only, not both. Currently, 96 kHz operation is available for Windows only. Recessed headphone jack is awkward for adapters.

Manufacturer
Emagic USA
tel. (905) 649-5115
e-mail emagic@emagicusa.com
Web www.emagic.de

system requirements carefully and take special note of the supported operating systems. Adhering to OS requirements is one of the bugaboos of dealing with USB audio devices in general. Implementation of OS support for USB audio on Macintoshes and PCs has been maddeningly gradual. The EMI 216 supports Mac OS 9.1, but it does not yet support OS X. Windows ME and XP are the only way to go on a PC; the EMI 216 will function under Windows 98SE or 2000, but the digital input is not fully supported. (Under 98SE, you can't set the one-way latency lower than 20 ms.)

Despite its minor limitations, I like the EMI 216 quite a bit. It sounds good, it's easy to use, and it's an inexpensive way to delve into surround mixing. Its compact size makes it ideal for remote recording. Heck, even my headphones take up more space in my bag! It even comes in its own little leatherette gig bag. For the musician on the go or for anyone on a budget who needs multichannel outputs, the EMI 216 is worth a look. ❁

I'M BIASED

David Torn aka splattercell
Guitarist/Texturalist/Producer

Collaborators include: david bowie • ryuichi sakamoto • carter burwell • kd lang • david sylvian • cliff martinez • me'shell ndegéocello • chute • page hamilton • b.l.u.e.

Soundtrack work includes: traffic • a knight's tale • three kings • heist • the velvet goldmine • simone

Photographed by Karjean Ng at the studio of film composer Carter Burwell, New York City

David Torn is a genuine musician's musician — one of the most respected of our time.

Whether working with David Bowie on his latest album, or creating trademark textural soundscapes for *Traffic* and other blockbuster movies, or crafting a new splattercell CD, David's aesthetic for raw sonic exploration goes far beyond a conventional approach to music, let alone guitar. And to help him make his discoveries, David turns to BIAS software.

As he puts it, "I'm not much interested in what's been done before, especially when it comes to my own work. I need to keep uncovering new ground — and I love how BIAS products help me do that so intuitively, with critical speed & stability. Like my guitar, they feel like they were built just for me, letting me create a vocabulary for the language of my music."

It only makes sense that BIAS software is an integral part of David's creative process. After all, we share a common focus: the intersection of technology and art, where creativity flows on a path of least resistance. And it's from this place we create tools to help *you* define your own unique vocabulary.

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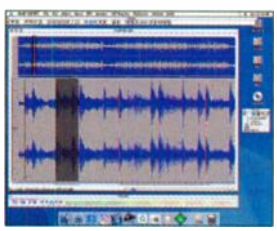

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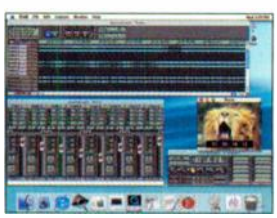

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WRH

WAVES

NATIVE RESTORATION (MAC/WIN)

Bring your recordings back to life by killing the clicks, pops, hums, and buzzes.

By Rob Shrock

Waves is renowned for its high-quality software plug-ins and hardware processors. I use Waves tools almost every day. However, when I heard that Waves was releasing a plug-in collection for vinyl restoration, extreme noise problems, and forensic work, I hardly got excited. I didn't think I needed surgical noise removal—I make sure that my recordings are always noise-free—and I haven't been recruited yet to clean up wiretaps for Uncle Sam.

Within a week, however, two people asked if I could transfer some of their old vinyl records to CD. I have to admit it—maybe I have a need for this stuff after all.

The Native Restoration bundle contains four plug-ins: X-Click, X-Crackle, X-Hum, and X-Noise. Not intended solely for vinyl restoration, they are each aimed at solving the specific audio problems that their names suggest. You can run them individually or in series; results vary according to the quality of the original source material.

Each plug-in is extremely powerful, yet Waves did an excellent job of keeping the interfaces simple. Most of the processes involve properly setting Threshold and Reduction sliders, and great presets are provided. You can monitor the resulting audio or hear the actual noise being removed. That lets you determine whether you are removing any audio material so that you can adjust the settings accordingly. The plug-ins are real time and single ended, meaning they perform their processing without the need for encoding/decoding stages as in Dolby or dbx.

X-Click is designed to remove loud pops such as vinyl scratches or digital clips. It removes the clicks and interpolates audio data to fill in the holes. Waves posted an updater to X-Click that is better at removing clicks than the version that shipped on the original CD.

X-Crackle removes or diminishes the lower-level crackles that pollute most vinyl recordings. It's usually used after X-Click.

X-Hum employs eight harmonically linked steep, low-cut, notched EQ bands to remove rumble and DC offset. It's geared toward noises with a steady pitch, such as 60 Hz hum from bad grounding.

X-Noise, a broadband noise-reduction plug-in, "learns" a portion of the noise and tailors its response to the customized profile. It's the one to use for tape hiss, guitar buzzes, and other residual background noise, such as air conditioners.

PRODUCT SUMMARY

Waves
Native Restoration
noise-reduction plug-ins
$1,200

FEATURES	4.0
EASE OF USE	4.5
QUALITY OF SOUNDS	4.5
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Removes a wide range of noise sources. Works in real time. Easy to operate.

CONS: Requires a fast computer. Not multiprocessor savvy. Audible artifacts at extreme settings.

Manufacturer
Waves
tel. (865) 546-6115
e-mail sales@waves.com
Web www.waves.com

FIG. 1: Clicks and pops in vinyl recordings (and other sources) can be removed with X-Click. Detected clicks are shown in red. In some severe cases, using milder settings and processing the audio twice produces better results. In this example, the clicks being removed from the audio are monitored by switching the Difference button on.

FOLLOW YOUR ABCs

When specifically cleaning up vinyl records, a good rule of thumb is to use the plug-ins in alphabetical order. That means you first get rid of the big loud pops and then move on to the crackles. If there are hum or noise problems, run those two plug-ins last. You can run the plug-ins simultaneously in series, but I received much better results by concentrating on one process at a time and doing the vinyl cleanup in stages. There are often more noticeable artifacts when you try to do more

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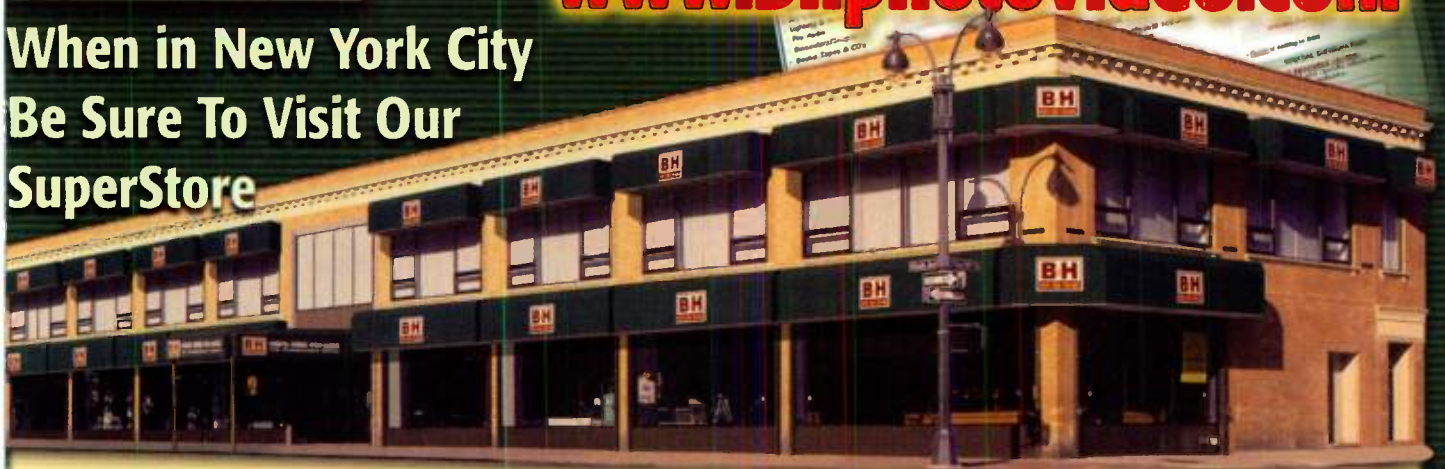

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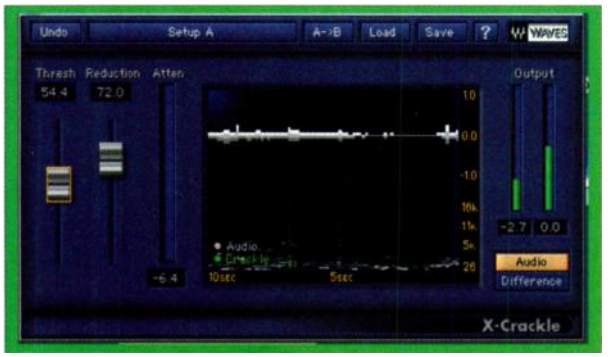

FIG. 2: Crackles detected in X-Crackle are shown in green below the audio waveform. The user can toggle between monitoring the audio output and monitoring the amount of crackle removed by pushing the Difference button.

than two processes, especially because the processing is in real time.

The Restoration plug-ins are not yet multiprocessor savvy. Even on a dual G4/800 MHz with 1.25 GB of RAM, the hit on the processor is pretty high, although I could run all four processors in series with no problem. Still, it's better to approach the plug-ins as surgical tools that you use and put away rather than as processors that you strap across a bunch of tracks and leave in place.

The Waves installer CD includes half a dozen music and dialog phrases with various noise problems. You can play with the files to learn your way around the processors. There are some serious noises, pops, and hums on these recordings, and I was able to do some amazing noise reduction on each one. Using test files provided by the manufacturer and cleaning up files in the real world, however, are two different things.

BUDDY, FREDDY, AND DISNEY

One day last December, my father-in-law dropped by with two old vinyl albums under his arm. The first was an original Coral Records *Buddy Holly Story,* and the other was an old Freddy King record in the original paper dustcover; they were two of my father-in-law's favorites when he was a kid. By coincidence, a few days later, my neighbor asked if I could transfer his Disney singalong records that he had listened to as a child so that he could play them for his six-month-old son. All of the records were old and in pretty bad shape, but I knew they would be a great test for the Waves plug-ins.

The first challenge was creating audio files that didn't skip. A few spots in the Disney records ended up having crossfades in them because I eventually gave up trying to capture some sections. Once I had the audio files of all four records in the computer (I chose 16-bit, 44.1 kHz for the sake of convenience), it was time to start the cleanup.

Sticking to the aforementioned rule of thumb, I started by using X-Click to go after the big pops. I was able to remove about 75 percent of the pops at first, and after updating to the newer version of X-Click at the Waves Web site, I got rid of most of the offensive clicks, as well (see **Fig. 1**). The Freddy King record had the worst pops, and I had to remove a few by hand in an audio editor. But the number of pops removed by X-Click in a few hours would have taken weeks by hand. There are virtually no audible artifacts with X-Click, and the interpolated data sounds perfectly natural while also maintaining the integrity of the program length.

X-Crackle was effective for getting rid of most of the remaining little pops on all of the records, although it takes a softer hand at the controls to avoid dulling the high end (see **Fig. 2**). That's where I really learned that vinyl restoration—and serious audio cleanup, in general—is a balancing act between noise and the artifacts of noise removal. It is impractical to expect to remove every single offensive artifact without adversely affecting the original audio. However, used with taste and common sense, each Restoration plug-in is a little magic box.

I didn't really need to use X-Hum on those four records, but I did have a few audio tracks that were suffering from a little ground hum. X-Hum has a few presets that are tailored for 50 Hz and 60 Hz hum, and that did the trick on a colleague's preamp that was humming when he recorded some overdubs for me (see **Fig. 3**).

TURN THE BEAT AROUND

Going back to my records, I did notice a little turntable rumble. X-Hum is quite sophisticated, allowing you to customize a highpass filter and its set of eight filters, which can be linked or unlinked to gain. Again, I found a preset that did the trick.

If it's possible to isolate a tiny portion (at least 100 ms) of residual noise, then X-Noise will pay big dividends. X-Noise removed most of the general noise that remained on the records at this point (see **Fig. 4**). This is the trickiest and, if abused, potentially most damaging plug-in in the bundle, but it can really work wonders on noisy audio. Simply toggling the Learn button while listening only to a short portion of the noise without any program material (usually found at the beginning or end of the material) creates a noise profile that can be saved. Then it's just a matter of properly setting the threshold

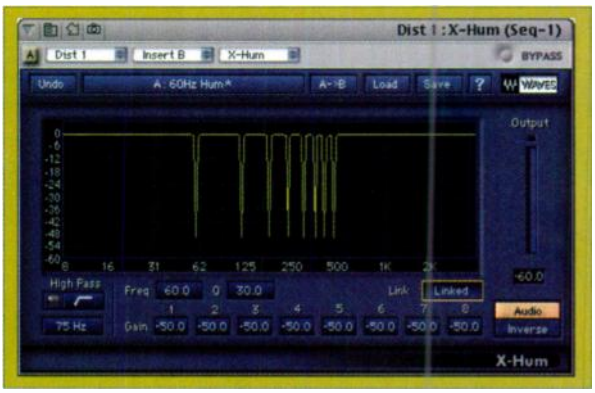

FIG. 3: X-Hum is perfect for removing static noises, such as hums and buzzes. Here the 60 Hz Hum-Removal preset is cleaning up a guitar track from a rig with grounding problems. The steep notches are harmonically related to 60 Hz, which removes the overtones of the hum, as well. The frequencies can be linked, as above, or set independently.

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and reduction amounts, keeping in mind that too much processing will cause weird phasing or aliasing sounds.

ORDER RESTORED

I can't say that the results of the vinyl restoration are perfect or that they rival the original masters—the records were in pretty bad shape. But I can say that the difference in the overall listening experience between the original audio files and the processed recordings was like night and day.

For serious audio professionals in the world of sound design, TV-production audio, film, and field recording, the Native Restoration bundle is a no-brainer. It's also great for small labels or distributors wanting to clean up their vinyl catalogs for CD distribution. It is a little pricey for the average consumer who just wants to clean up his or her vinyl collection before transferring to CD, but that's not the product's main purpose.

For professionals who need serious audio-cleanup tools, the Native Restoration plug-ins are inexpensive compared with equivalent hardware solutions. The fact that the processors run native under DirectX, MAS, RTAS, and VST hosts makes them flexible with a wide range of applications.

All of the vinyl records I worked with were transformed by each Waves processor. I haven't given my father-in-law and neighbor their CD copies yet, but I have half a mind to also give them CDs of the original audio files before cleanup so that they can appreciate how powerful the Native Restoration bundle really is.

FIG. 4: In this example, a profile (white line) of the residual noise of a vocal track has been created with the Learn button. Judicious control of the Threshold and Reduction sliders in X-Noise completely removed the noise on the output, shown by the green line.

Minimum System Requirements

Native Restoration

MAC: PPC 603/180, 64 MB RAM; OS 8.5, RTAS, AudioSuite, VST, or MAS host

PC: Pentium II/266; 32 MB RAM; Windows 95/98/NT/2000; RTAS, AudioSuite, VST, or DirectX host

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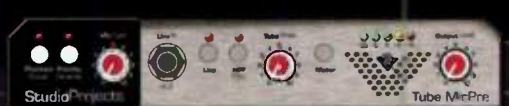

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The true story behind the worldwide #1 best-selling ear training method

by **David Lucas Burge**

It all started as a sort of teenage rivalry . . .

I'd slave at the piano for five hours daily. Linda practiced far less. Yet somehow she always shined as the star performer at our school. It was frustrating. *What does she have that I don't?* I'd wonder.

Linda's best friend, Sheryl, bragged on and on to me, adding more fuel to my fire. "*You* could never be as good as *Linda*," she would taunt. "*Linda's* got *Perfect Pitch*."

"What's Perfect Pitch?" I asked.

Sheryl gloated about some of Linda's uncanny abilities: how she could name *exact tones and chords*—all BY EAR; how she could sing any tone —*from mere memory*; how she could play songs —after just *hearing* them!

My heart sank. *Her fantastic EAR is the key to her success.* How could I ever hope to compete with her?

But it bothered me. Did she *really* have Perfect Pitch? I finally asked Linda point-blank if it was true.

"Yes," she nodded to me aloofly.

But Perfect Pitch was too good to believe. I rudely pressed, "*Can I test you sometime?*"

"OK," she replied.

Now she'd eat her words . . .

My plot was ingeniously simple: When Linda least suspected, I challenged her to name tones—*by ear.*

I made her stand so she could not see the piano keyboard. I made sure other classmates could not help her. I set up everything perfectly so I could expose her Perfect Pitch claims as a ridiculous joke.

With silent apprehension, I selected a tone to play. (She'll *never* guess F♯!)

I had barely touched the key.

"F♯," she said. I was astonished.

I played another tone.

"C," she announced, not stopping to think.

Frantically, I played more tones, skipping here and there all over the keyboard. But somehow she knew the pitch each time. She was *AMAZING!*

"Sing an E♭," I demanded, determined to mess her up. She sang a tone. I checked her on the keyboard—but she was right on!

Now I started to boil. I called out more tones, trying hard to make them increasingly difficult. Still she sang each note perfectly on pitch.

"How in the world do you do it?" I blurted. I was totally boggled. (age 14, 9th grade)

I was totally boggled. "*How in the world do you do it?*" I blurted.

"I don't know," she sighed. And that was all I could get out of her!

The dazzle of Perfect Pitch hit me like a ton of bricks. My head was dizzy with disbelief. Yet from then on, I knew that Perfect Pitch was real.

I couldn't figure it out . . .

"*How does she DO it?*" I kept asking myself. On the other hand, why can't *everyone* recognize tones by ear? It dawned on me: people call themselves *musicians* and yet they can't tell a C from a C♯?? Or A major from F major?! That's as strange as a portrait painter who can't name the colors of paint on his palette! It all seemed odd and contradictory.

Humiliated and puzzled, I went home to work on this problem. At age 14, this was a hard nut to crack.

You can be sure I tried it for myself. With a little sweet-talking, I would get my three brothers and two sisters to play tones for me—to name by ear. But it turned into a guessing game I just couldn't win.

Day after day I tried to learn Perfect Pitch. I would play a tone *over* and *over* to make it stick in my head. But later I couldn't remember any of them. And I couldn't recognize any of the tones by ear. Somehow they all sounded the same after awhile; how were you supposed to know which was which—just by *listening?*

I would have done anything to have an ear like Linda, but it was way beyond my reach.

So, finally, I gave up.

Then it happened . . .

It was like a miracle . . . a twist of fate . . . like finding the lost Holy Grail. Once I stopped *straining* my ear, I started to listen NATURALLY. Then the incredible secret to Perfect Pitch jumped right into my lap.

I began to notice faint "colors" within the tones. Not *visual* colors, but colors of *pitch*, colors of *sound*. They had always been there. But this was the first time I had ever really "let go"—and *listened*—to discover these subtle differences.

Soon—to my own disbelief—*I too could recognize the tones by ear!* It was simple. I could hear how F♯ sounds one way, while B♭ has a *totally different sound*—sort of like "hearing" red and blue!

The realization struck me: THIS IS PERFECT PITCH! This is how Bach, Beethoven, and Mozart could mentally envision their masterpieces—and

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know tones, chords, and keys—all by ear.

It was almost childish—I felt sure that *anyone* could unlock their own Perfect Pitch by learning this simple secret of "color hearing."

Bursting with excitement, I went to tell my best friend, Ann (a flutist).

She *laughed* at me. "You have to be *born* with Perfect Pitch," she asserted. "You can't *develop* it."

"You don't understand Perfect Pitch," I countered. I showed her how to listen. Timidly, she confessed that she too could hear the pitch colors. With this jump start, Ann soon realized that she had also gained Perfect Pitch for herself.

We became instant celebrities. Classmates loved to call out tones for us to magically sing from thin air. They played chords for us to name by ear. They quizzed us on what key a song was in. Everyone was endlessly fascinated with our "supernatural" powers, yet to Ann and me, it was just normal.

Back then I never dreamt I would later cause such a stir in the academic world. But as I entered college and started to explain my discovery, many professors *laughed* at me.

"You must be *born* with Perfect Pitch," they'd say. "You can't *develop* it."

I would listen politely. Then I'd reveal the simple secret—*so they could hear it for themselves*. You'd be surprised how fast they changed their tune!

In college, my so-called "perfect ear" allowed me to *skip over* two required music courses. Perfect Pitch made *everything* easier for me—my ability to perform, compose, arrange, transpose, improvise, sight-read (because—without looking—you're sure you're playing the correct tones)—and my *enjoyment* of music skyrocketed. I learned that music is very definitely a HEARING art.

Oh, so you must be wondering what happened with Linda? Please excuse me, I'll have to backtrack . . .

It was now my senior year of high school. I was nearly 18. In these three-and-a-half years with Perfect Pitch, my piano teacher insisted I had made ten years of progress. And I had. But my youthful ambition still wasn't satisfied. I needed one more thing: *to beat Linda*. And now was my *final chance*.

The University of Delaware hosts a music festival each spring, complete with judges and awards. To my horror, they scheduled me that year as the *grand finale* of the entire event.

The day arrived. Linda gave her usual sterling performance. She would be tough to match, let alone surpass. But my turn finally came, and I went for it.

Slinking to the stage, I sat down and played my heart out. The applause was overwhelming.

Later, posted on the bulletin board, I discovered my score of A+ in the most advanced performance category.

Linda got an A.

Sweet victory was music to my ears—mine at last!

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- "Thanks...I developed a full Perfect Pitch in just two weeks! I don't know how it worked. It just happened out of nowhere like a miracle." *B.B.*
- "It is wonderful. I can truly hear the differences in the color of the tones." *D.P.*
- "I heard the differences on the initial playing, which did in fact surprise me. It is a breakthrough." *J.H.*
- "I'm able to play things I hear in my head a lot faster than ever before. Before the course, I could barely do it." *J.W.*
- "I hear a song on the radio and I know what they're doing. My improvisations have improved. I feel more in control." *I.B.*
- "In three short weeks I've noticed a vast difference in my listening skills." *T.E.*
- "I can now identify tones and keys just by hearing them. I can recall and sing individual tones at will. When I hear music now it has much more definition, form and substance. I don't just passively listen to music anymore, but actively listen to detail." *M.U.*
- "Although I was skeptical at first, I am now awed." *R.H.*
- "It's like hearing in a whole new dimension." *L.S.*
- "I wish I could have had this 30 years ago!" *R.B.*
- "Very necessary for someone who wants to become a pro." *L.K.*
- "This is absolutely what I had been searching for." *D.F.*
- "Mr. Burge—you've changed my life!" *T.B.*
- "Learn it or be left behind." *P.S.* . . .

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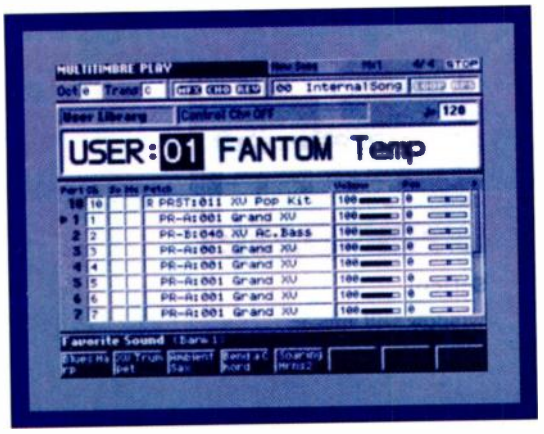


FIG. 2 : The Multitimbre screen shows you the name of the selected multitimbre and its parts, as well as the group, number, and name of the patch assigned to each part.

Mode button a bit awkward. I expected it to immediately switch between the three modes. Instead, it takes you to a menu where you use the navigation controls to select which mode you want. Then you must push one of the soft buttons under the screen to actually enter the new mode. That is too much effort for so simple a task.

Patch mode (see **Fig. 1**) is for playing and editing the instrument's individual programs. Fantom comes with 7 banks of 128 patches: five presets with 128 patches each, one General MIDI 2 (GM2) bank with 256 sounds, and one bank of 128 user patches. The factory user bank is made up of "best-of" patches from the preset banks. Multitimbre mode (see **Fig. 2**) is intended for sequencing and comes with 16 useful preset templates (Rock, Jazz, Hip-hop, Techno, Orchestral, and so on), and 16 user template slots. Performance mode (see **Fig. 3**) allows you to split and layer as many as 16 patches across the keyboard in any manner. There are 64 preset performances and 64 user slots.

The Performance and Multitimbre preset banks are duplicated in the user bank when the unit first ships. I think that is a good idea because it encourages users to dig in and create custom setups without fearing that they will overwrite something important.

On the left-hand side of the instrument are the performance and transport controls. The Fantom has four toggle switches, which illuminate when activated, and four real-time knobs. Their functions vary from program to program, but their current assignments are displayed on the screen in Patch mode in any case. The preset value of the knobs is displayed until one of them is turned, and then the value immediately reflects the knob's physical position.

I found what appears to be either a slight bug or an oversight in the operating system regarding the soft buttons. If one of them is set to toggle a parameter (such as Portamento on/off or Mono/Poly) and that function is already engaged as part of a Program, you would expect that pressing the switch would turn that parameter off. Not so: it takes *two* button presses to disengage the assigned parameter; the first press simply lights the button. (Roland is aware of the problem and is working to correct it.)

SPIRITED CONTROLS

The Fantom also includes tape-style transport controls for the sequencer; dedicated on/off buttons for the arpeggiator and rhythm pattern generator; a D-Beam controller; and the Roland combination pitch bend/mod paddle. I find that the paddle functions nicely as a pitch bender, but it is a weak mod controller because there is no way to leave it engaged.

The rear panel (see **Fig. 4**) has a pair of balanced ¼-inch main outputs; a set of unbalanced ¼-inch auxiliary outputs; MIDI In, Out, and Thru; and inputs for one momentary footswitch and two continuous foot controllers, which are assignable. The Fantom also has two S/PDIF outputs—one is coaxial (RCA), the other optical (Toslink)—which is a nice touch. A contrast knob and a stereo ¼-inch headphone jack are also located on the rear panel.

BUILDING BLOCKS

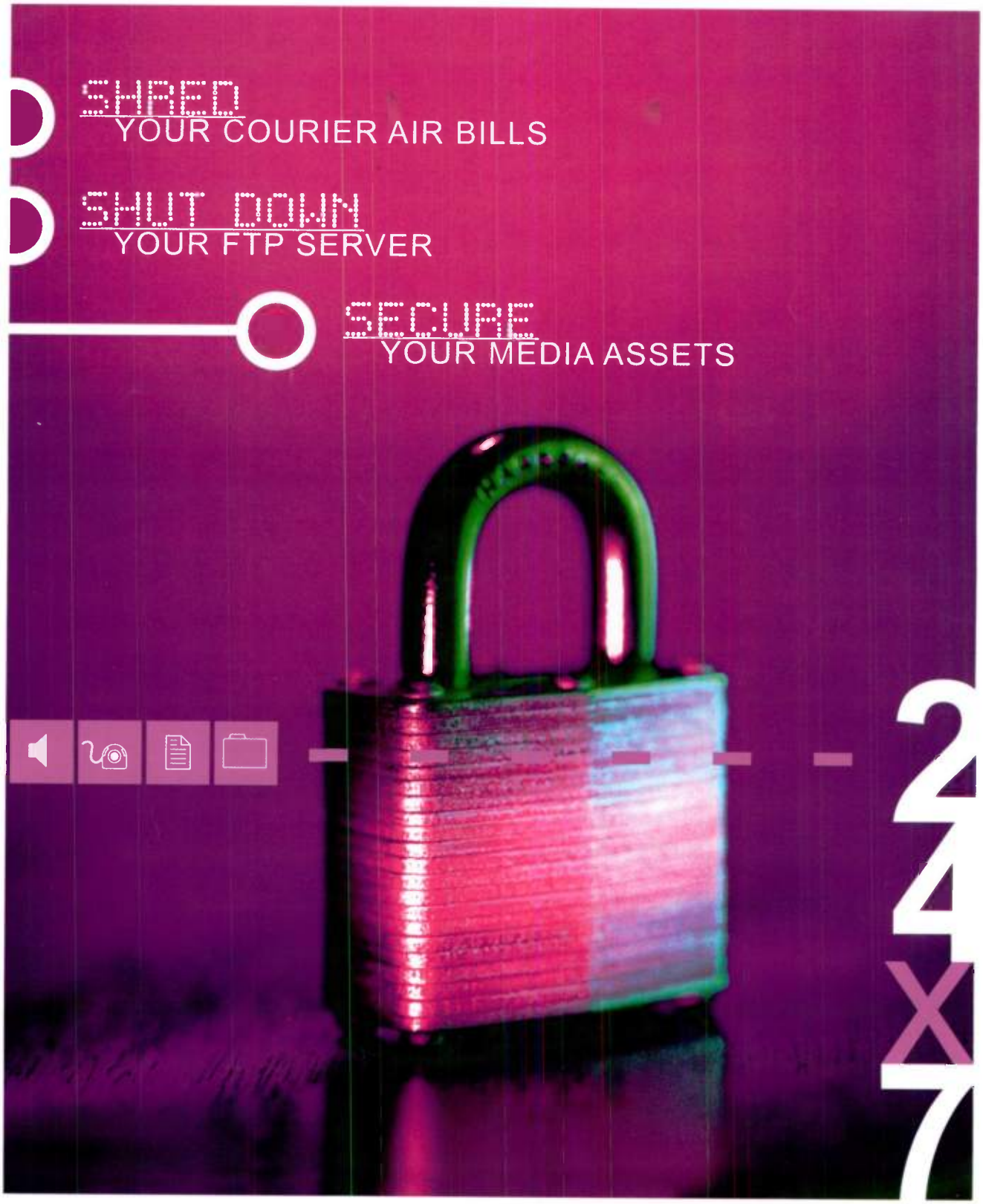
The Fantom's 64-voice architecture is based on Roland's latest XV engine, which essentially employs the same four-layer-per-program ROMpler technology that the company has been using successfully for years. However, there are a few new twists: it has four times the ROM, 24-bit D/A converters and effects, and the ability to access the new, larger expansion boards.

In addition, it is now possible to use two waveforms in a single tone. The Fantom's wave ROM contains a selection of stereo samples, including piano, organ, brass, strings and drums. As you might suspect, using these robs polyphony, so building a four-tone patch with each tone using two waveforms requires eight voices per note. I found that the Fantom's layered piano and pad patches in particular suffered from fairly noticeable voice stealing compared to similar patches on other instruments I own (all of which have the same amount of polyphony or less).

Roland has made the Fantom expandable, but they have chosen to limit the unit's expansion capabilities to two of the newer SRX boards and just one of their numerous SR-JV ROM sets. The expansion boards are easily installed by even the most technophobic end-user.

Among the noteworthy features of the Fantom's architecture are real-time parameters that can be linked up using a modulation matrix. The easy-to-understand grid in Patch Edit mode

FIG. 3: From the Performance Play screen, you can view the song file name, measure location, time signature, tempo, MIDI channel, and status of the multi-effects.



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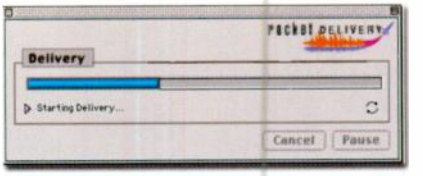

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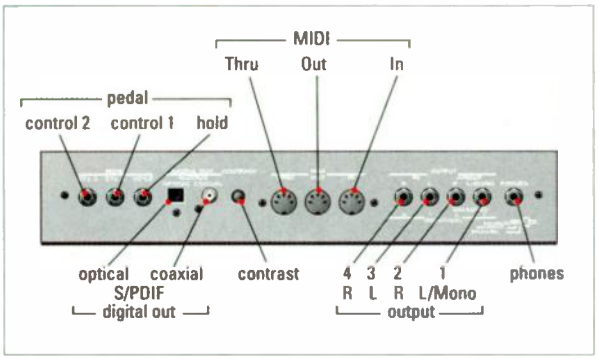

FIG. 4: The Fantom offers a pair each of balanced and unbalanced ¼-inch analog outputs, coaxial and optical S/PDIF digital outputs, and more.

allows you to assign as many as 4 sources to any combination of 33 different destinations. These can be toggled on and off on a per-tone basis. Moreover, commonly used parameters—Cutoff; Resonance; and Attack, Decay, and Release times—have already been mapped to dedicated Continuous Controller commands, making controlling them much more convenient. You can assign and control as many as four additional effect parameters in the same manner.

Another program parameter that caught my attention is called Analog Feel, which applies 1/f Modulation intended, according to the manual, to "simulate the instability characteristic of an analog synthesizer." Basically, it makes the instrument's tuning drift using an LFO to change the pitch. The user can set the amount of Analog Feel between 0 and 127, but there's no way to control the LFO's speed. Nice idea, but to my ear it resembles sample and hold more closely than it does analog drift.

In its attempt to make the Fantom more user-friendly than other keyboard workstations, Roland didn't put a sampler in the instrument. At first that may seem to put the product at a disadvantage. But for a musician who wants a no-nonsense, easy-to-use compositional tool, the sampler might not be missed.

LISTEN UP

The basic sounds in Program mode are organized into banks of 128 patches. These can be called up in numerical order or viewed by category. I really miss having a numeric keypad somewhere on the synthesizer: selecting programs on the Fantom without one is somewhat frustrating because you're restricted to the data wheel and the Inc and Dec buttons (you can hold down the Shift button to increase the dial speed). Roland does give you instant access to any of the 64 sounds stored in eight banks of eight Favorites. That is helpful, but there's still no way to just immediately grab any program in the instrument.

The sounds in the Fantom, including one of the more interesting sets of electronic patches I've heard, are very impressive. It took me quite a while to get through them all because I kept getting inspired to cut tracks. There is a full range of leads, from sweet to searing; pads, both lush and evolving; fat synth brass; gorgeous strings; lots of great basses; and numerous complex and intriguing textures and effects guaranteed to provide a wealth of inspiration.

If the Fantom's sound set has a weakness, it's in some of the acoustic emulations. The piano's decay segment, for example, is a bit short. The way the samples are looped makes sustained notes sound a little unnatural, and the velocity crossover between the soft- and hard-strike samples is a bit choppy. I also found the electric guitars somewhat lacking. Of course, if these instruments are an important part of your music, you can add one of the SR-JV or SR-X expansion ROMs. The SRX-02 Concert Piano expansion board, for instance, features a 64 MB grand piano set.

In contrast to the electric guitars, I really like the Fantom's electric pianos, Clavinets, and acoustic guitars tremendously. The majority of the orchestral instruments were more than adequate, but they left me wondering how much of an improvement I'd get if I added an orchestral ROM.

Because Roland provides an easy way to globally defeat the effects, I was able to audition many of the sounds in their dry state. You're probably going to want to leave the effects on, because they are as integral to the sonic architecture of the instrument as the synthesis elements.

GENERAL EFFECTS

In addition to separate reverb and chorus/delay, the Fantom has 90 multi-effects (MFX) configurations that give you a huge variety of individual and combined effects to choose from. They include most of the effects you'd expect to find, as well as ring mod, mono and stereo formant filtering, lo-fi noise and compression, and, of course, the ubiquitous Roland Beat Slicer.

Effects combinations can be found in simple two-way combinations, such as Distortion/Delay or Overdrive/Flanger, and in more complex combinations identified by names like Keyboard Multi (ring mod, 3-band EQ, pitch shifter, phaser, and delay) or Stereo Overdrive (overdrive, amp simulator, and 2-band EQ). Roland has also woven its RSS 3-D imaging technology and its COSM modeling into the mix. Used mainly for

PRODUCT SUMMARY

Roland
Fantom
keyboard workstation
$2,295

FEATURES	4.0
EASE OF USE	4.5
DOCUMENTATION	4.0
VALUE	4.0

RATING PRODUCTS FROM 1 TO 5

PROS: Sensible interface. Big display. Great-feeling keyboard. Optical and coaxial S/PDIF outputs.

CONS: Limited expansion capability. No alphanumeric keypad. Stereo layers can reduce polyphony. No sampler.

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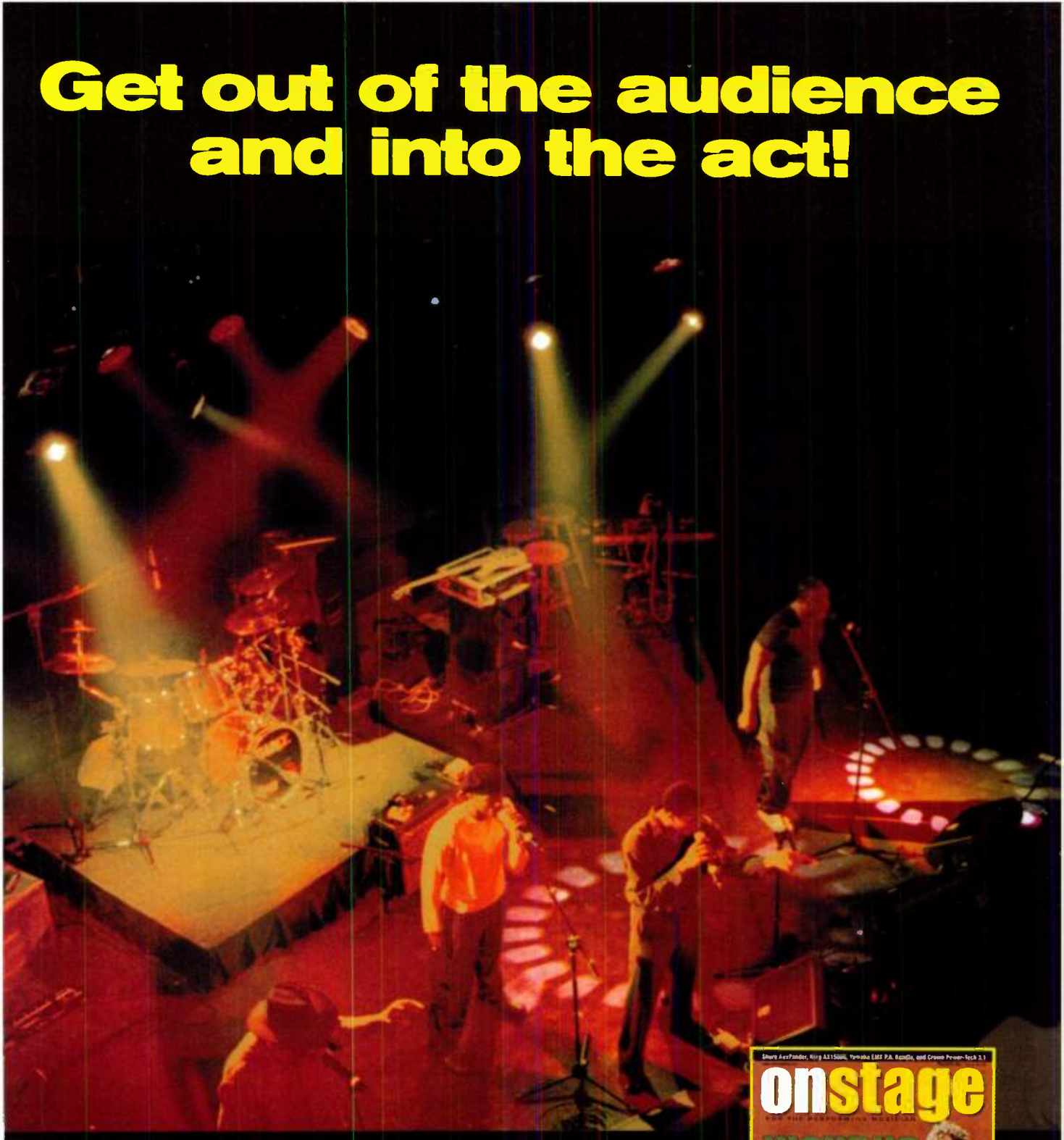

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guitar-amp simulations, COSM is also lots of fun on synth leads, electric-piano patches, and organ emulations.

LET'S MAKE TRACKS

Another of the Fantom's standout features is its onboard sequencer. The large display gives you an environment that resembles a PC version of Roland's MRC software. Almost every task that you need is easily accessible.

The majority of the sequencer's mixing functions are available in the main screen of Multitimbre mode, which gives a list of 16 parts, each with its own settings for Channel, Solo, Mute, Patch Selection, Output Assignment, Chorus, and Reverb. Choose a track to work on, select your Program, hit record, and off you go. Want a scratch rhythm track, or maybe some drum loops to build dance tracks around? Just toggle a track to Rhythm status, select a drum kit, engage the rhythm-pattern generator, and start pressing keys to get perfectly placed loops. You can even play sampled drums in real-time as you're laying the loops down. Synchronization happens transparently: the rhythm patterns, arpeggios, LFOs, and time-based effects automatically lock to the sequencer's tempo.

Although the sequencer does give you a generous 120,000 notes of memory, everything must be archived to the floppy drive: anything that's not backed up is lost when the machine is turned off. The Fantom uses the floppy drive as its memory repository: all songs are accessed from it, and only one song can be active in the Fantom's memory at a time. Thankfully, the software lets you play songs immediately from diskette, either individually (Quick Play) or in groups (Chain Play), without having to load them into the internal memory.

Fantom Specifications

Analog Outputs	(2) balanced ¼" TRS; (2) unbalanced ¼" TS; (1) ¼" stereo headphone
Digital Outputs	S/PDIF coaxial and optical (24-bit, 44.1 kHz)
Additional Inputs	(1) sustain pedal, (2) footpedal controllers
MIDI Ports	(1) In, (1) Out, (1) Thru
Sound Engine	sample playback; subtractive synthesis
Keyboard	76-key semiweighted; transmits Velocity, Channel Pressure
Polyphony	64 notes
Multitimbral Parts	16
Voice Memory	ROM: 256 GM and 9 GM drum kits; 640 Patches and 16 Kits RAM: 128 user and 16 user drum kits
Performance Memory	ROM: 64 preset; RAM: 64 user
Multitimbral Memory	ROM: 16 preset; RAM: 16 user
Waveform ROM	64 MB (1,083 waveforms)
Waveform Expansion	SR-JV series (1 slot); SRX series (2 slots)
Effects	Chorus (2 types), Reverb (4 types)
Multi-Effects	90 types
Arpeggiator	88 preset styles
Preset Rhythms	50 styles for each of the 12 patterns
Sequencer	16 tracks, 120,000 notes, 480 ppq resolution, SMF and MRC-Pro song import, one song in memory at a time
Real-Time Controllers	pitch/mod paddle; (4) assignable knobs; (4) assignable sliders; D-Beam
External Media	3.5" floppy drive
Display	320 × 240 pixel backlit LCD
Dimensions	49.94" (W) × 4.56" (H) × 15.75" (D)
Weight	32.69 lb.

MOVIN' AND GROOVIN'

The Fantom's arpeggiator provides 88 preprogrammed arpeggio patterns, which Roland calls *styles*, to choose from. Each arpeggio style includes variations, and there are ten motifs that control the order in which the notes are arpeggiated. You can also edit the arpeggios' accent rate, shuffle amount, and resolution. Those powerful features should help make up for the fact that you can't program your own arpeggio patterns from scratch, adjust the gate time of the notes, or trigger arpeggios while the chord just played is still sounding.

The Fantom's rhythm-pattern generator is a series of specialized arpeggios that works on any of the drum kits. A different pattern is mapped to each key within a single octave. When used with the drum and rhythm programs, the rhythm-pattern generator provides a nice assortment of instantly accessible beats and phrases. Try using it in a Performance setup with other drum sounds and a few synth patches to get your creative juices flowing.

UNMASKED

Roland's Fantom is a powerful and flexible workstation with a great-feeling keyboard, a comprehensive feature set, and a screaming collection of patches. Although I was a bit disappointed by a few of the acoustic samples, overall the Fantom sounds great, and you can easily augment its sound set with expansion boards.

Roland seems to have created Fantom for musicians who want something they can use with ease and program without feeling intimidated. The instrument is aimed perhaps at more ambitious GM customers who want something they can grow into. This concept can be as appealing to professionals as it is to hobbyists: as a seasoned synth user, I was relieved to play something this intuitive for a change. Sometimes it's nice to just be able to plug and play and get great results.

David Bryce *is a keyboardist, composer, and voice-over artist living in the Los Angeles area. He also claims to make killer lasagna.*

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SHURE

KSM27

A really fine large-diaphragm condenser mic at a bargain price.

By Barry Cleveland

The relatively inexpensive KSM27 joins the cardioid KSM32 and the multipattern KSM44 as the latest in Shure's KSM series of studio condenser microphones. The KSM27 is a general-purpose mic designed to sound good in a variety of applications. Shure describes the mic as having a more full-bodied sound than the KSM32, with a frequency response more like the KSM44's. According to the manual (which is written in six languages), the KSM27 can handle vocals and broadcasting; acoustic, electric, wind, and low-frequency instruments; drums and percussion; and choral and orchestral ensembles. Oh, and it can be used as an ambient room mic. I didn't have a chance to use the KSM27 in quite that many ways, but I did try it on several typical sources and a few less typical ones.

The new Shure KSM27 is an affordable, solid large-diaphragm condenser mic that sounds consistently good on a wide range of sources.

The microphone comes in a thick red velveteen pouch. A little more than six inches long and two inches wide, the champagne-colored KSM27 looks like a slightly smaller version of its more expensive siblings. At nearly a pound and a half, the mic has a nice heft, and its die-cast zinc housing gives it a solid feel. A Shure nameplate identifies the business side of the mic.

The KSM27 is a side-address, large-diaphragm condenser mic with a fixed cardioid polar pattern. Its ultrathin one-inch-diameter Mylar diaphragm is sputtered with 24-karat gold and feeds a Class A, discrete, transformerless preamplifier. High-quality electronic components and gold connectors are used throughout. The mic requires 48V phantom power to perform optimally, but it can be used with as little as 11V—as long as you don't mind some diminished sensitivity and headroom.

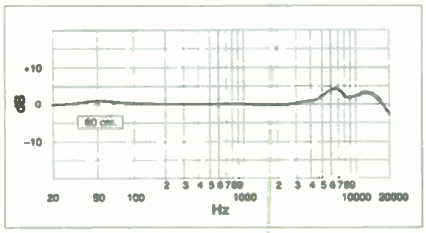
Two small switches on the rear of the KSM27 control a 15 dB pad (the mic can handle SPLs as high as 153 dB with the pad engaged) and two highpass filters: a mild 6 dB-per-octave rolloff at 115 Hz and a steeper 18 dB-per-octave cutoff at 80 Hz. A subsonic filter, which is always functioning, eliminates frequencies below 17 Hz entirely, and an integrated three-layer mesh grille reduces unruly sibilants, plosives, and other undesirable breath sounds.

A really nice touch is the included ShureLock Rubber Isolated Shock Mount. Most mics in this price range come with a marginal shockmount if they come with one at all. The KSM27's shockmount is sturdy, well designed, and simple to use. It connects to the KSM27 through threads at the base of the mic and uses four fairly rigid rubber bands to suspend the mic.

Optional accessories include the A32SC aluminum carrying case ($88.40), the A32WS foam windscreen ($13.26), the PS-6 Popper Stopper ($43.67), and the A32ZB padded carrying bag ($29.17).

TEST CONDITIONS

I had the opportunity to use a pair of KSM27s for more than a month. I used them most with an Aphex 1100 discrete Class A tube-mic preamp going directly to digital media (ADAT or MOTU Digital Performer) and analog tape, though for comparison I sometimes also used the preamps on my Yamaha 03D digital mixer. Connections were made with various Mogami cables, and I monitored sources and playback on JBL LSR28P powered monitors.



COURTESY SHURE INC

FIG. 1: The KSM27's frequency-response graph shows a significant "presence boost" between 5 and 8 kHz.

I noticed first that the KSM27's output level was generally a little lower than that of the average large-diaphragm condenser. I also noticed, over time, that differences between the two KSM27s were negligible in all applications.

During my tests, I tried engaging the highpass filters at various points and found that they both worked quite well. I didn't use the mic in any live applications, but it is easy to imagine that the 80 Hz low cut would come in handy for eliminating bass-amp rumble and other stage vibrations.

The KSM27's manual indicates that the mic has a frequency response of 20 Hz to 20 kHz. The response is basically flat, but with a slight bump at 50 Hz and a rise of nearly 5 dB at around 5 and 6 kHz. This "presence boost" remains 2 or 3 dB up from there until dropping steeply at around 15 kHz (see **Fig. 1**). That gives the KSM27 a little extra sparkle in the highs and high mids, and the boost at 5 kHz makes it a natural for acoustic and electric guitars.

HEARING VOICES

I recorded two vocalists. First up was a female vocalist who had a thin voice with a slightly annoying edge in the upper mids. Given the KSM27's steep boost at 6 kHz, the mic theoretically should have exacerbated the edginess. Instead, it actually mellowed out the

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KSM27 Specifications

Element	externally polarized, DC bias capacitor ("true" condenser)
Diaphragm	1", 2.5 µm, 24-karat-gold-sputtered Mylar
Polar Pattern	cardioid
Frequency Response	20 Hz–20 kHz
Dynamic Range	124 dB
Sensitivity	–37 dBV/Pa
Signal-to-Noise Ratio	81 dB
Self-Noise	14 dB
Power	48V phantom
Maximum Sound-Pressure Level	138 dB; 153 dB with pad (for <1% THD)
Highpass Filters	(1) 17 Hz (fixed); (1) 80 Hz, 18 dB/octave (switchable); (1) 115 Hz, 6 dB/octave (switchable)
Attenuation Pad	(1) 15 dB
Dimensions	6.5" (H) × 2.2" (D)
Weight	1.41 lb.

sound and added some much-needed fullness and warmth to the low mids. It turned out to be an excellent match for her particular voice.

The other vocalist, a man, sang and read some poetry. His voice was fairly deep with lots of resonance, and he worked the mic closely, particularly during the spoken-word session. Unlike the first vocalist, he really understood microphones and had great technique, which enabled him to take full advantage of the KSM27's forgiving proximity effects. At one point, when it looked as though he was going to swallow the mic, I engaged the low-frequency filter—a move that allowed the mic to be "eaten" yet still produce successful results.

Despite the contrast in the qualities of the two voices (and the difference in their technical skills), the KSM27 captured both performers with a surprising amount of clarity. The highs were light and airy, the mids well represented, and the lows smooth and tight. The mic didn't impart a lot of character, but the sound was pleasant and satisfying, and both vocalists were happy with the results. The KSM27's integral pop filter (the three-layered mesh grille) worked well, but not perfectly—in both cases, I wound up having to use an external pop filter.

SIX-STRING STALWART

When placed about six or seven inches directly in front of a Martin D15 steel-string acoustic guitar's sound hole, the KSM27 produced a warm yet balanced sound—perhaps a little too warm for a gentle fingerpicker who wants to hear ultrabright highs, but about right for a player using a pick and strumming chords. In a more conventional position, about six inches from the intersection of the neck and the body, slightly off-axis, the KSM27 accentuated even the most subtle finger sounds in a pleasing manner while still retaining a significant amount of low mid warmth. The imaging was equally well defined in both cases.

The results were even better on electric guitar. When placed a half inch away from the single 12-inch speaker in a Rivera Thirty Twelve, at the edge of the cone, the KSM27 sounded great on clean and distorted amp settings. Placing it about 20 degrees off-axis removed a little of the bite and emphasized the roundness of the mids. My favorite location, however, was back about a foot away from the speaker. That position let in just the right amount of air and ambience to capture what I was hearing in the room.

SKINS AND WINDS

Though I didn't have the opportunity to use the KSM27 on a drum kit, I did record several hand drums and other percussion instruments with the mic. The KSM27 sounded great on a large ceramic dumbek, particularly when I used the pair of mics, one on either end of the drum, to capture the high *bek* sounds coming off of the head and rim and the low *dum* sounds from the other end. There was just the right amount of finger sound to give the image a natural presence, and when I moved my hand in and out of the drum, raising and lowering the bass pitch, the mic tracked the air movement with impressive accuracy. I got similarly good results with conga, tar, and other hand drums, as well as with a slot drum and an assortment of shakers.

To further test the KSM27's versatility, I used it to record three instruments modified by Michael Masley (aka the Artist General; www.artistgeneral.com; see **Fig. 2**). In all cases, the modifications were in fact significant enough to qualify the instruments as original creations.

The Bandrum is a large metal dumbek with two half-inch-wide rubber bands stretched around it lengthwise and a large cork at the center of the head that serves as a bridge for the "strings." Inside is a large spring that

PRODUCT SUMMARY

Shure
KSM27
large-diaphragm condenser microphone
$575

AUDIO QUALITY	3.5
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Solid construction. Versatile. Class A, discrete, transformerless preamplifier. 15 dB pad. Two switchable highpass filters. Subsonic filter. Comes with high-quality shockmount.

CONS: Output level slightly lower than average.

Manufacturer
Shure Incorporated
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Web www.shure.com

JASON CLOPTON

FIG. 2: The Artist General (Michael Masley) poses on the set of the "documental" film *Art Officially Favored* with the Reedslide, one of his many hybrid musical-instrument creations.

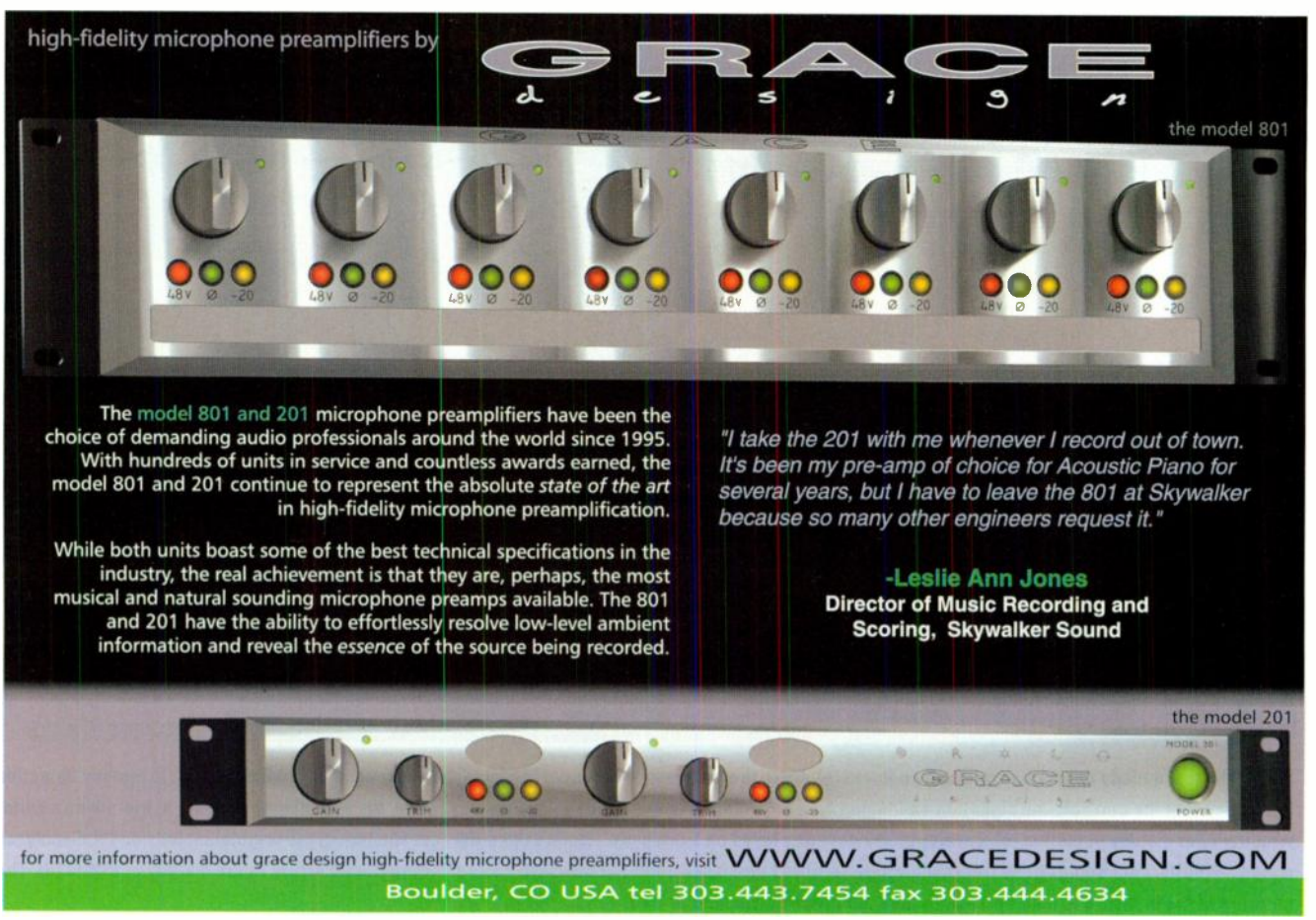
acts as an acoustic reverb unit. Hitting the cork produces a kick-drum-like sound, tapping the rim produces snare-like sounds, and "plucking" the rubber bands produces "bass" notes; in addition, the internal spring acts as a reverb for all three sounds simultaneously. The KSM27 did a remarkable job of capturing the complex cluster of sounds generated by the odd instrument, keeping each distinct and in balance, including the subtle "reverb" tails.

The Reedslide and the Lakota Slide are variations on a theme—modular instruments that use a clarinet and a flute mouthpiece, respectively. The mouthpieces are attached to the bodies of an Irish flute, a silver C flute, or a recorder through a trombonelike mechanism that allows you to slide between pitches mechanically while fingering the airholes. The Reedslide produces throaty timbres ranging from rich low notes to high squawks, and the Lakota Slide produces woody, flutelike sounds. The KSM27 handled them all, including the more bizarre variations, reproducing each sound with no distortion and little, if any, coloration. I've tried pricier mics that didn't fare nearly as well, so the KSM27 got high marks in this difficult application.

TAKE TWO

The Shure KSM27 isn't a mic with lots of personality; rather, it is a solid general-purpose microphone that can be used on a wide variety of sources with good results. Its versatility makes it a great choice for personal-studio owners looking for an affordable yet good-quality large-diaphragm condenser, and the included shockmount really sweetens the deal. Indeed, given the KSM27's low price, you might want to consider buying two of them—these mics work really well as a stereo pair. Two thumbs up.

Barry Cleveland *is a Bay Area–based recording artist, engineer, and producer (www.barrycleveland.com). He is the author of* Creative Music Production: Joe Meek's Bold Techniques *(artistpro.com, 2001), a book about the visionary British producer's contributions to the art of recording.*



CELEMONY

MELODYNE 1.0.1 (MAC)

An audio editor that "knows" about music.

By John Duesenberry

Imagine using a sample editor to change a vocal melody from major to minor or to accent the third beat of every measure using an amplitude boost. Sound tedious? Melodyne 1.0.1, from German newcomer Celemony Software, represents audio in a musical way and makes transformations such as those rather easy to do.

Melodyne is a Mac program that takes a fresh and original approach to the sonic materials musicians work with. (A Windows version is in late beta as of this writing.) It offers many capabilities common in signal processing, sequencing, and transcription software, including melody detection and transcription, pitch shifting, formant correction, time compression and expansion, tempo adjustment, and audio-to-MIDI file conversion. Melodyne lets you work with those features in a musical context. It analyzes a monophonic audio signal and presents the results in terms of pitches and rhythms within an overall metric and tempo structure.

Melodyne's musical intelligence makes editing audio feel like editing music. Consider pitch correction, for example. With a conventional audio editor, you locate a sour vocal note visually or with a scrub tool; then, you select the samples, calculate the required pitch correction, apply a digital signal-processing pitch-shifting operation (with formant correction, preferably), and do your best to edit out or mask any resultant glitches. Even the best pitch-shifting algorithm might distort subtle musical characteristics of the altered event, such as the singer's vibrato or the pitch transitions to the surrounding notes.

Minimum System Requirements

Melodyne

G3/300; 128 MB RAM; OS 9.0.4

With Melodyne you select a range of notes (rather than a range of samples) at a given measure and beat location; next, you drag it to the desired pitch level. The amount of shift could be a single cent, or it could be quantized in semitones or in terms of a scale and key, if desired. Formant correction is applied automatically. Because Melodyne knows about the internal characteristics of each note, you can tweak those characteristics, widening the singer's vibrato a little, for example.

COMPATIBILITY

I reviewed Melodyne on a Macintosh G4/867 MHz with OS 9.2. The audio hardware was a Korg OASYS PCI card with version 2.0 software installed. I encountered no compatibility problems.

Setting up Melodyne is simple—just

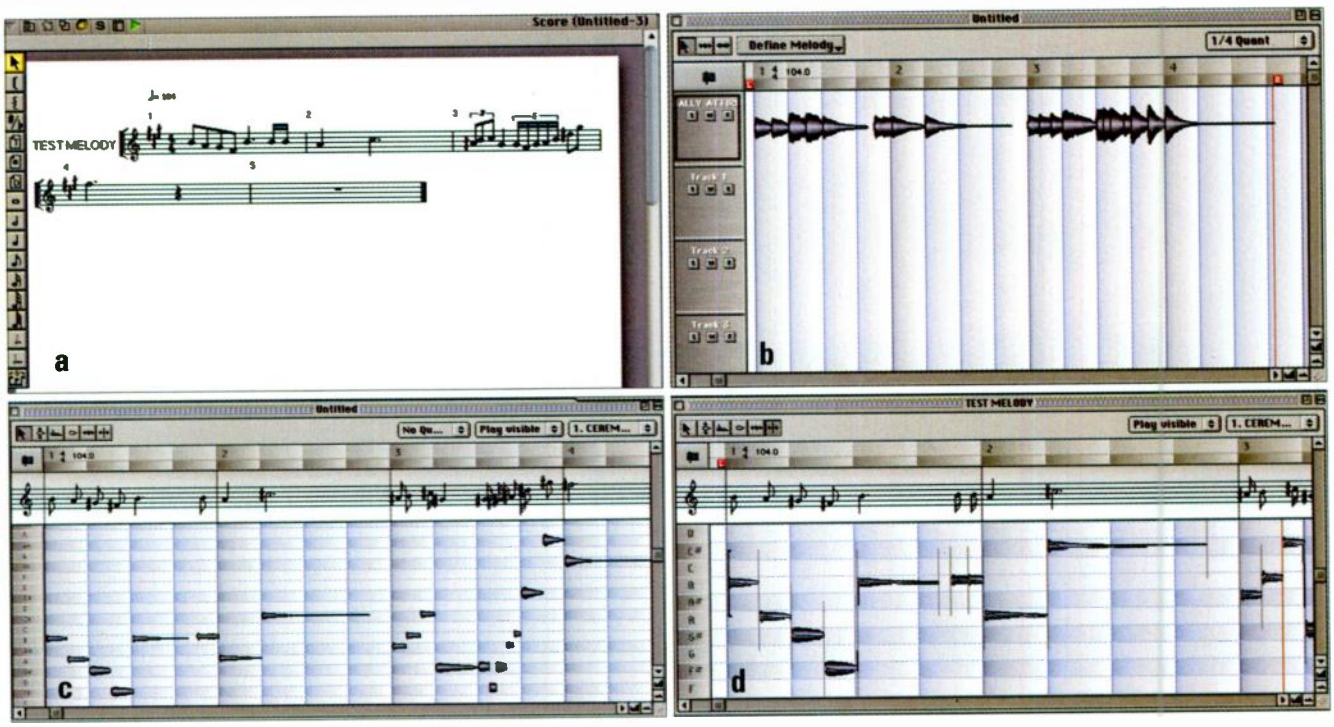


FIG. 1: The test melody appears as originally notated (a). Next, the test melody is shown in Melodyne's Arrangements window prior to melody detection (b). Notice that the correct time signature and tempo is in the timeline above the envelope display. Third, the test melody appears in Melodyne's Editor window after melody detection (c). Envelopes are now displayed on a pitch grid. Notice the differences between the original melody and the analyzed melody. Finally, note separations (represented by vertical bars) were added in measure 1 to correct rhythmic errors in the melody analysis (d). The notation of the measure is now correct, though not properly beamed or tied.

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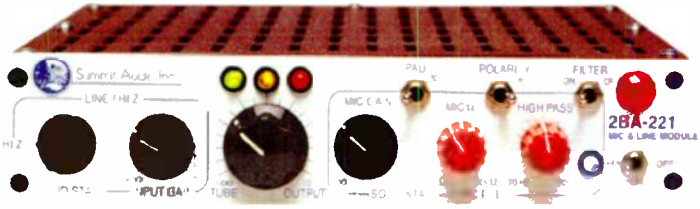

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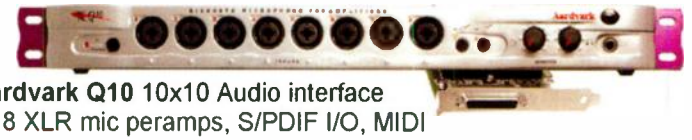

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run an installer program and enter a license key. Then, use the Preferences window to specify audio parameters. By default, Melodyne uses the Macintosh Sound Manager for audio playback and recording, but you can direct Melodyne to use an ASIO driver. I hooked up Melodyne to my OASYS hardware through ASIO and used it that way throughout the review period.

SEEK AND DEFINE

The heart of Melodyne is its melody-detection process, which operates on monophonic tracks. The program is not designed to analyze polyphonic music; its melody- and rhythm-detection algorithms require that each track contain a single-note melody or a monophonic percussion track. Tracks must be as clean and dry as possible. If notes within a track are not clearly articulated or are smeared together by reverb, Melodyne might detect spurious pitches or incorrect rhythms and durations.

Each track is associated with a sound file in AIFF, WAV, or Sound Designer II (SDII) format. You can record a file directly within Melodyne, or you can import one. If you import a stereo sound file, it will be handled as mono.

To edit a track, you must first let Melodyne analyze the signal and produce a melody-definition file. The melody definition is Melodyne's representation of the audio signal's pitch and rhythmic content. A separate melody-definition file is created for each analyzed sound file. Think of the melody definition as a template from which you can produce as many different versions of a track as you want. (Melodyne's authors make it clear that the initial melody definition might contain imperfections and will typically need some manual correction.)

Once you are satisfied with your melody definition, you can start editing the track. Before looking at Melodyne's editing capabilities, though, I'll investigate the melody-detection process.

DETECTIVE WORK

To evaluate Melodyne's performance with reasonably clean input, I prepared a brief test example (concocted to challenge the software, not to please the ear) as a Mark of the Unicorn Digital Performer MIDI track. **Fig. 1a** shows the notation of the melody using Digital Performer's QuickScribe. I then recorded a note-perfect performance in the SDII format. The tune was rendered on a Kurzweil K2500 using a piano preset without reverb. Each note was sustained for 80 percent of its written duration to articulate each event clearly.

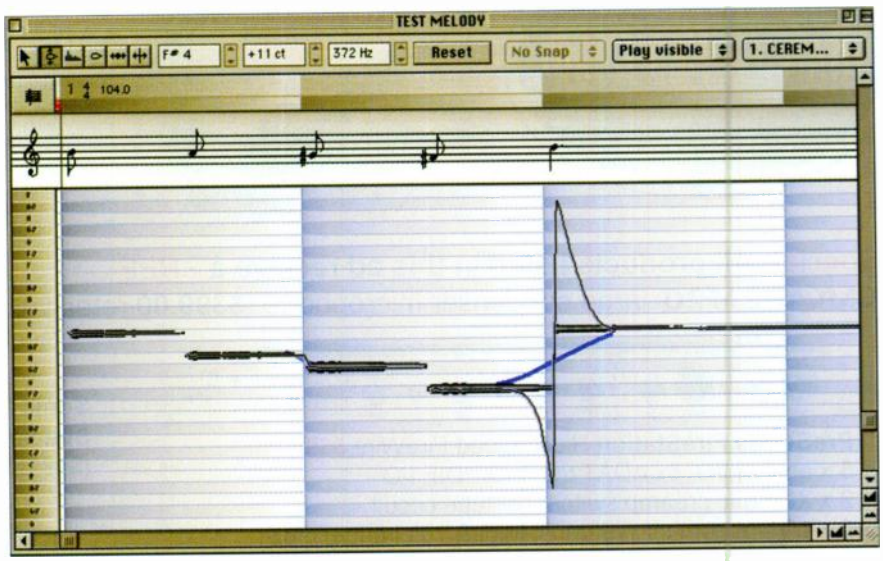

FIG. 2: The Editor window is shown with the Pitch Transition tool selected from the Pitch tools menu. The blue handles superimposed on the notes let you manipulate pitch trajectory between notes.

When the SDII file was imported into a Melodyne track, Melodyne performed an initial analysis of the sound file's temporal structure (but not of its pitches). Melodyne detected the correct tempo, time signature, and number of measures (see **Fig. 1b**). At that point, because no pitch analysis had been done, the audio signal was displayed in an envelope representation, much like that of an ordinary sample editor.

So far, so good—parsing a stream of audio samples and extracting rhythmic information is not a trivial software challenge. The next step was to invoke the Detect Melody command. When you initiate melody detection, you can optimize the process by giving Melodyne information about the expected pitch range and other properties of the source material. To see how well the program would do without any hints, I just used the defaults.

After that analysis, I brought up the Melody Definition window to view the analyzed melody (see **Fig. 1c**). That window displays the notated melody as well as an envelope display arranged on a pitch/time grid. As the window shows, Melodyne got all the pitches right—again, pretty impressive.

But Melodyne didn't detect all of the rhythms. The repeated B naturals in measure 1 were not detected correctly, apparently because their articulation was too legato to suit Melodyne. To correct that, I selected the Note Separator tool from the toolbar at the top left of the window and clicked on the attack points of the two 16th-note B naturals. In **Fig. 1d**, the display is zoomed in to show the first measure as corrected.

In measure 3, however, I encountered a limitation: Melodyne doesn't detect or notate tuplets, so the triplets and quintuplets are not notated correctly. There is no way to fix this, but Celemony states that its programmers are working to overcome the restriction.

This may seem a somewhat mixed performance, particularly in terms of transcription and notation. But remember that Melodyne is primarily a tool for editing and correcting audio within a musical context. The first task of such a tool is to locate audio events in musical space and time. (You can't edit something you can't locate.) From that point of view, Melodyne did a remarkably good job.

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Although Melodyne isn't primarily a notation tool, it does have potential in this area. I hope the authors will improve the notation features, at least with respect to handling tuplets. Correctly spaced, beamed, and tied notes would be nice, too.

TRACK EDITING

Once you have a melody definition associated with a track, you can do detailed, nondestructive editing in the simple-to-use Editor window. First, you select a tool from the toolbar at the window's top left (see **Fig. 2**). Then, you select the notes you want to edit. The Editor provides some powerful selection features, such as selecting by pitch or by beat.

You can edit notes graphically with the mouse, type parameter values into edit fields, or use up and down arrows to change values incrementally. You can edit on the fly, hearing your parameter changes in real time during playback.

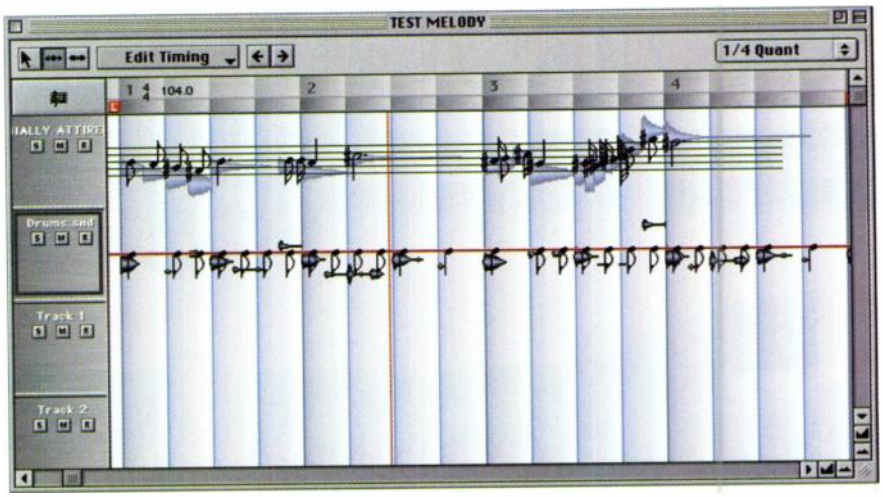

FIG. 3: A percussion part (lower track) was dropped into the Arrangements window and synced to the test melody using the Adapt Time command. The notation overlay shows the rhythmic alignment of tracks.

Rather oddly, Melodyne supports copy, cut, and paste edits, but not undo or redo. (According to the manufacturer, a multiple-level undo feature is included in the 1.1 version, which should be available soon.) However, a Reset button associated with each tool lets you undo the most recent change made by that tool.

When you select a tool, Melodyne

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changes the display so that you can manipulate the appropriate property. For example, when the Pitch Transition tool is selected, handles are superimposed on each event. By selecting and dragging a handle, you can vary the trajectory of pitch change between one note and the next. In Fig. 2, I have used that tool to produce an exaggerated upward pitch bend on the dotted quarter-note B in measure 2.

The Editor Window provides a powerful set of editing tools. The Pitch tools allow you to change the pitch of notes with a one-cent resolution, widen or flatten pitch fluctuations (such as vibrato) within notes, and adjust the pitch transitions between notes. Pitch-shifting automatically adjusts formants to preserve the timbral character of pitch-shifted notes.

The Formant tools let you shift the position (but not the bandwidth) of formants, which permits some interesting filtering effects. You can also adjust the formant transitions between notes.

The time-related tools allow you to reposition notes in time or change the duration of notes. When you perform either edit, the neighboring notes are also adjusted so that the metric structure of the melody is preserved. For example, suppose you have two half notes in a 4/4 measure. If you shorten the first note to a quarter note, the second note lengthens to a dotted half note. That is cool!

The Edit Time Handle tool is also time related. It lets you tweak the initial speed of a note, adjusting the attack time and the rate of internal pitch fluctuations.

The Amplitude tools allow you to increase or decrease the amplitude of notes or mute notes. You can also adjust the amplitude transitions between notes.

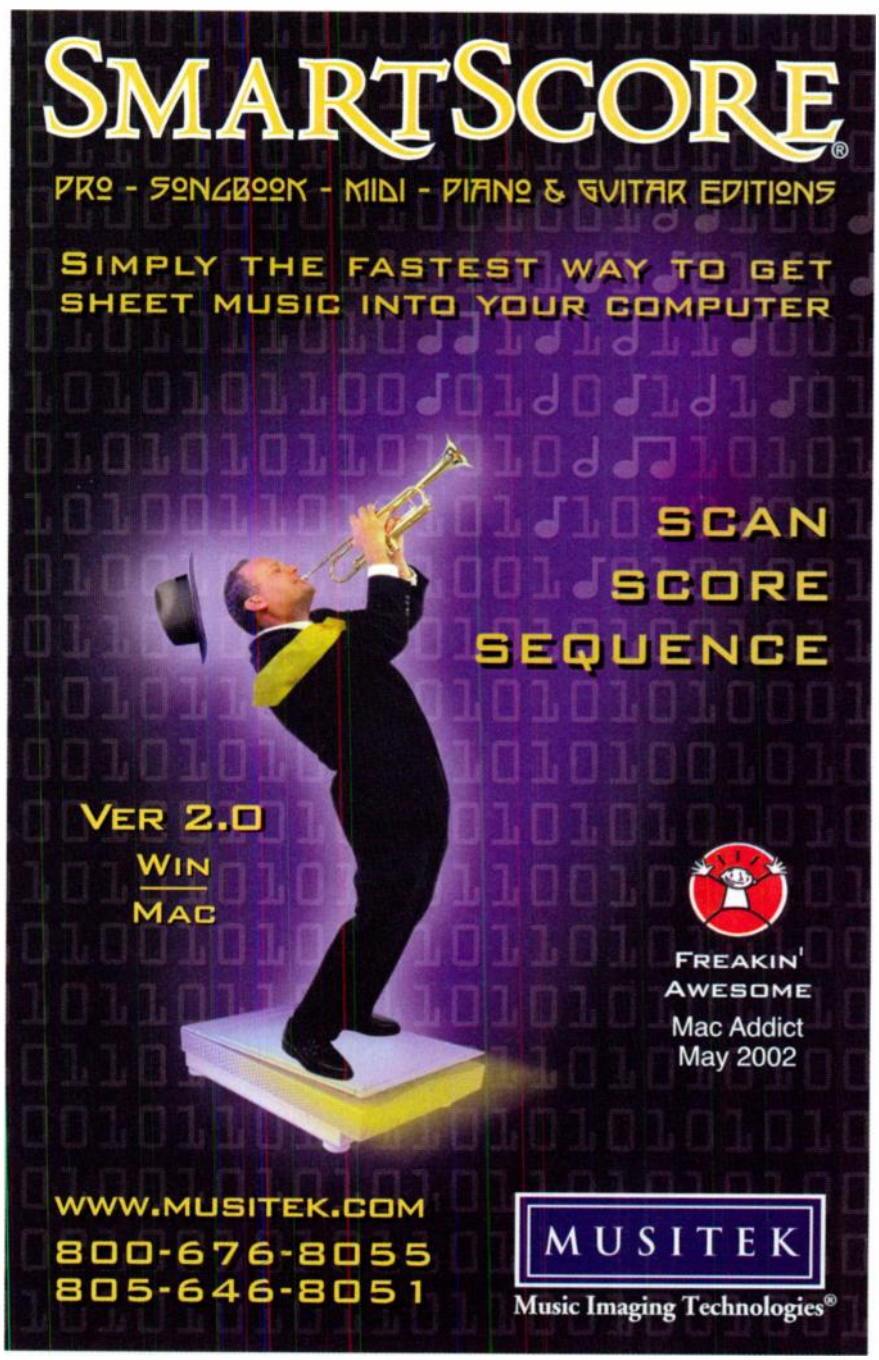
The note-separation tools let you divide a note into two parts, join two notes into a single event, or cut parts of the melody into free-standing segments.

HANDLING ARRANGEMENTS

The Arrangements window is equivalent to the project windows of conventional multitrack audio programs. The window displays one or more tracks, represented by track selectors with Solo, Mute, and Record buttons (left pane).

At the top of the Arrangements window's main scrolling pane is a timeline divided into measures and beats. Below the timeline are tracks displayed in an envelope format much like the Editor's. You can overlay the envelope displays with musical notation. Unpitched (or unanalyzed) tracks are displayed in percussion notation.

The Arrangements window also allows you to do a variety of edits on time regions within tracks, groups of tracks, or an entire arrangement. Edits include changing the tempo or time signature and shifting selected material around in time. One of the more interesting features of the Arrangements window is time adaptation of one track to another. To accompany my test melody with percussion, I imported a completely unrelated rhythm track into the arrangement. Then, using the Adapt Time command, I adjusted the tempo



of the percussion track so that it synchronized perfectly to the melody (see **Fig. 3**).

The Temporary Play Offsets window lets you modify the pitch, tempo, or formants of the entire arrangement in real time. The changes are instantaneous and, for the most part, free of artifacts. If you like what you hear, you can apply those modifications to the arrangement permanently.

OTHER AUDIO FUNCTIONS

Melodyne isn't designed to compete with sophisticated multitracking software such as Pro Tools. Melodyne's Transport Bar and Mixer windows, however, do support basic recording, playback (normal, looped, fast-forward, and rewind) and mixing functions. The Mixer offers a conventional arrangement of controls such as input and output selectors, faders, pan pots, effects sends and returns, and level meters. The Mixer's rotary controls are sluggish and unresponsive. A crude reverb is the only effect available, which is unfortunate, as Melodyne does not support any effects plug-in formats. Mix automation is also not supported.

You can export all or part of an arrangement to an audio or a MIDI file and export audio as a stereo mix or as individual mono files per track. Likewise, a MIDI file can be written as a single multichannel file or as individual files for each channel. When exporting MIDI files, I noticed an apparent bug that caused Melodyne to omit the first note of one or more tracks, though all other notes translated correctly.

Professional users will probably wish Melodyne interfaced (other than exporting individual tracks) better with other audio tools. It would be nice, for example, if Melodyne could import and export tracks to and from other project formats, such as Pro Tools sessions or Open Media Format files.

SUPPORTING CAST

Melodyne comes with a brief manual in German and English. The English documentation is well organized but poorly translated and, therefore, sometimes unclear. Celemony maintains an informative Web site where you can find additional information and a demo of the program.

Melodyne is a powerful and innovative (if pricey) tool for editing traditional music that can be represented in a more or less conventional pitch and rhythmic format. It won't appeal much to experimental composers, but Melodyne will probably find a niche in professional studios that need an efficient performance-correction tool. Although Melodyne is strong in its specialized domain, it is definitely not an all-purpose multitrack recording application. Most studios will use it as an adjunct to more mundane programs such as Pro Tools or Digital Performer.

Did I mention that Melodyne is fun to work with? Visit Celemony's Web site, download the Melodyne demo, and start having some fun with it yourself.

John Duesenberry's *latest equipment acquisition is a Triumph Bonneville. It's very analog. Bikers and other readers are welcome to email johndu@world.std.com.*

PRODUCT SUMMARY

Celemony Software GmbH

Melodyne 1.0.1 (Mac)
pitch-detection/correction software
$995

FEATURES	3.0
EASE OF USE	3.5
AUDIO QUALITY	4.0
VALUE	3.0

RATING PRODUCTS FROM 1 TO 5

PROS: Unique musical approach to audio editing. Powerful set of tools for pitch, time, amplitude, formant, and other edits.

CONS: Transcription/notation does not handle tuplets, beams, or ties. No multiple undo/redo. Poorly translated English documentation.

Manufacturer

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wide or tight spacing, handwritten scores, scores with multiple columns, and even scores that included guitar tablature were not properly recognized.

In most cases, however, SmartScore can get you quite close to your final result. To finish the job, you use the program's comprehensive notation editing capabilities. SmartScore presents its notation in a two-paned window (see **Fig. 1**). The top pane contains the original scanned image; the bottom provides the notation-editing features. The two panes remain synchronized as you scroll, allowing you to see where your recognized notation differs from the original source.

THE TOOL BOX

SmartScore's editing procedures are intuitive and easy to use. You use the mouse for selecting, inserting, deleting, or changing the notation. Use the keyboard to determine which of those operations the mouse performs and to gain quick access to several palettes of notation elements. Operations on selected notes include voice splitting and joining, beam or stem direction changes, cutting, and copying. Each operation can be initiated with a single keystroke.

Once I got the hang of it, I found myself using SmartScore's editing methods really quickly. All of the various editing operations have menu equivalents, but the keyboard equivalents are the way to go. For the most part, I could leave one hand on the mouse and the other hand on the keyboard while editing.

New in version 2 is the Edit Shapes tool. When it is enabled, you can reposition any notation element by simply dragging it with the mouse. What's more, "handles" appear on note beams, slurs, ties, and dynamic markings. The handles let you change beam angles, the length and arc of phrase markings, and the length and width of crescendo and decrescendo wedges.

Version 2 also introduces intelligent lyric editing. SmartScore allows multiple lyric lines in your scores, and it aligns the syllables in your lyrics to their associated notes. You can insert dashes to break words into syllables or use underscores to stretch one syllable out over several notes. SmartScore provides complete control over the lyric fonts, and you can reposition cramped lyrics with the Edit Shapes tool.

Transposition couldn't be easier. You simply pick the new key signature, and SmartScore does the rest. Notes and chord symbols are adjusted, and key changes within your music are automatically converted to an equivalent change in the new key. Furthermore, you can limit transposition to specific measures, parts, or voices. Transpositions can also be executed harmonically or enharmonically within the existing key signature.

PRODUCT SUMMARY

Musitek

SmartScore Pro 2.0.2 (Mac/Win)
music-scanning software
$399

FEATURES	3.0
EASE OF USE	4.0
DOCUMENTATION	4.5
VALUE	3.5

RATING PRODUCTS FROM 1 TO 5

PROS: Excellent recognition of scanned music. Capable MIDI editing. Powerful notation editing and arranging.

CONS: MIDI environment is not comprehensive. Recognition fails with nonstandard scores. A few bugs and program crashes.

Manufacturer

Musitek
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PLAY IT AGAIN, SAM

SmartScore includes a capable set of MIDI recording, playback, and editing features. Unlike many notation programs, SmartScore plays the notation you see, including tempo changes, dynamics, repeats, and multiple endings. Articulations such as staccato, legato, and accents are also played as written.

Changes in notation are easily rendered into MIDI, but the reverse is not always true. You can generate notation from MIDI, but you can't update existing notation by changing things in the MIDI realm. Phrase and dynamic markings, ornaments, text, and custom formatting are all lost each time you generate notation from MIDI.

However, SmartScore offers considerable control over MIDI performances from within the notation itself. For example, you can choose the Instrument (MIDI program) that each voice plays, and when you activate the Velocity tool, SmartScore draws vertical lines over each note in the score (see **Fig. 2**). You can then resize the lines to change note Velocities for more expressiveness. A similar tool allows you to draw in tempo changes.

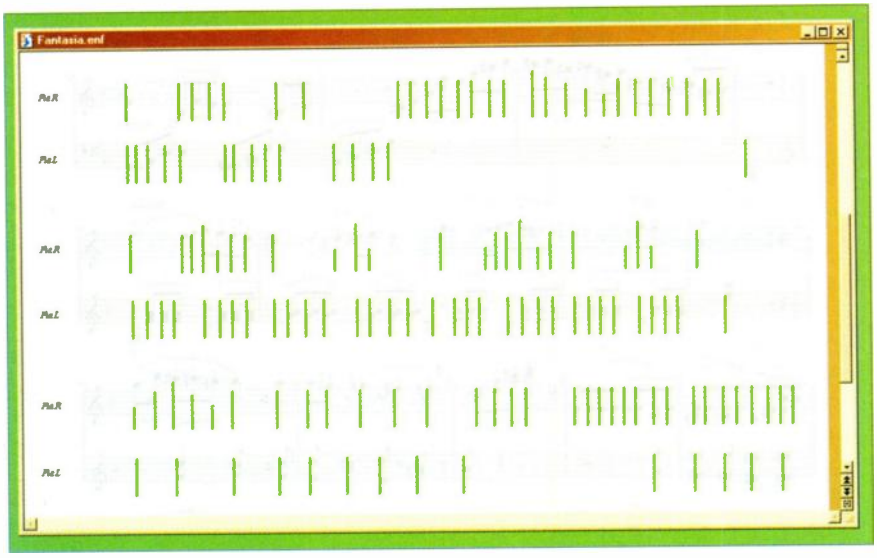

FIG. 2: New in version 2 is the ability to draw Velocity values directly on top of the notes in your score. A similar tool exists for creating expressive tempo changes.

If creating notation is your goal, then you'll find SmartScore's MIDI capabilities to be more than adequate. You can record in real or step time and edit your music in an Event List, a Piano Roll (see **Fig. 3**), or an Overview (track sheet) screen. There are also tools for graphically editing MIDI controller data and for inserting messages, such as MIDI Program Changes.

However, if you're looking for an extensive MIDI sequencing and editing environment, SmartScore may not fit the bill. It offers no support for SysEx messages, and there are no advanced MIDI processing tools like humanization and groove quantization. I like manipulating groups and phrases of related MIDI events as a single entity (called Clips in Sonar). That capability is not available in SmartScore.

THE FINAL SCORE

SmartScore is easy to use, but I don't recommend bypassing the manual. If you do, you'll miss out on tips for optimizing your music scans. Furthermore, some of the concepts aren't obvious. (The relationship between notation and MIDI views is one example.)

The well-written manual and on-line help system are excellent. The help system isn't context-sensitive, but I could usually find what I needed with relative ease.

I did encounter a few bugs and program crashes during the review period, and I made Musitek aware of them. Some of the problems may be fixed by the time you read this.

All in all, SmartScore is an excellent tool for working with written music, whether it's scanned in, moused in, or recorded with MIDI. I found it quite easy to convert a page from a church hymnal into four separate parts (one each for soprano, alto, tenor, and bass). If you regularly work with musical ensembles, or if you're a performer who just wants to hear what a piece of written music sounds like, SmartScore is a tool worth buying.

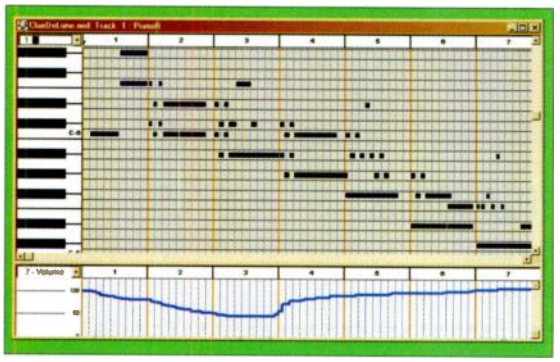

FIG. 3: SmartScore provides a Piano Roll view with features similar to other sequencers. The graphic controller area lets you draw Velocity and MIDI controller values.

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

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Quick Picks

YELLOW TOOLS

Pure Drums

By Dan Phillips

I've listened to many drum-kit libraries that focus on building a particular vibe through creative production techniques. Yellow Tools' *Pure Drums* (Akai; $149.95) takes a decidedly different and perhaps more traditional approach: record the drums as simply and purely as possible. All samples are dry and in mono without room ambience or added reverb. Some sounds use a fair amount of compression, but many others sound very much as though you were simply putting your ear dangerously close to the drum (or cymbal) itself. I first compared *Pure Drums* with several other drum libraries that exhibit lots of ambience, compression, and so on. Initially, *Pure Drums* sounded somewhat flat and drab in contrast to the other libraries.

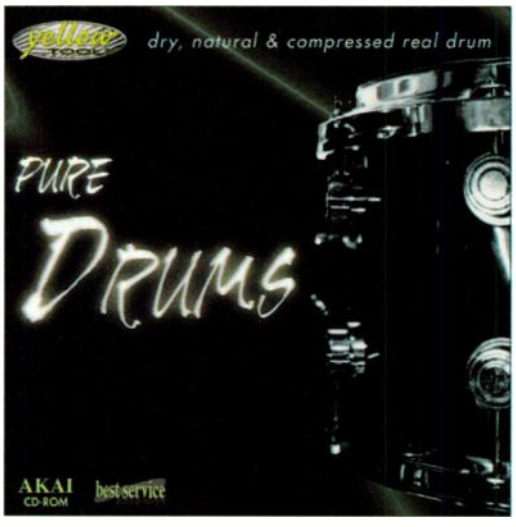
Drums Straight Up

The trick is that the drab quality is intentional. The CD-ROM's sparse documentation notes that the samples are presented dry so that "there are no limits to your creativity." Because the drums are completely dry, you can add compression, EQ, and ambience yourself to create your own finished drum sound.

That is a either great advantage or a major drawback, depending on your preference and working style. If you need samples that you can instantly drop into a track with no processing required, then *Pure Drums* is probably not for you. However, if you want to make your own decisions about processing, this collection gives you plenty of raw material to blend to your liking.

Through extensive Velocity switching—more than I've seen in any other drum library—the samples enable as much creativity in playing and programming as they do in production. For instance, each kit includes no fewer than 44 snare samples: 16 Velocity levels each for left and right hands and 4 levels of Velocity each for side stick, flam, and buzz roll. All of the snare samples are also available in a separate program, laid out with one sample per key. Kick and tom samples offer 16 Velocity levels, hi-hats have 6, and cymbals provide 4. This structure is identical for all programs on the disc—a commendable degree of organization! With so many levels of Velocity available, it's relatively easy to make parts sound natural, expressive, and highly dynamic.

You get 17 basic kits, each with 2 variations. My favorites include Funk Kit A, with its snappy kick drum and a compressed snare that rings, and the solid kick drum and low-pitched snare of Street Kit A. I appreciate the unusual luxury of having two brushed kits (Swing and Jazz) to choose from, but I still wish that their ride cymbals had been recorded with brushes instead of sticks.



Yellow Tools' *Pure Drums* sample CD-ROM in Akai format offers expressive, extensively Velocity-mapped drum kits instead of processed sounds.

Get Your Kicks

Almost all of the snares have an interesting and useful character, but they tend toward higher tunings and can sometimes sound a tad brittle (easily solved by a touch of EQ). Although many of the kicks are solid, several have a disappointing hollow character that I couldn't fix with postprocessing. Finally, there is a good selection of toms, from the beefy Rock Kit to the trashy Jungle Kit, but not one includes the sympathetic buzzing of the snare drum, which is sometimes desirable.

Overall, *Pure Drums* is fairly successful. The pervasive Velocity switching is amazing, but not all of the sounds measure up to this level of control. Considering the affordable price, those interested in more sonic and expressive control over their drum sounds should certainly give it a listen.

Overall EM Rating (1 through 5): 3.5
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POCKET FUEL

RADS: The Sound Gallery, vols. 1 and 2

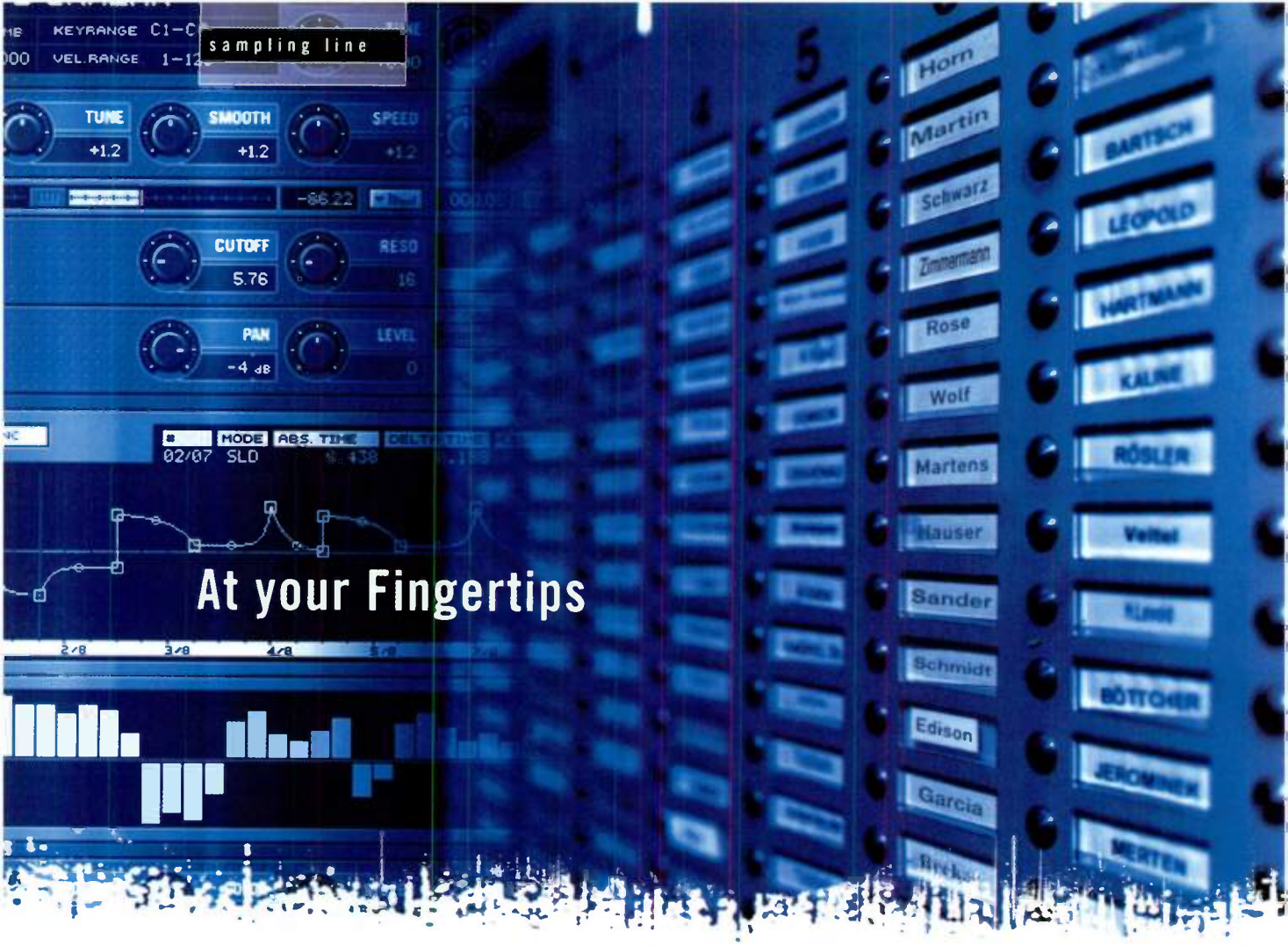
By Jeff Obee

Pocket Fuel designs drum and rhythmic instrument loops that it archives in a sound-library series called RADS, which stands for Rhythmic Architectural Design Systems. Each week Pocket Fuel offers a new set of loops for free on its Web site; you need only register to access them. *RADS: The Sound Gallery,* vols. 1 and 2, CD-ROMs ($39 each; $25 for registered members) gather a year's worth of the loops. Yes, they will cost you, but musicians with dial-up accounts will no doubt appreciate having a half-year's worth of samples on each disc without the time and hassle of downloading.

Architecture

Both discs come with 26 folders' worth of samples. Volume 1 offers samples from weeks 1 through 26, and volume 2 gives you weeks 27 through 52. A single week's folder houses five subfolders—one each for AIFF, WAV, MP3, REX, and RCY versions of roughly a dozen loops. The loops are generally between two and four bars in length, although a few are eight bars long.

The variety of file formats is a good thing, but it also means that samples are redundant, and you're essentially paying for one-fifth of the disc. However, if you use multiple applications, such as a digital



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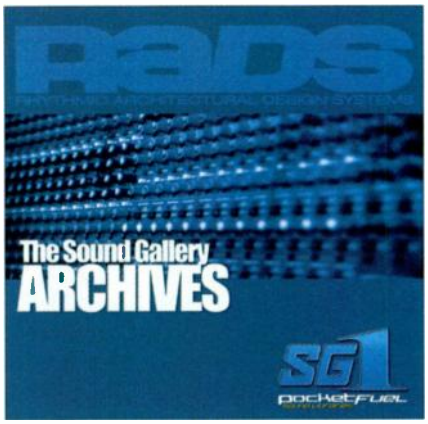


Pocket Fuel's *RADS: The Sound Gallery* offers a year's worth of groove-oriented samples on two discs.

audio sequencer along with Propellerhead ReCycle and Reason, or if you use Mac and Windows platforms, then your bases are covered. Furthermore, the WAV files are Acidized, so users of Sonic Foundry's Acid are good to go.

Pocket Fuel's offerings tend toward drum loops—along with some keyboards, percussion, and full mixes—and are quite eclectic from week to week. For example, week 1 features Great Acoustic Drums, which consists of 12 tastefully recorded, grooving loops at tempos of 85, 90, 100, and 133 bpm. Week 2 is made up of 23 acoustic-drum-kit one-shots, and the following week offers Urban Dance Rhythms—12 processed drum-machine grooves, half of which fall at an urgent 165 bpm. A folder of acoustic hip-hop mixes offers drums with some keys and incidental effects (no bass or guitar).

Get the Map Out

Things don't remain stuck in urban or hip-hop styles, however; the disks quickly jaunt into different territory. The sonic trail is stylistically all over the map, with electronic house, industrial trip metal, drum 'n' bass grooves, and solo dance keyboards.

One of my favorites is Fat Techno Drums. Although there are too few tracks, the eight offerings are forceful, rhythmic acoustic loops. I don't know what makes week 35's Asian Tech Drums especially Asian, but the loops are filtered and have a pleasing feel. All eight loops clock in at 100 bpm, so if you like them, you have plenty to work with.

Week 33, Fun with Guitars, is true to its name, but its samples bounce around too much from style to style. Heavy-metal loops go by far too quickly and are followed by dub-style loops and then a couple of funk and R&B slices—all at vastly different tempos. There just isn't enough of any one style and tempo to sink your teeth into to create an entire song. Tech Zeppelin is a hoot, though; its eight loops are all at 100 bpm and feature big, full, Bonham-like acoustic drums with a techno-synth dressing.

Groovy

Those seeking quality drum loops should investigate these discs as well as Pocket Fuel's Web site. Sonic Foundry Acid users will find these loops particularly useful, especially for dance music. My loop-based dance band has already built a couple of

new songs using Acid in combination with these drum loops, and the rhythms are very musical.

I like the discs despite their redundant files and the sparseness of sounds per style. In all fairness, these are archival CDs made available to those who didn't have access to last year's downloads. I doubt that I'd use them all the time, but they will serve well as an addition to my library. I'm going to brave my 56 Kbps connection and keep abreast of Pocket Fuel's new weekly creations.

Overall EM Rating (1 through 5): 3.5

Pocket Fuel, Inc.; tel. (888) 643-8263 or (212) 726-1341; e-mail radsinfo@pocketfuel.com; Web www.pocketfuel.com

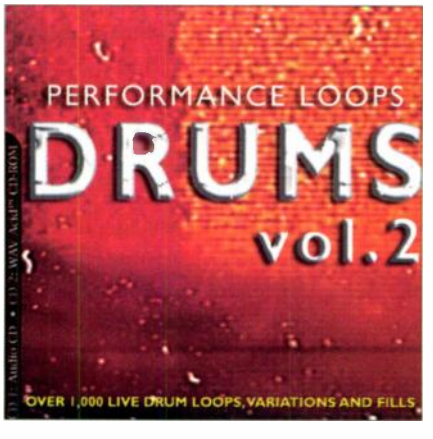
BIG FISH AUDIO

Performance Loops Drums, vol. 2

By Jeff Obee

Drum loops are as common as ants at a picnic, and for good reason. They provide a basic rhythmic template for songwriting, they're the foundation of contemporary dance music, and they work great for broadcast and multimedia projects in which deadlines are a concern.

However, electronic, quantized drum loops can get old fast. Producers always look for new ways to spice things up and offer something different. Big Fish Audio's *Performance Loops Drums*, vol. 2 ($99.95), fills that need, employing actual acoustic-drum performances instead of the usual highly processed drum-machine sample approach.



Big Fish Audio's *Performance Loops Drums*, vol. 2, captures drummers playing along to full songs in order to impart subtle, intricate variations for your tracks.

Drummers on Acid

The collection pairs an audio CD with a CD-ROM of Acidized WAV files. This provides the ease of use of a CD-ROM and the backup and auditioning amenities of an audio CD. Twenty folders of WAV files contain the essential material, and you get four additional folders of bonus tracks. The main folders are organized according to tempo, from 73 to 140 bpm. They include the body of loops along with breaks, fills, hits, and endings. The performances were recorded to full-length songs, so they contain the natural musical inclinations of the drummer.

A few folders also contain loop variations: there are full kits, some with kick and snare only, some with room mic ambience, and some without. The additional material includes a smattering of miscellaneous

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Quick Picks

hits, processed loops and hits, and a bunch of bonus loops.

Pocket Change

Three drummers recorded the tracks in different studios under differing conditions and using different setups. Nonetheless, the quality of sound is consistent throughout. The collection presents a good cross-section of styles and beats, including straight-ahead rock, funk, and pop rock; straight blues and blues shuffles; various ballads; and solid dance grooves. I was delighted with the variety of brush performances—busy brush beats, folk-rock styles, and on-top-of-beat, danceable grooves. I really enjoyed the Brush Folk Rock loops with their deliciously in-the-pocket groove and syncopated snare patterns and the occasional addition of a side stick with the brush hits.

The loops are well mixed. Many of the snares, particularly those played with brushes and side sticks, have an excellent timbral quality. The side stick on the 87 bpm ballad, for instance, has a crisp and clear presence with just the right amount of room reverb. The kicks are punchy and nicely compressed overall. I heard some slight headphone bleed in some tracks, but Big Fish mentions this in the documentation. Otherwise, all the material is as clean as a whistle.

Can't Be Beat

As I sit and listen to the 77 bpm Groove Beat tracks, I remember just how much the subtleties of a real drummer can add to a piece of music. The little drags and ruffs, the slight variations in the velocities of snare hits, the way the hi-hat is played, and the way a drummer uses ride and crash cymbals—chaining these loops and fills together in various ways can provide lots of understated intricacy to a drum track. Whether you use them alone or combine them with electronic loops, they'll breathe a bit of life into your music. Go to Big Fish Audio's Web site and do some auditioning. ●

Overall EM Rating (1 through 5): 4

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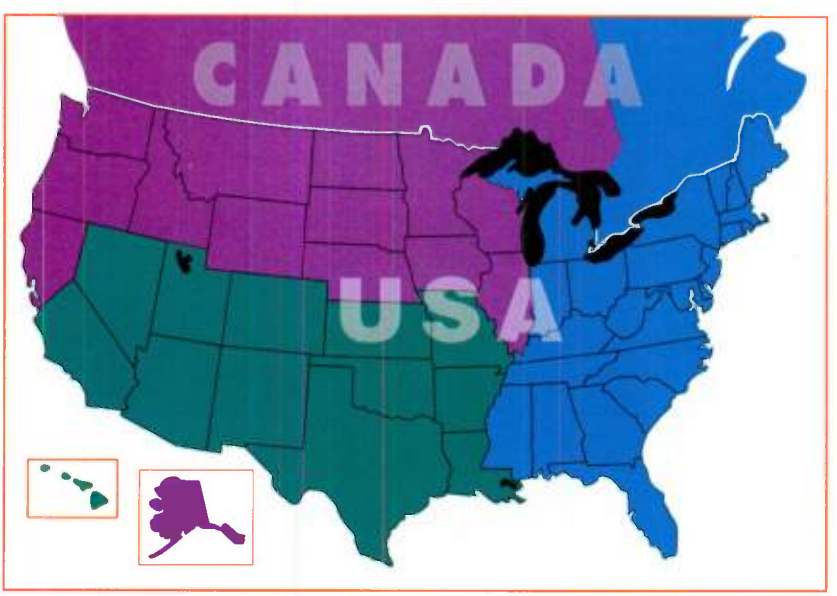

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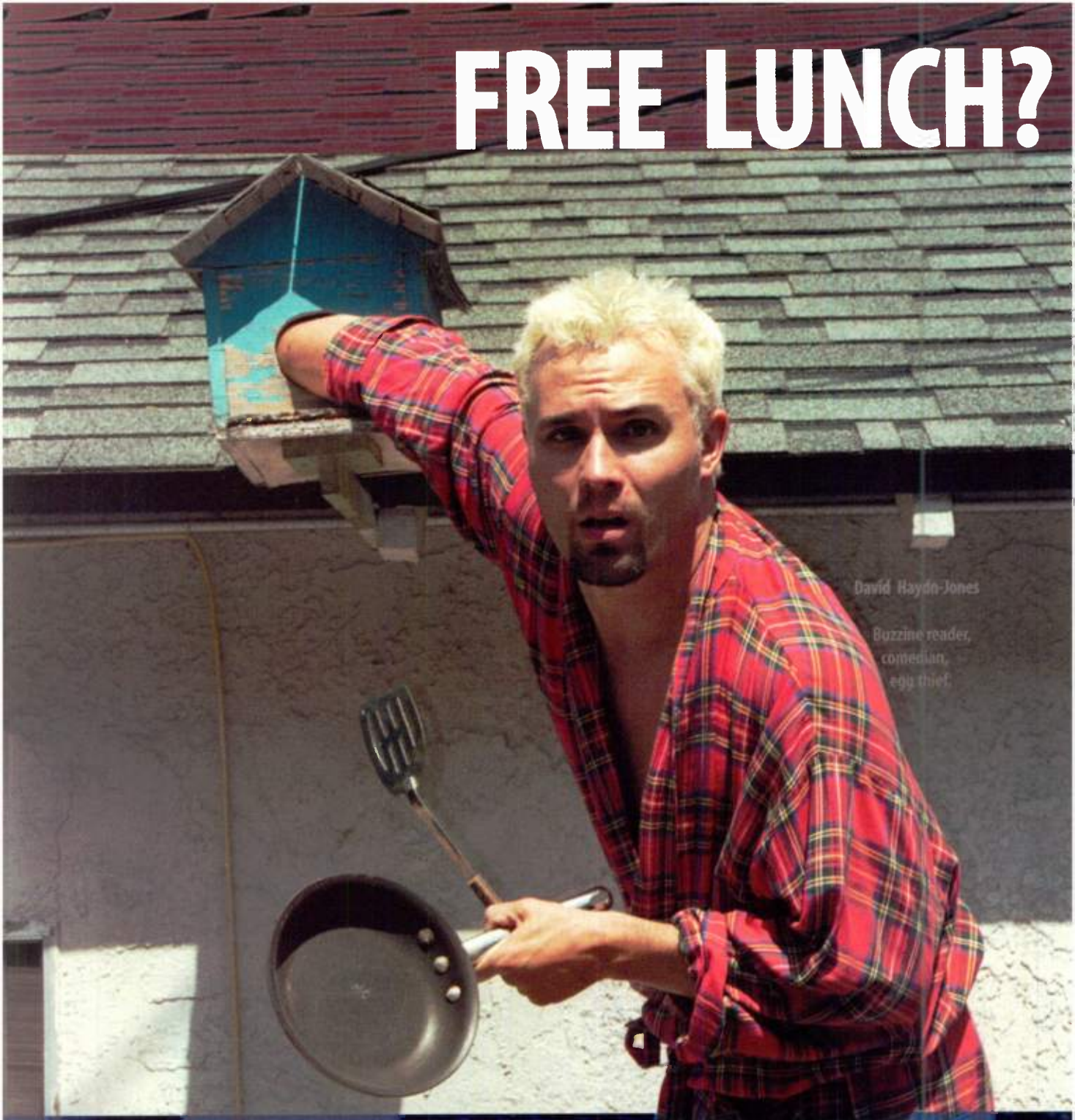

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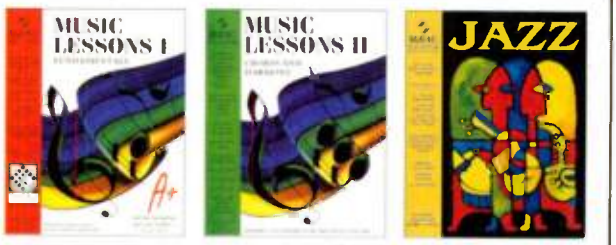

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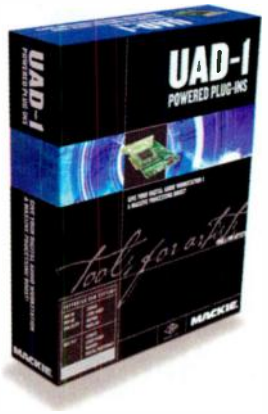

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FINAL MIX

By Larry the O

Nothing Is Better, Nothing Is Best

This is a column about nothing. Actually, it is about something, but the something is nothing. This is because nothing is more important than most people give it credit for. Generally, people feel guilty about nothing, but it is as necessary as anything; in fact, it is an antidote for too many things.

I am talking about nothing because, at the moment, I am submerged in way too much something. I am in the middle of what is affectionately referred to as "crunch mode," which is essentially an overabundance of something, specifically work.

Most of us endure situations where there is way too little time to get accomplished what needs to be done, forcing us go into overdrive, working endless hours in a desperate effort to meet expectations, deadlines, and milestones. It is my sense that people experience these crunches more frequently today than in the past; in fact, I think people are actually working harder in general than they have in my lifetime.

We all know the axiom about all work and no play, and it is entirely true, in my experience. Some cure the ill effects of working hard by playing hard: hang gliding or mountain climbing or partying around the clock. That tactic can go quite a long way toward curing the stresses of overwork. Other times, however, crunch mode leaves one drained of physical as well as emotional and mental energies, and exertion of any kind—even recreational—is not what is needed. Nothing is what is needed.

I should have gone to work today, even though it is Sunday, because time is short, and the remaining work before my current looming deadline is still large, even though I've been pounding on it incessantly for a couple of weeks straight. I didn't go in because, with one more week to go, I would break down in one way or another if I kept pushing. Logic dictated that if I wasn't going to work, I should catch up on laundry, my checkbook, and other personal affairs that I have neglected in favor of full absorption in work. But I knew that would relieve the stress of falling behind in personal affairs yet leave the exhaustion of overwork. The only thing for me to do was forgo being constructive in any manner whatsoever and just lie around the shack, letting my body and soul go off duty for a while.

So I did exactly that: I read, watched some videos, dozed, drank some wine, and munched. That's about it. I didn't feel the least bit guilty about it because I've learned through numerous crunches over many years that this is not simple laziness—it is purposeful laziness, aka recuperation. One day of rest will not make up for all the extra energy I've expended, but it will let me catch my metaphorical and metaphysical breath well enough to haul through the next week.

There are many benefits to the appropriate enjoyment of nothing: allowing one's brain to let go of ceaseless analysis and worry about work, reconnecting with one's partner (even if only briefly), remembering what home looks like (and forgetting, for a moment anyway, what the studio looks like), and, most important, reminding oneself that work—in fact, activity—is not the extent of human existence. It also opens a little space for inspiration, which is easily driven out when one is occupied with striking items from a mile-long to-do list.

Although I chose sheer sloth today, meditation is another excellent form of nothing. Other forms of divine laziness, like lying in the grass in the park for an hour on a sunny day or perching on a scenic vista until the cool of evening comes on, are equally rewarding.

Am I saying it is good to be a lazy bum? Yes, I am. I do not make that as an unqualified, blanket statement: there is a point at which laziness impedes rather than preserves constructiveness—that point being when the scale is regularly tipped toward inactivity.

But in measured doses, as counterintuitive as it may seem, nothing helps you get through life better than nothing. ❁

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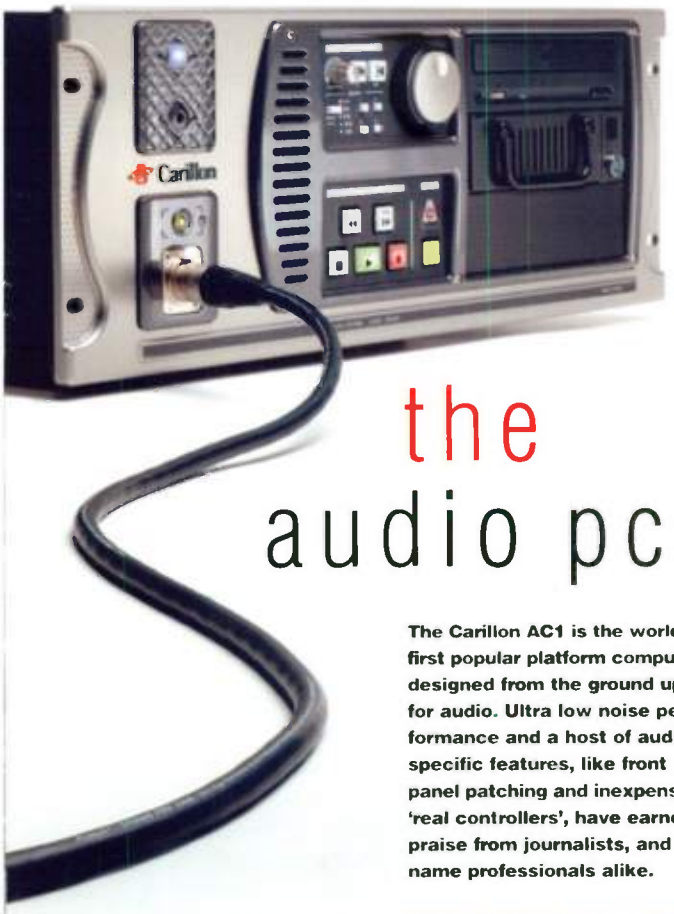

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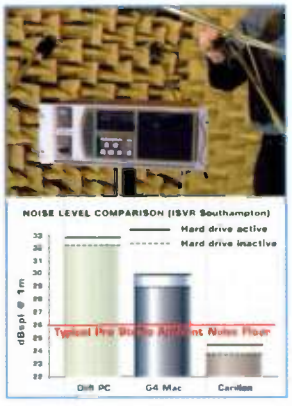

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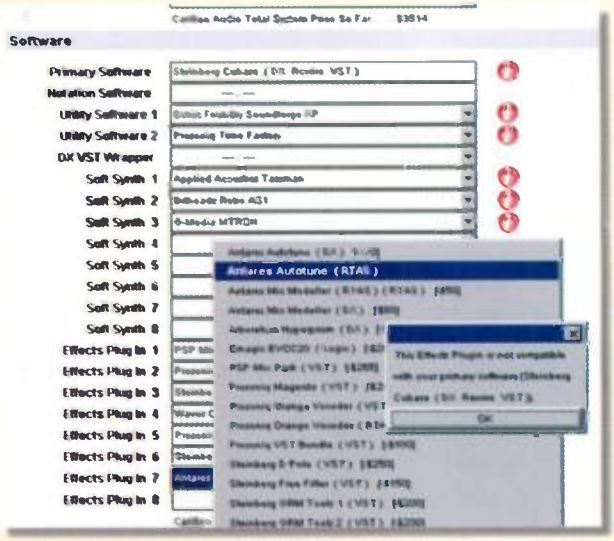

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Specification and prices subject to change without notice. Patent Application Nos US 09/909,130 CE 01306246.8 GB 0018000.0

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