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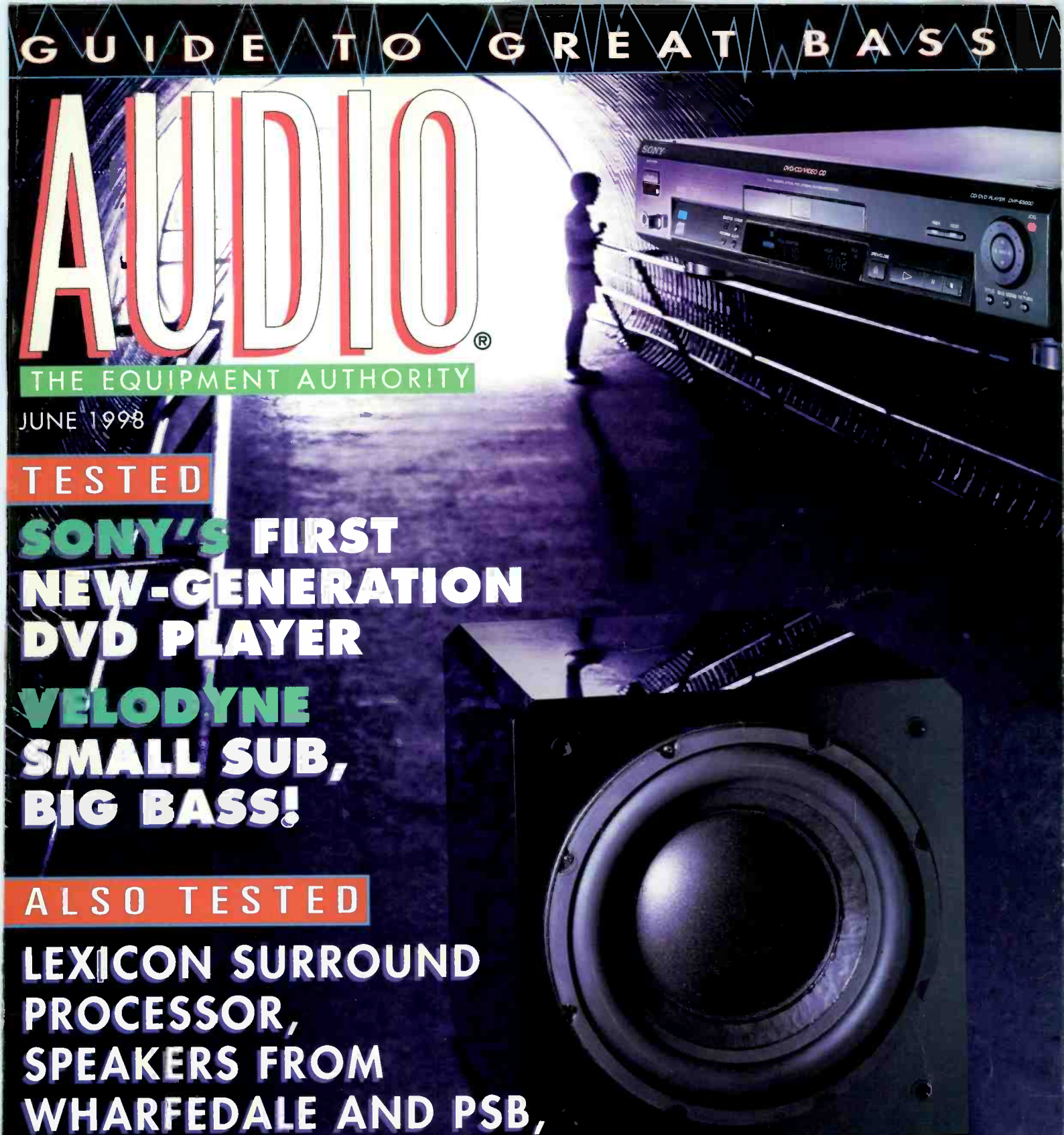

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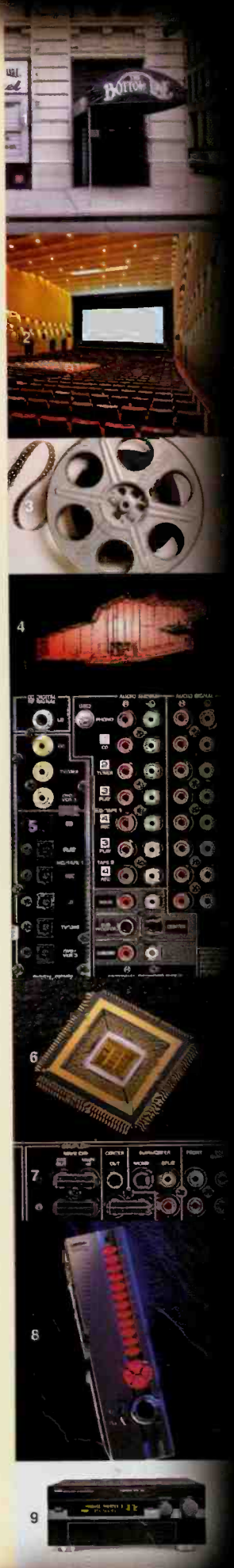

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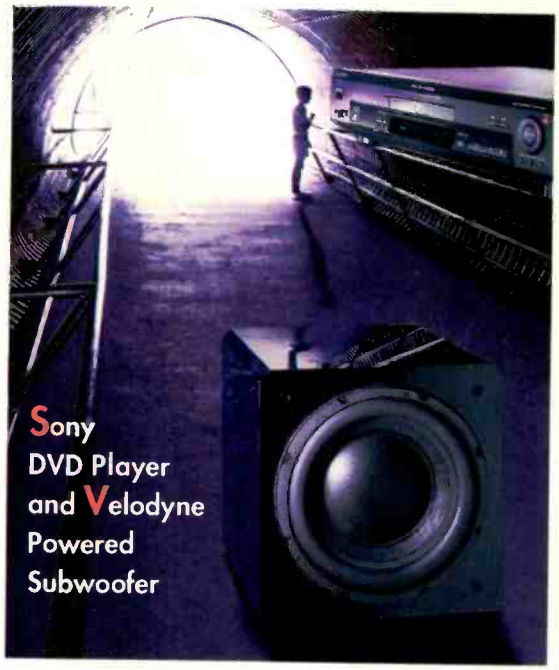

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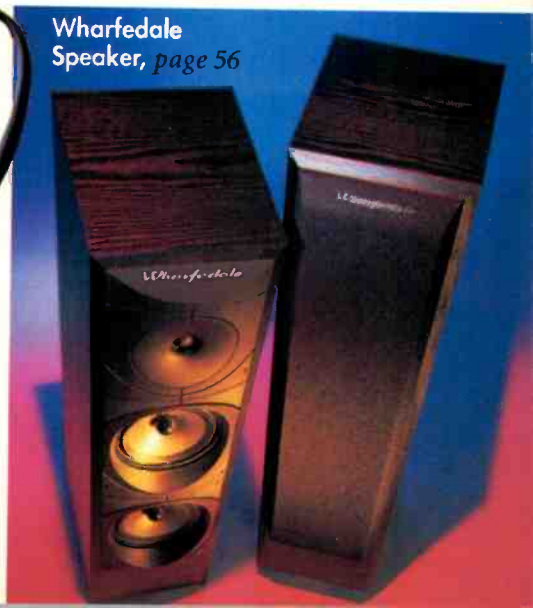

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FAST FORE-WORD

One of the odd—and to me, at least, unexpected—byproducts of the digital age has been the emergence of seemingly endless wrangling between software and hardware producers over the issue of copy protection. The basic attitude of your typical movie studio or record label executive (and presumably most artists) seems to be that home recording is copyright infringement, a menace to profits, and thus something that ought to be stamped out. I find this attitude peculiar, as, I think, do most other people. It's not as though there were some tidy relationship between copies made and sales lost. One can even make a reasonable argument that home audio and video recorders have helped the music and video software industries grow. (On the other hand, there's that old saw about walking a mile in the other man's shoes.)

Regardless of where the truth of the matter may lie, the two sides have managed in recent years to find compromises that have enabled new digital formats and products to come to market without crippling encumbrances. The Serial Copy Management System (SCMS) may be an annoyance, but for most people using digital audio recorders it's no more than that (and often not an issue at all). As time goes on, however, it seems to me that the software side is gradually winning the war. With every new introduction, the line gets pushed back a little farther; the next time around, the hardware side gives a little more ground to stave off being blocked altogether.

Recently the Home Recording Rights Coalition has raised a red flag over new copyright legislation pending in the House. Its concern is that the bill known as H.R. 2281 might stifle future development of recording devices and possibly re-open the door to litigation against such everyday items as VCRs, which are clearly allowed under current law. The bill's sponsors argue that there is no reason for alarm. It appears to me that they are correct to the extent that it would require a bit of a stretch for the law to be applied in the way the HRRC fears. But given how much such stretching seems to go on in courts these days, and how easy it would be to reword the bill slightly to eliminate the risk altogether, I would give the point to the HRRC.

You can find more information on this matter at the Web sites for the HRRC (www.hrrc.org) and the Digital Future Coalition (www.dfc.org). Congress should be encouraged to think carefully about the possible implications of the legislation's current wording before proceeding.

On a somewhat related subject, a number of people have asked me recently why I am so adamantly opposed to the Divx variant of DVD, which should be entering test markets around the time you receive this magazine. There are a number of reasons, but at the core is the way in which Divx seeks to change what it means to buy prerecorded entertainment software. Today if you buy a CD or a video, you essentially own the contents for the purposes of your personal use. You can't legally make and sell copies of them, but that's about it. With Divx, what you would buy is more like a license to use the contents in certain strictly defined and limited ways, with control remaining very much in the hands of the software provider.

For example, even if I pay to have a Divx disc permanently "unlocked," so that I can play it whenever I want without further charges, that privilege applies only to me. If I give the disc to someone else who owns a Divx player, he will be able to use the disc, but he will be charged for doing so. I can transfer the physical carrier—the disc—but not the item of real value, which is the license to use the contents. I find this aspect of the scheme profoundly repellent. If ever there were a path not to go down, this is it.

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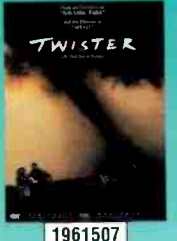

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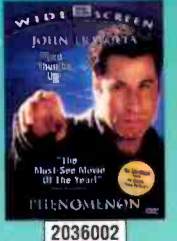

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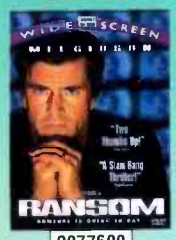

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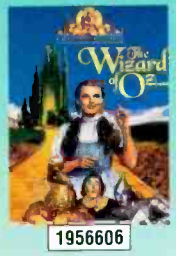

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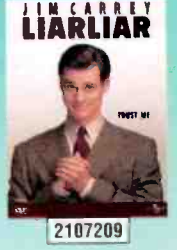

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LETTERS

Digital Dialog

Dear Editor:

I wanted to thank you for J. Robert Stuart's informative and thought-provoking article, "Digital Audio for the Future, Part 1," in the March issue. This kind of analysis is exactly why I subscribe to *Audio* and is distinguished from flowery articles filled with such words as "transparent," "musical," "involving," and similarly nebulous descriptions. Keep up the good work.

Tom Pye
via e-mail

Dear Editor:

I congratulate Bob Stuart for his outstanding article, "Digital Audio for the Future, Part 1."

Much of what appears in print these days has questionable merit and often is just an extension of some marketing department's pseudoscience technobabble. Stuart's essay, however, is right on track, and I commend him for the effort he's making to clear up a lot of the misconceptions that are afloat in both the high-end consumer and professional audio industries. His concern that his "nailing a flag to the mast" might leave him "open to all manner of attack" is, of course, justified by past experience in the business. But I, for one, want to be among the first to salute him for his clear and conscious thinking and presentation.

I recommend that all my professional peers (and interested consumers alike) read the article thoroughly and think of how it might apply to their work—existing or future products.

Glenn Phoenix
Westlake Audio
Newbury Park, Cal.

Dear Editor:

I found Part 1 of "Digital Audio for the Future" to be a very interesting discussion of quantization effects in digital audio. J. Robert Stuart showed just how far the industry has come in the quest for sonic perfection when he characterized harmonic distortion of less than –100 dBFS as "abuse"!

Despite my nearly 20 years of experience designing, testing, and writing about analog-to-digital converters, however, I am bewildered by Stuart's claim that "the correct dither makes the temporal resolution effectively infinite." He stated that without dither, the time resolution of standard CD audio is the sampling period divided by the number of quantization levels. (Someone also slipped a decimal point in the calculation: The period of a 44.1-kHz sampling clock divided by 65,536 quantization levels is 346 picoseconds, not 34.6.) What is the justification for dividing the sampling period by the amplitude resolution of the quantizer in order to derive this specification for temporal resolution?

When an analog signal is sampled, the temporal resolution is determined by the aperture uncertainty in the A/D converter or sample-hold circuit. The resolution of the A/D converter is totally irrelevant to the outcome in regards to timing resolution—and so is the sampling rate. In the ideal case, each clock pulse causes an analog sample to be acquired that is separated by exactly the same time interval for each clock period. However, real-world phenomena cause each sampling instant to be randomized to some extent. The factors affecting the aperture uncertainty can be internal to the A/D converter (e.g., thermal noise) or external (e.g., clock jitter). Unlike the correlated amplitude truncation, which is the result of finite resolution in the quantizer, the temporal resolution is a random phenomenon (unless the clock generator itself has some periodic error). The result is additional white noise, which has an amplitude characteristic that is proportional to the signal frequency.

Perhaps Stuart can elaborate on how adding random dither to an already randomized sampling process can improve temporal resolution.

Mike Demler
via e-mail

Author's Reply: Thank you for taking the time to respond to my article.

I see that maybe I was not clear enough in the distinctions here. In this part of the discussion, I was neatly sidestepping the issue of converters at either end of the chain and simply looking at the ability of a PCM channel to resolve signals that were already digital. The justification for this is not to ignore conversion errors but to see just what the channel's ultimate limits are. Of course, it is true that real A/D converters have timing uncertainty (which we often call jitter).

In this section of the article, I was addressing directly a common misunderstanding about sampling, which is the idea that the sampling period represents the granularity of the time structure. The relevance of the word size is that, actually, a signal at the band edge can be encoded in phases calculated (as you correctly say) to 346 picoseconds for CD. The application of triangular-probability-distribution dither does allow resampling in the digital domain to be effectively infinite in resolution of time.

Once again, it was not meant to be implied that signals starting and ending in the analog domain attain infinite precision—although they may have very high resolution with accompanying jitter.—*Robert Stuart, Meridian Audio, Cambridge, England*

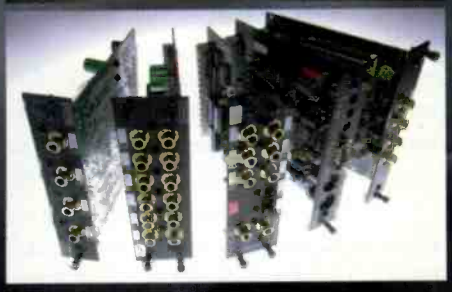
The Ratings Trap

Dear Editor:

Regarding your "Performance" ratings for classical CDs—for example, "Performance: A+"—when the work is known, such as a Dvorák symphony, then the A+ is intended for the conductor. However, in the case of unknown composers or more obscure works of known composers (Liszt violin-piano works, for instance), the performance rating is confusing. Does it signify that the performer is trying his best but the music itself may not be so great, or is it a combination of the two? It would help if you rated the composition itself and the performer's effort separately.

Anthony Hudaverdi
Santa Monica, Cal.

Editor's Reply: In our reviews of classical music, the "Performance" rating usually does refer solely to the musicians', ensemble's, or conductor's performance. Because



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of classical music's long, established history, many readers are already familiar with the music and have formed their own opinion about it. Our writers often comment about a composition in the body of the review, especially if it is a lesser-known work or exceptional in some way. It's always best to read the full review even if the recording has a particularly high or low "Sound" or "Performance" rating: The reviewer usually explains that as well.—*D.H.*

Hey, Let's Do Some Shows!

Dear Editor:

In regard to Michael Riggs' comments in his January "Fast Fore-Word" about the viability of having a national electronics expo geared toward consumers, I think that a few smaller, regional shows, similar to the auto-show circuit, would work. This would negate the travel problem for attendees that would plague a national show.

There are enough large cities with strong dealer networks that could financially support a two- or three-day regional show and showcase the manufacturers and the dealers well. For example, a show in the Detroit area would do well, not only because of its large population but because of the large numbers of Canadians who make the short trip across the Detroit River from Windsor every day to shop at the area malls and attend the local trade shows (as well as the annual auto show). The dealer network in the area is healthy enough that it would be good PR for them to sponsor a regional show.

While *Audio* is an excellent magazine, it would be nice for people to be able to experience first-hand the equipment you evaluate without having to travel to several stores. Isn't that what part of being consumer-friendly is all about?

Keith C. Clem
Lincoln Park, Mich.

Unfazed Phasing

Dear Editor:

D. B. Keele, Jr., in his February "Equipment Profile" of the Infinity Compositions Overture 3 speaker, stated that the four woofers (two of which fire to the rear) "are oppositely phased; therefore, their equal and opposite motional forces cancel. . ." I imagine that he was referencing marketing hype that is usually aimed at a nontechnical audience and frequently technically incorrect, as it is in this case.

Since Mr. Keele is well known for his "bass expertise," certainly he well knows that if the aforementioned woofers are oppositely phased electrically and *acoustically*, there will be quite a bit of bass energy cancellation, akin to what happens with dipole speakers.

If I understand correctly what happens with the Overture 3's woofers, they actually operate in phase, but since they are pointed in opposite directions, when the ones in front are pumping "north," the ones in back are pumping "south," thus creating the potential for cancelling some of the motional forces. Or did I miss something here? Please school me further.

Alan Payne
State College, Pa.

Author's Reply: No, you didn't miss anything; you're absolutely right. Your interpretation of what I said is correct. The system is not a dipole, and the woofers are electrically and acoustically in phase. Be-

cause they are on opposite sides of the cabinet, their excursions are opposite to each other; hence their inertial forces are equal and opposite and thus may cancel. With respect to an observer inside the enclosure, when both sets of drivers move in, the pressure in the box increases (and vice versa). This can happen only if the drivers are wired in phase and thus moving oppositely because of their placements in the cabinet.—*D. B. Keele, Jr.*

Bravo B & K

Dear Editor:

I bought a B & K Components MC-101 preamp in 1991. Last year it developed an intermittent loss of one channel. The preamp spent months at two shops, and repair charges approached a good percentage of its original cost. Still, the problem remained elusive, so I was ready to look for a new preamp.

While I was on a visit to Beaverton, Oregon, Chelsea Audio—which would, I'm sure, have preferred to sell me a new preamp—suggested I contact B & K directly. After writing a few letters and making a couple of phone calls, I shipped the unit off to Buffalo, New York. B & K replaced most, if not all, of the discrete transistors and capacitors. I fully expected to be billed for repairs, acknowledging that the preamp was way beyond warranty. But B & K charged only for the round-trip shipping. And, yes, the company nailed the problem.

Was this good service? Not just good—exemplary!

David Bremer
Twain Harte, Cal.

Revivalist History

Dear Editor:

I was very surprised by what I read in Daniel Levitin's interview with John Fogerty in the January issue. Before Fogerty's giant head explodes, he should listen again to some of his old Creedence Clearwater Revival recordings. Until I recently heard a couple of them on the radio, I had forgotten how bad that garbage was. Why he wants to single-handedly take credit for some of the worst rock 'n' roll ever created is beyond me.

Charles Bloom
Loveland, Colo.

File "S," for Screw-Up

Dear Editor:

The CEMA Web address listed in the April issue "Fast Fore-Word" is incorrect. It was listed as www.cemacity.org/works/pubs/dar.htm, but it should have been www.cemacity.org/works/pubs/files/dar.htm.

I hope this helps out.

Michael Petcou
via e-mail

ERRATUM

Z-Systems pointed out to Bascom King that the crosstalk he measured for its RDP-1 digital preamp (April) with 16-bit dithered input and output was not really crosstalk but just the dither noise. King subsequently retested the RDP-1 and confirmed this. If the dither is turned off, the readings drop to digital silence, which is about –140 dBFS for the Audio Precision test system. This means that the RDP-1's crosstalk is effectively below our measurement limit.—*M.R.*

AUDIO CLINIC

JOSEPH GIOVANELLI

Playing MIDI Through a Hi-Fi System

Q *I've been told that playing real instruments through home hi-fi systems is harmful because of possible damage to speakers. But is it safe to play my computer sound (MIDI/Soundblaster) through my audio system?*—Antonio Souza, Salvador, Bahia, Brazil

A If you keep a wary eye on the volume control and maintain moderate playback levels, I don't foresee any difficulties with playing computer sound-card music through your hi-fi system. Inasmuch as I am a keyboard player and something of an arranger, I do this regularly, using MIDI (Musical Instrument Digital Interface) techniques and a software sequencer. I have not had the slightest problem with my hi-fi system.

However, playing live instruments—particularly electrified instruments—through a hi-fi system can produce peaks that may cause a power amplifier to clip, and clipping can burn out tweeter voice coils. Moreover, I would not recommend playing solid-body electric instruments, such as an electric bass, through a home audio system. The woofers and voice coils in home speakers are not always rugged enough to withstand the powerful bass transients produced by electric guitars.

Using a Step-Down Transformer

Q *I am moving to a new home where the AC power source is 220 volts at 50 Hz. All my audio gear is 110 volts at 50 Hz. I bought a 2,000-watt step-down transformer to power my system. Does the transformer consume power while it is plugged into the wall outlet or only when the equipment is turned on? And will the transformer degrade sound quality in any way?*—Enrique Claure, Miami, Fla.

A Transformers are very efficient devices. When there is a load on their secondary windings, they draw the appropriate amount of power from the AC line. In idling mode, when there is no load (i.e., the components are turned off or unplugged), the transformer consumes very little power. And it will not degrade the performance of audio components connected to it.

However, I hope your 2,000-watt transformer has sufficient capacity to power all your hi-fi components operating *simultaneously*, with some reserve power for safety. You should avoid running a transformer at its maximum rating because of heat buildup inside the transformer. If your components need 2,000 watts, your transformer's minimum rating should be 2,500 watts; in fact, I'd prefer that it be capable of handling 3,000 watts.

Subwoofer Disturbance

Q *The back wall of my new house is less than 10 feet from the house on the adjoining lot. If I install a home theater system in my finished basement, will my powerful sub be heard in my neighbor's basement or in his house? Will the earth between the two buildings attenuate the sound, or should I be more concerned about sound leaking through the basement's small windows? And if my system does disturb the neighbors, what can I do to lessen the problem?*—David W. Creighton, Linden, N.J.

A The degree of low-frequency sound transmission is determined by the characteristics of the structure surrounding the speakers and the subwoofer. Be comforted because you have 10 feet of earth between your basement and your neighbor's; in my judgment, very little energy will be transferred to his house. And the dictum regarding layers of dissimilar materials (wooden studs, drywall, concrete, and earth) attenuating vibration also applies.

Because the windows are relatively small, they are more likely to conduct midrange frequencies than bass energy. Window glass is thin enough that it can vibrate, acting as a diaphragm just like a speaker cone. However, its output will be much less than a speaker cone's, thank heavens.

I think you will be okay, but you could avoid a potential problem from the outset by using double- or triple-glazed basement windows that are tightly sealed with weatherstripping or caulking. Any tiny crack that air can enter enables sound waves to exit, so a good seal is the best defense against sound leakage. Placing the subwoofer (and your main speakers) on some resilient supports rather than directly on the floor should also help somewhat.

If problems arise, there is usually little to be done without a major renovation, which typically may require staggered-stud walls, extra-thick Sheetrock, a "floating floor," and caulking with a non-hardening sealant. (For more details, see "Muffling the Neighbors," November 1990.)

Flawed Home Theater

Q *The back wall of my home theater, where the listener sits, extends only halfway across the room and opens to another room. I have one surround speaker mounted on the wall and the other on a stand. Both are at ear level, but their sound differs noticeably. Would using a dipole speaker on one side and a conventional speaker on the other, provided they were similar in timbre, work better? Or should I use two dipoles or two conventional speakers?*—Sean Barnett, Mesa, Ariz.

A The boundary effects of the wall to which your surround speaker is attached will inevitably alter the timbre of that speaker, no matter what type you select. It will *always* sound different from the stand-mounted surround speaker. However, your letter suggests you're using the wrong wall. Both surround speakers should be on the side walls adjacent to the seating area.

If it's awkward mounting the surround speakers on the side walls near your seating area, you might move them forward a little—perhaps halfway between the front speakers and your listening position. The surround effects will not be exactly what was intended, but you will still sense a spacious ambience and be rid of the timbral anomalies you're currently experiencing.

Speaking informally, most of us continue to refer to the surround channels as the

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If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1633 Broadway, New York, N.Y. 10019, or via e-mail at JOEGIO@delphi.com. All letters are answered. In the event that your letter is chosen by Mr. Giovanelli to appear in Audioclinic, please indicate if your name or address should be withheld. Please enclose a stamped, self-addressed envelope.

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Seattle, Washington • 18422 103rd Ave. NE (Bothell, WA) • Cox Music Co. • July 17th & 18th*
Vancouver, B.C. • 7283 Cambie St. • Principal Legacy Audio • July 25 & 26th
Oakland, California • 4231 Park Blvd. (Oakland Hills) • J. Nelson & Co. • October 17th & 18th
Atlanta, Georgia • 3315 Chamblee-Dunwoody Rd. • Legacy Audio of Atlanta • November 14th & 15th

All show times are Saturday 12 pm - 6pm, Sunday 11 am - 4 pm unless otherwise noted
* Friday and Saturday

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Los Angeles, California • Hi-Fi '98 • The Westin-LAX • June 10th - 14th, Rooms 550/551
New Orleans, Louisiana • CEDIA, Ernest N. Morial Convention Center • September 9th - 13th, Booth #423
Newport Beach, California • Home Theater Expo • Hyatt Newporter (Ocean Room) • October 9th - 12th

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"rear" channels (the opposite of front); it's a natural mistake. I even catch myself doing it at times, but it's just plain wrong and encourages further misunderstanding. Think of commercial movie theaters: Most of the surround speakers are along the side walls, which is how they should be positioned in our homes.

Playing Damaged Records

In the January issue, you advised William Peyser to use an LP stylus (presumably stereo) to play his old 45-rpm singles from the '60s. This works well if the records are new, but these days most 45-rpm discs are not. Many records bought in the '60s were played with worn stereo sapphire styli, which caused severe damage in the lower half of the grooves. These records will distort harshly whenever loud passages are reproduced. To minimize this, I recommend using a larger, 1-mil, LP diamond stylus. It will ride above the groove wear and alleviate, if not eliminate, much of the fuzzy distortion on loud passages. A 1-mil stylus is also suitable for playing mono LPs from the '50s and '60s.

Stanton Magnetics has reintroduced the 1-mil LP stylus because of strong demand from collectors. The company also sells various-sized styli for playing damaged 78-rpm discs. These styli ride above or below the groove wear caused by antique 3-mil styli.—Kevin A. Barrett, KAB Electro-Acoustics, Plainfield, N.J. (908/754-1479; www.KABusa.com)

Splitting CD Player Output

Q *If I use a Y connector to split the line output from my CD player to feed two separate receivers, will this double its output signal in the same way that an amplifier will deliver more power into a 4-ohm load than into 8 ohms? Will using a splitter damage the CD player?*—Jason Stites, Salem, Ore.

A Using a splitter will not double the output signal from the CD player. And because the combined input impedance of the two receivers is still much higher than the output impedance of the CD player, there will be no signal loss when both receivers are connected. If you want or need to, you can feed several preamps or receivers from a single CD player; the only downside is increased cable capacitance (and associated high-frequency losses) if the interconnects are too long, so limit their maximum length to 6 feet.

Dolby Dubbing

Q *When I'm dubbing a Dolby-encoded tape (type B, C, or S), should I activate Dolby noise reduction on both the record and playback decks, on just the playback deck, or only on the record deck? I've noticed that if I engage it on both, the sound becomes quite muddy.*—Mark Reesor, Pickering, Ont., Canada

A Dolby Labs says that you should activate Dolby noise reduction on both the playback deck (apply the same type that was used to record the original tape) and on the record deck. If possible, play the tape back on the machine on which the tape was originally made, which will avoid complications that might ensue from azimuth differences and Dolby mistracking on different machines.

On the record deck, you can use a different type of noise reduction for the copy, although you won't be able to improve the signal-to-noise ratio of the original. For example, if the original tape was recorded (and played back) with Dolby B, and you use Dolby S on the record deck, the resulting copy will not contain audible noise added by the dubbing procedure. However, it will still evidence the background level of hiss normally audible with Dolby B. In other words, Dolby S won't remove hiss already present on the original tape.

If by "muddy" you mean that the sound of your dub is distorted, make sure you don't let peaks in the program material go more than a few dB into the red on your record deck's level meter. Perhaps you should lower your recording levels a little.

If the sound is muffled or dull on the copy, it's likely a result of Dolby mistracking arising from incorrect tape sensitivity and bias adjustments on the recording deck. When you play back the original tape with Dolby noise reduction engaged, is the sound clear, with crisp high frequencies? It should be, if the Dolby circuits are properly tracking and matched to the tape formulation on the playback machine. On the other hand, if the high frequencies are dull on the playback deck, have it properly calibrated for a specific brand and formulation of tape. The same applies to the recording deck. Some cassette decks have user-adjustable controls or automatic circuits that calculate bias, equalization, and tape sensitivity. A

DVD

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WHAT'S NEW

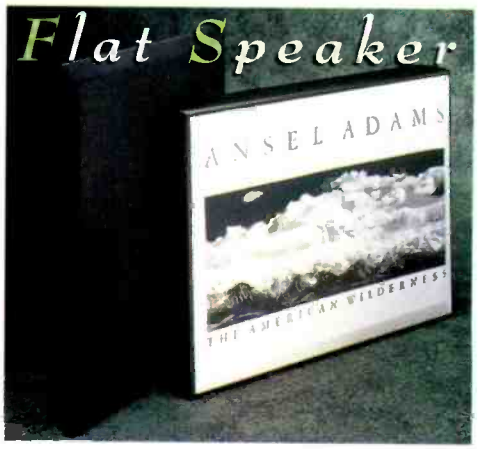
M&K In-Wall SPEAKERS

According to M&K, the frameless design of the SW-85 and SW-95 in-wall speakers enables them to blend unobtrusively into the wall and with any room decor. Each has a paintable magnetic grille that attaches to an 11-gauge steel baffle with six magnets. Said to be timbrally matched to all M&K satellites, the SW-85 or SW-95 can function as main- or surround-channel speakers. The SW-85 uses a 5¼-inch woofer, and the SW-95 has a 6½-inch woofer; both are two-way systems. Prices: SW-85, $350 each; SW-95, $550 each. *(M&K Sound, 310/204-2854)*

SENNHEISER HEADPHONES

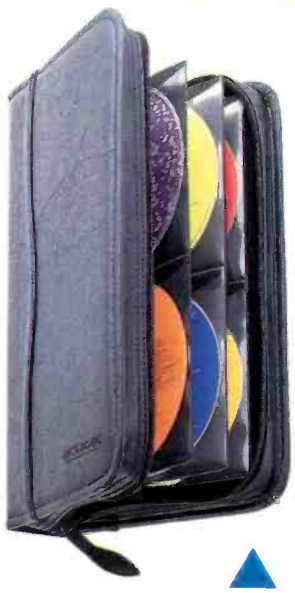
Claimed to be rugged enough to wear while rollerblading, jogging, or cycling, the HD 400 Headmax open-air dynamic 'phones are designed for comfort (they weigh just 4½ ounces) and a good fit. They have hypoallergenic earpads and a self-adjusting headband. Price: $39.95. *(Sennheiser, 860/434-9190)*

Gekko Flat Speaker



Using proprietary flat-panel transducer technology, the Model GK-1114 is said to produce such broad, even dispersion that every listener is in the sweet spot. This virtue, combined with the speaker's ease of wall mounting (it's just 2 x 11 x 14 inches), is claimed to make it almost invisible in home theater setups. The standard grille is black, but you have a choice of hundreds of decorative prints like the one shown here. Frequency range is specified at 100 Hz to 15 kHz, with sensitivity of 85 dB (at 1 watt per meter). Prices: $299 each; replacement art-print grille, $79 each. *(Gekko, c/o Noise Cancellation Technologies, 800/278-3526)*

•CASE LOGIC CD HOLDER•



It often seems that CD cases don't have enough slots for burgeoning disc collections. The KSW-72/36, however, should meet most travelers' and vacationers' needs: Its double-sided black sleeves hold 72 CDs (or 36 discs with their liner notes). The case's outer material, Koskin with saddle detailing, is said to have the look and feel of real leather. A zippered closure protects the discs from dust. Price: $29.99. *(Case Logic, 800/925-8111)*

E.A.R. MC Step-Up Transformer

E.A.R. claims that the MC 3, designed by Tim de Paravicini, will match the output voltage of a moving-coil cartridge to the phono input of a preamp without adding noise, changing phase, or affecting bandwidth. Three inputs enable a range of impedance matching between 2 and 100 ohms, with voltage gain of 10, 20, or 30 times. Overall bandwidth is specified as 10 Hz to 100 kHz, with a maximum of 5° of phase shift. Price: $995. *(E.A.R., 310/396-1919)*

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WHAT'S NEW

Jensen Car CD Changer

Measuring 3x 11¼ x 7¼ inches, the UCH 6006 six-disc CD changer should fit easily in a glove compartment, under a seat, or in the trunk of a car. Supplied with two six-disc magazines, the changer is compatible with Jensen in-dash receiver/CD controllers. It uses a three-beam laser pickup, twin 1-bit D/A converters, and eight-times oversampling. The anti-shock mounting is claimed to prevent skipping caused by potholes. Price: $349. (Jensen, c/o Recoton Mobile Electronics, 800/223-6009)

PSB POWERED SUBWOOFER

DSP technology combined with infrared remote control lets you fine-tune the Stratus SubSonic 4's crossover points, frequency response, and output level from your listening chair. Moreover, you can store (or modify) different subwoofer presets for diverse kinds of music. The 15-inch driver is powered by a built-in, 300-watt Class-D/AB amplifier said to be capable of 700-watt peaks. On-axis frequency response is specified at 20 to 120 Hz, ±3 dB, with a –10 dB point at 18 Hz. Price: $1,399 in black ash or $1,499 in gloss black. *(PSB Speakers, 800/263-4641)*

ROTEL AMP

Said to have a mammoth power supply, the RB991 is specified to deliver 200 watts per channel into 8 ohms, from 20 Hz to 20 kHz, with 0.03% THD. (Into 4 ohms, it's rated at 350 watts per channel.) And because of its 10 output devices per channel,

the RB991 is claimed to be exceptionally stable and reliable. Front-panel heat sinks should help improve airflow in cramped quarters. The amp's balanced XLR and unbalanced RCA inputs are switch-selectable. Price: $999.90. *(Rotel, 800/370-3741)*

ONKYO DVD PLAYER

Besides a 10-bit video D/A chip, the DV-S501 has component-video outputs to maximize picture quality with large-screen TVs having that type of input. Other connections include S- and composite-video jacks and, on the audio side, coaxial and optical outputs for Dolby Digital and PCM. A zoom lets you magnify any one of 25 screen zones, and various effects (still-frame, frame advance, slow motion, and the like) are said to be glitch-free. The player also has a dual-laser pickup, for DVD and CD modes, and 20-bit, 96-kHz audio D/A converters. Price: $799.95. *(Onkyo, 201/825-7950)*

Nakamichi In-Dash CD/Receiver

Track scan, track repeat, random play, and a 1-bit D/A converter with an eight-times oversampling digital filter are among the features of the CD-40's CD section. The four-channel built-in power amp section produces 5 watts per channel into 4 ohms at 0.1% THD (1 kHz); four pre-outs are provided for system expansion. Up to 30 AM and FM stations can be stored in the tuner's memory, and preset scan will automatically play each for 5 seconds. A carrying case is supplied for the CD-40's detachable face. Price: $399. *(Nakamichi, 310/538-8150)*

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Ron Goldberg, *E-Town*, June 1997

"...the DC-1's sound quality was little short of stunning. No component I've heard can provide the depth of DSP ambience processing (and extraction), user-customization, and flexibility of the DC-1."

Daniel Kumin, *Video*, January 1998

"The DC-1 did a better job of serving both music and soundtracks than any surround processor I've experienced to date."

J. Gordon Holt, *Stereophile Guide to Home Theater*, Winter 1996

"The surround steering has the sort of drive-by-wire precision that even Ferrari can't match. The DC-1 is one of the nearest things the home entertainment industry has to being a classic."

Home Entertainment, April 1997

"[The] beyond-stereo sound of the Lexicon defies traditional multi-channel chaos... I revelled in convincing, seamless, but above all, lifelike surround."

Ken Kessler, *Hi-Fi News & Record Review*, October 1996

"The [DC-1's] ability to recreate a sense of height as well as width, depth and surround was uncanny... ...Unbelievably good."

Edward J. Foster, *Audio*, May 1996

"Looking for the most advanced digital processing you can buy? This [DC-1] is it, no contest."

Home Theater Buyer's Guide, Winter 1996-97

"The DC-1 produces staggering audio. It's easy to set up and it delivers every conceivable (and inconceivable) surround mode – both for home cinema and music. If you are a connoisseur of home cinema, then look no further."

Bob Tomalski, *Home Cinema Choice*, June 1997

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IVAN BERGER

SOME EFFICIENT EVENING

Photo: Michael Groen

How do convention-goers spend their evenings in glittery Las Vegas? If the convention is the Consumer Electronics Show, they may get together and talk tech. Which is what I wound up doing with our speaker reviewer, Don Keele, and Sunfire's Bob Carver, discussing the details of how Bob's Sunfire True Subwoofer works—details we didn't have room for in our review of this powered sub last November.

What boggles a lot of minds about the True Subwoofer is not its small size (which is plainly visible) or its bass performance (which anyone can hear) but its claimed efficiency. A passive speaker's efficiency is easy to measure—just compare signal input power to sound power out. But with a self-powered speaker, especially one whose amplifier is known to be highly efficient, the efficiency of the driver and enclosure are harder to gauge. Having been briefly boggled myself, I whipped out my laptop computer and took notes on what Don and Bob had to say.

Bob Carver (left) and Don Keele at play

Photo: Ivan Berger

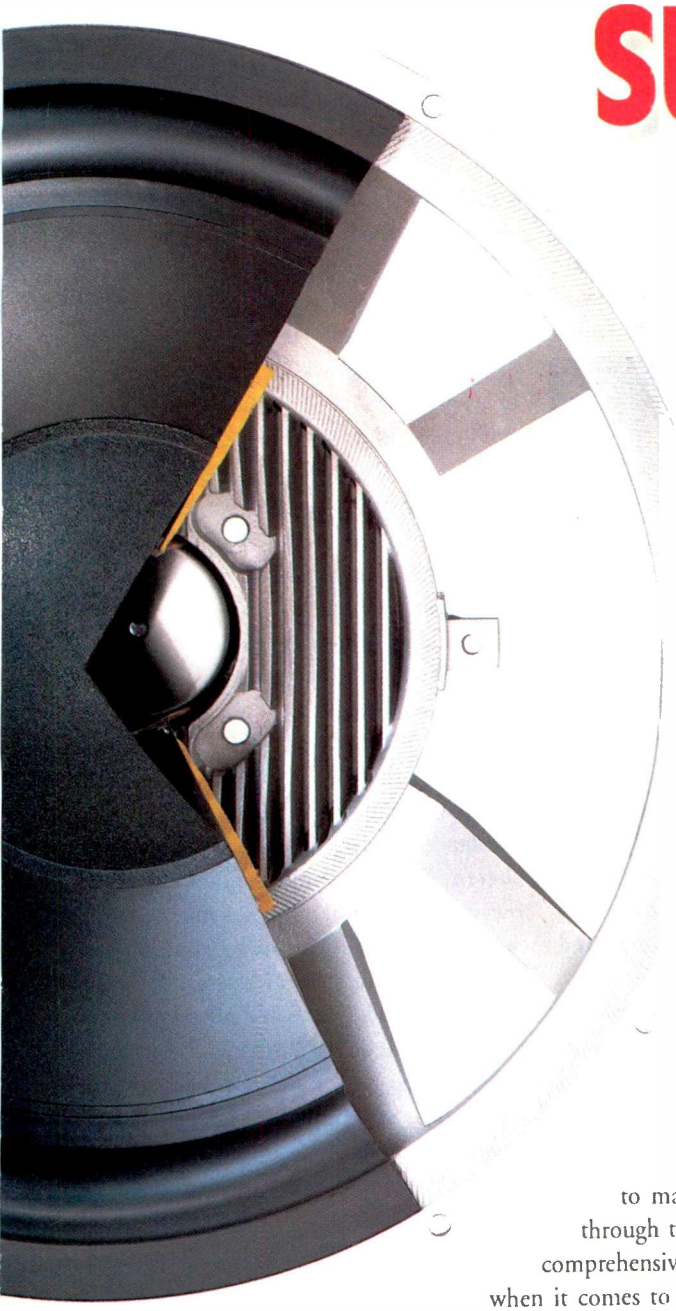
Said Bob, "The True Subwoofer's efficiency is easy for most people to understand. The people who have trouble with it tend to be speaker designers, who are apt to see everything in terms of Thiele-Small parameters."

Remarked Don, "To simplify the design process, the Thiele-Small parameters assume that a speaker's input impedance is constant at all frequencies. And impedance is defined as either the DC resistance of the woofer's voice coil or the minimum impedance in the woofer's passband. If we assume that the speaker's impedance is independent of frequency, then the power it draws when fed a constant voltage (which Thiele-Small calls the nominal input power) will also be independent of frequency. The speaker's efficiency is then defined as the ratio of acoustic output power to nominal input power." (Yes, engineers really talk this way—or pretty close.)

"But with those assumptions," I asked, "doesn't that ratio actually define the speaker's *sensitivity*—its acoustic output for a given voltage input?"

"Not exactly," Don replied. "For speaker designers, it's convenient to use this definition of efficiency because it gives the curve of a speaker's efficiency versus frequency the same shape as the speaker's frequency response for a constant-voltage input. Otherwise, the efficiency curve would follow the shape of the impedance curve. So the Thiele-Small definition of efficiency is quite similar to sensitivity, acoustic output for a given voltage input.

"As it happens, a speaker's Thiele-Small efficiency is relatively constant for frequencies above its cutoff, the bass frequency where response drops 3 dB below its midrange response. The efficiency in this midband region is called the reference efficiency.



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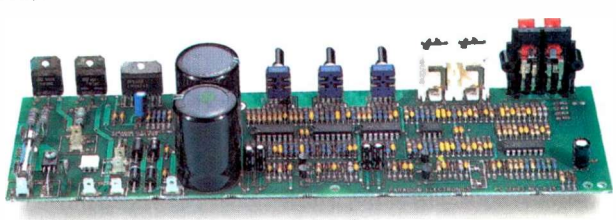

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§ Inside Track Annual Dealer Survey

A speaker's true efficiency, the ratio of acoustic output power to *actual* input power, is higher at some frequencies than its reference efficiency, because its impedance does vary with frequency and usually exceeds the voice-coil's resistance."

"In a way," added Bob, "the Thiele-Small definition of efficiency makes sense. If your amplifier is a constant-voltage source (and most amplifiers are today), then the speaker that has the highest sensitivity will be the one that produces the most sound pressure from that amplifier's output. But sensitivity is not efficiency. Efficiency, in speakers as in everything else, is not how much output you get from a given input voltage but how much you get from a given input power. If a speaker were a purely resistive load, the two would be the same, but what speaker is?

"Confusing efficiency with sensitivity leads to stupid design decisions, such as making speakers that are very sensitive but so low in impedance that they're almost impossible to drive."

"For example," interjected Don, "I've seen crossovers that gave their speakers very flat response—but dropped the speakers' impedance to 1 ohm at crossover. Not an easy load!"

"But if you maximize a speaker's efficiency and go no further," Bob continued, "you get something even stupider, a speaker with no bass." Obviously, making a high-efficiency speaker work as a subwoofer is not a straightforward process, but a convoluted one—and full of contradictions, as I learned from listening to Bob and Don.

"If you shrink a 10-cubic-foot woofer to one-tenth its original size—and do it intelligently so that its frequency response remains the same—then its efficiency drops by a factor of 10," said Bob. Don nodded in agreement but pointed out that, in conventional terms, this is a fallacy. Shrinking a speaker doesn't cut efficiency in the midband, which is where the Thiele-Small parameters define it; it cuts efficiency at low frequencies—in other words, it cuts bass.

And indeed, that would be true for a full-range speaker. But since Bob was talking about a subwoofer, he meant efficiency in the low bass, about 20 to 40 Hz. So in this case, cutting bass and cutting efficiency were essentially the same thing. "When you cut a speaker's efficiency by 90%," he said, "you can't make up for it by feeding in 10 times more power, because the power you'd need would be enough to burn out the voice coil. To make a small woofer perform like a woofer that's 10 times larger, you must make its driver 10 times more efficient." That seemed plausible at the time. Only later did it strike me that there might be ways to increase the driver's power-handling capacity so it wouldn't burn out.

"SPEAKER DESIGNERS," BOB CARVER SAYS, "FIND MY SUBWOOFER HARD TO UNDERSTAND."

However, increased efficiency is the path the Sunfire sub followed, so let's get back to Bob's argument. "You can get that increased efficiency," he said, "by making the magnet 10 times larger."

Not that this would restore the original low-frequency cutoff, Don countered, because "you'd actually be raising midband sensitivity."

In fact, according to naysayers, simply increasing magnet strength would overdamp the speaker, thereby *cutting* bass. To avoid that, moving mass would have to be increased tenfold. But doing so would give us the same poor efficiency we used a larger magnet to overcome, since increased mass requires greater power to accelerate.

Bob put the overdamping problem differently: "Making the magnet bigger increases the back-EMF [the voltage generated by the voice coil's motion, which opposes the input signal's voltage], which makes the bass go away. To get the bass back, we have to drive the speaker with a higher input voltage. But, all things being equal, the higher back-EMF raises the impedance a bunch. If we run this higher voltage into this higher impedance, we wind up, for a given acoustic output, dissipating about the same power in a 1-cubic-foot speaker's voice coil as we would have in the 10-cubic-foot enclosure—i.e., equivalent efficiency."

"True," responded Don, "—at 80 or 90 Hz, above driver resonance." Technically, that's the driver's sealed-box resonance, though it might not seem to apply to the Sunfire sub because it's essentially a vented box. However, at its driver resonance, 45 Hz, the passive radiator isn't moving, so the True Subwoofer acts like a sealed box. According to Don, 80 to 90 Hz is "the driver's mass-controlled region, where you can increase efficiency by strengthening the magnet or by decreasing the mass. But what happens at 20 or 30 Hz?"

"At that point, which is below the driver's resonance," Bob replied, "we have to put in lots of force to overcome the stiffness of the air in the enclosure. To calculate this force, we'd multiply magnet strength times current—which means that, for a given force, increasing magnet strength reduces the current we require.

"Reducing the current drastically reduces the amount of power wasted as heat. In a real speaker, the vast majority of the power fed to the voice coil, maybe 99% of it, winds up heating the coil rather than moving it. The power consumed this way is equal to resistance times current squared. So halving current by doubling magnet strength means we waste one-fourth as much power; using a magnet 3.16 times stronger than normal drops our power losses by 10, which is 3.16 squared. That's the efficiency gain I'm talking about." Thinking about what Bob had just said, I realized that reduced heat is especially important in a small box, where a given amount of heat will raise the temperature far more sharply than it will in a large one.

A FUSE TO LIGHT YOUR FIRE

The trade-only Mobile Electronics Show has morphed into a public event, Fuse '98, to be held June 19th to 21st at the Convention Center in Atlantic City, N.J., in conjunction with Beachfest '98, a free entertainment festival. Events will include exhibits by more than 40 manufacturers, "dB Drag Racing" to see whose car is loudest, a serious sound-quality competition conducted by IASCA, installation training sessions, and the Panasonic National In-Line Skate Series competition.

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"We also have to change the equalization, of course," Bob reminded us. "You can think of designing a speaker by Thiele-Small parameters as a way of equalizing it mechanically to get a desired response. You do it by adjusting mass, compliance, and so on. But if you have a built-in amplifier, you're often better off if some of this equalization is performed electronically—which many self-powered subwoofers do."

"Yes," Don pointed out, "but actual power is not just voltage and impedance. It also relates to the phase angle between the voltage and current, or power factor."

This time, Bob nodded. "If you have a motor moving freely, even a linear motor of the kind that drives a cone speaker, it's not drawing much power because the back-EMF generated by its motion cancels most

EFFICIENCY IS USUALLY DEFINED DIFFERENTLY FOR SPEAKERS THAN IT IS FOR EVERYTHING ELSE.

of the input voltage applied to it. When you first increase the load on this motor, its motion changes slightly, if at all, but its power draw increases. With a constant-voltage source [which you have when you drive a speaker from most modern amplifiers or drive a motor from your power line], this increased power draw doesn't change the input voltage much, but it does increase current flow. It also reduces the phase angle between the driving voltage and back-EMF, or slip angle. But there's a limit. As the slip angle approaches 90°, the motor does begin to slow down. This lowers back-EMF, which allows more current to flow, and that current becomes waste heat, decreasing efficiency. At 90°, the motor simply stops.

"A subwoofer's impedance consists of its resistance, capacitance, inductance, back-EMF, and slip angle," Bob recapped. "Slip angle is what I had in mind when I said that high back-EMF would raise impedance if all else were equal. What keeps this from happening in the Sunfire subwoofer is that its slip angle changes, keeping its impedance almost the same as a much larger conventional woofer's.

"Making the magnet bigger makes the load more reactive," said Bob, while Don nodded his agreement. "This would ordinarily make the speaker very difficult for a real-world amplifier to drive [because reactivity affects power factor]. If your amplifier delivers 100 volts at 3 amperes, or 300 volt-amperes, you might think it was delivering 300 watts. But put that 3 amperes into a 4-ohm load, and, by Ohm's law [power equals current squared, multiplied by resistance], the amp is actually delivering 36 watts. Meanwhile, it thinks it's delivering 300 watts. And because a speaker with a big magnet is such a highly reactive load, current flows from the speaker into the amplifier, where it gets dissipated by the heat sinks. This is why normal amplifiers have trouble with highly reactive loads."

The Tracking Downconverter amplifier in the True Subwoofer was specifically designed for such loads. Its power-supply rails closely track the audio signal, so the voltage across the output transistors is only 6 volts, greatly reducing current flow from the back-EMF.

"This amplifier can deliver 105 volts," Bob continued. "But because the large magnet and the woofer's long excursion generate so much back-EMF, the net voltage driving current through the voice coil is the difference between the amplifier's output voltage and the back-EMF. The Sunfire subwoofer's back-EMF is 93 volts, cancelling all but 12 volts of the amplifier's output. And the current through the voice coil, per Ohm's law, is 12 volts divided by 4 ohms, or 3 amperes. In practice, though slip angle will vary the current somewhat, it won't change the voltage."

By this time, I could summarize the story myself: To make the box small, you have to make the driver efficiency high. To make the efficiency high, you have to make the magnet big. But increasing the magnet strength overdamps the speaker, rolling its bass off. Making the magnet stronger also increases back-EMF, reducing current flow from the amplifier but also limiting the motion a given amplifier can impart to that speaker; make the magnet strong enough, and an ordinary amplifier can't move the speaker at all. To put it another way, the back-EMF increases the speaker's efficiency while, paradoxically, reducing its sensitivity. By driving the speaker with an amplifier that has a very high voltage swing, you can overcome the speaker's low sensitivity, take advantage of its high efficiency—and get the bass back.

Bob's summary was even shorter: "My driver is many times more efficient because its magnet is many times bigger. But to drive such a woofer, you need an amplifier that can swing many volts to make use of this efficiency." You need, in other words, an amp that can deliver about 2 kilowatts into a highly reactive load—and which, ironically, will not be called upon to deliver anything like that. A

GOING FULL CIRCLE

Once upon a time, audiophiles acknowledged professional sound gear as the best but usually couldn't afford it. Nowadays, most audiophiles consider high-end home audio gear as the best but can't afford that, either. Meanwhile, rock's high power demands have led many makers of pro speakers to put more emphasis on durability and consistency than on ultimate sound quality—especially in speakers made for home studios.

So it's no surprise to hear Ken Kantor say, "There is no good reason why today's professional or project studio customer should have to live with a monitor that is inferior in sound to a high-end home hi-fi speaker." As a speaker designer and the proud owner of a home studio that has already produced one CD (*Incoherent*, Anxious Hippy Music 6601), he should know what he's talking about.

Kantor also has an ulterior motive. After he and Chris Byrne left Now Hear This (NHT), they started a new company, Vergence Technology, in Benicia, Cal. Vergence will make speakers bearing the NHT brand, but only for the professional audio and home studio markets. Recoton, which bought NHT from Jensen (which bought it from Chris and Ken), will continue to make and market NHT speakers for the consumer hi-fi and A/V market.

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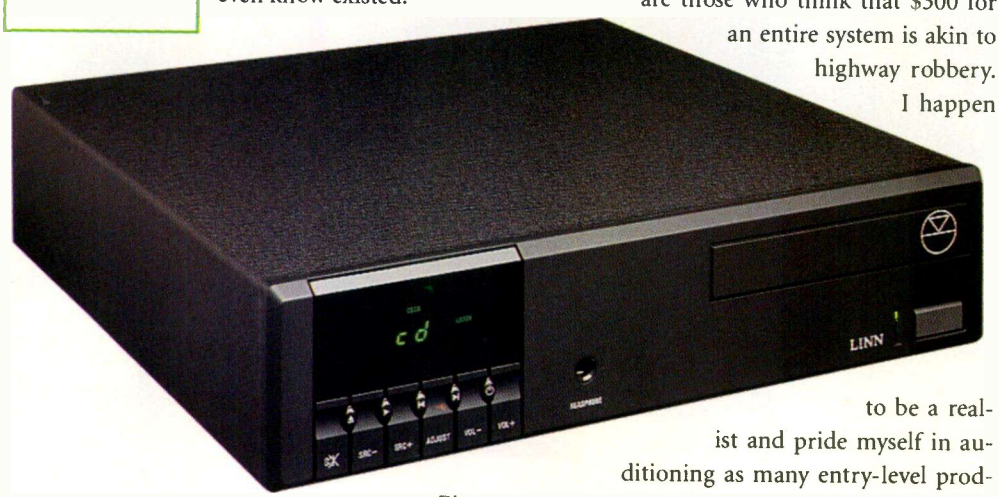
KEN KESSLER

WINNING COMBINATIONS

While the life of a journalist might be privileged, it does present one or two perils. Recently, I learned how out of touch I'd become with mainstream equipment because I hardly ever drop into hi-fi stores anymore. I mean, why bother? Most hi-fi salespeople (in the U.K., I hasten to add) have all the initiative of an appointed government official. But living the hi-fi life through press releases means getting only part of the story; I was missing out on an entire category of component, one I didn't even know existed.

Linn's clever, contradictory CD player/integrated amp, the Classik



First, my excuses: As a specialist audio journalist, I am rarely called upon to review dirt-cheap systems of the mini/midi variety. You, the readers, have evolved way beyond "music center" status and expect—nay, *demand*—reviews of separates from companies with proper audiophile credentials. Indeed, I would imagine that most of you would be mightily ticked off if you paid your four bucks for *Audio* and were regaled with tales of all-plastic, made-in-China, sub-boombox, $99-as-seen-on-the shopping-channel dreck.

Your audiophile status doesn't preclude buying affordable components, but affordable is a relative term. And though you and I might consider $300 to be a negligible sum for a pair of main speakers, a CD player, or an integrated amp, there are those who think that $300 for an entire system is akin to highway robbery. I happen to be a realist and pride myself in auditioning as many entry-level products—plenty of $300/pair speakers, sub-$400 CD players, $50 headphones, etc.—as I do high-end toys. But I must admit ignorance of the 1990s' equivalent of the old one-piece music center: the CD/receiver.

What's so embarrassing is that I, like every one of you who has been silly/brave enough to let on to friends that you are a hi-fi buff, am often asked what a non-crazy should buy for his or her lounge [British for "den."—*Ed.*]. The upside of this brain-picking is that it keeps one's feet on the ground. It's a reminder that most people are horrified by the price of audiophile cables, $20,000+ amplifiers, and $75,000 speaker systems. So rather than demur because it might be interpreted as snobbery, I do my best to think of something that will play CDs for under $500, complete with speakers. And, to my blessed surprise, relief for future queries has arrived in the form of the Sony RXD-700 [not available in the U.S.—*Ed.*].

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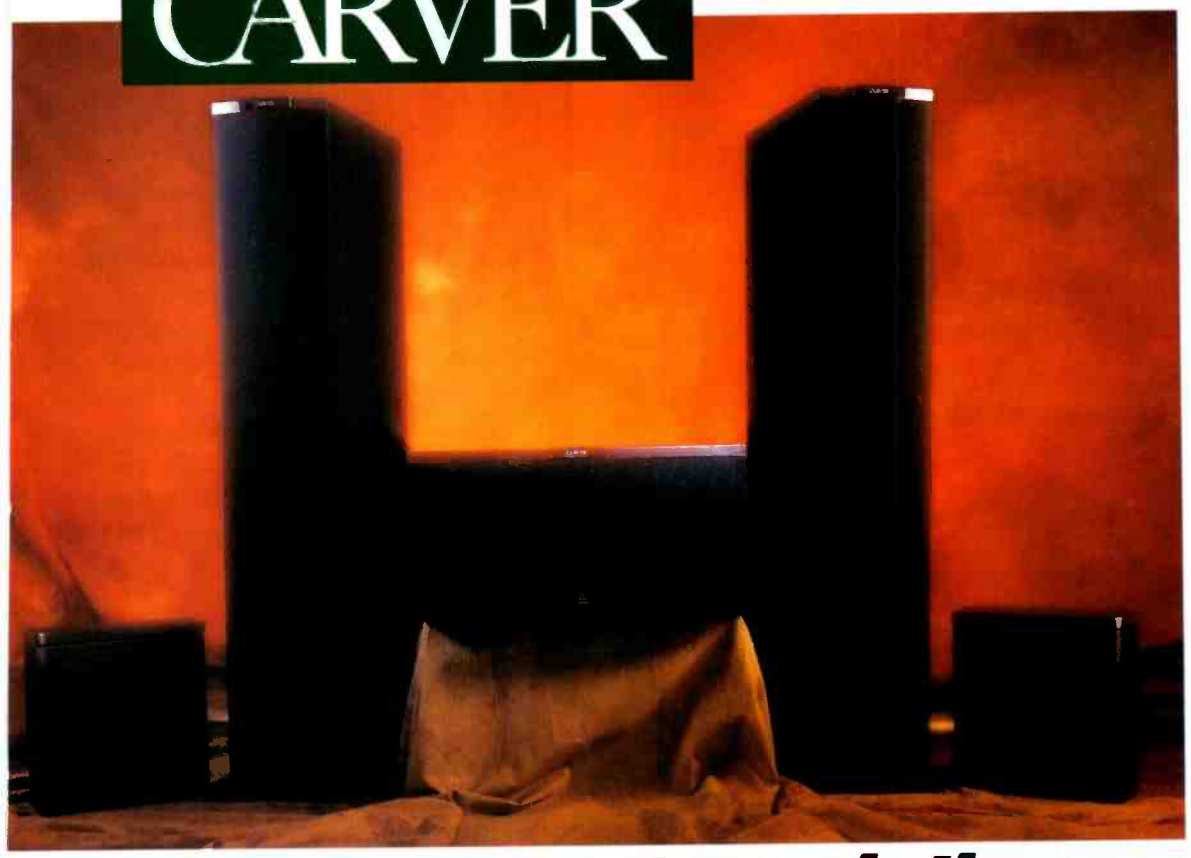
At first glance, I thought I was looking at a new Marantz component, something from its Slim Series, such as the stunning PM-17 integrated amplifier. Low-profile, champagne in color, subtly styled—what else could it be? Then I saw the price tag, the British equivalent of around $550. It was too little for products in a line where an FM tuner costs nearly a grand. Then the salesman pointed out the Sony logo.

What I saw was a little treasure. I sorta figured out that it was a CD player because of a drawer on the left. The drawer looked too small for CD, so I wondered if maybe it was for a MiniDisc. Full marks, then, to Sony designers for creating a combination CD player/tuner/integrated amp that could pass for just one of the trio. I'm not kidding: This marvel fits in a chassis that's 17½ x 4¼ x 13¼ inches.

By abandoning all manner of audiophilic pretense, Sony was able to endow the RXD-700 with most of the nifty features we're too damned snobbish to allow designers to include on high-end products. Naturally, this baby is fully remote-controlled, and its AM/FM tuner section offers RDS FM and a timer with sleep/wake-up capability. Its two-channel amplifier section is rated at 55 watts/channel into 4 ohms, enough to drive a host of modern, high-sensitivity speakers. And the designers at Sony were optimistic enough to provide switching for two pairs of loudspeakers in A-only, B-only, and A/B modes—not the cowardly A- or B-only.

CARVER



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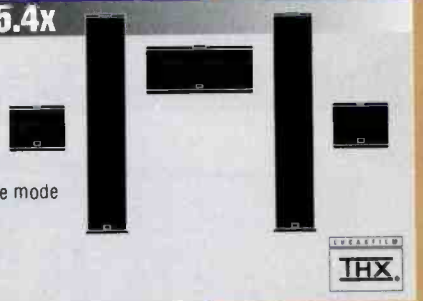

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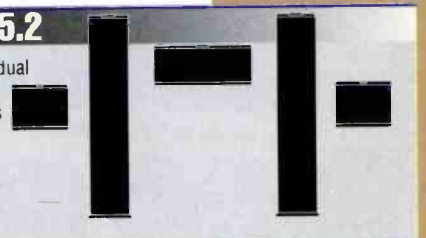
- Freq. response 24Hz-22kHz



CINEMA SYSTEM 5.1

- 150 Watt powered Large-Displacement subwoofer
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- Dipolar Surrounds
- Constant Directivity tweeters
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- Freq. response 27Hz-22kHz

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I warmed more and more toward the wee Sony. You can program in station names, enjoy the message graphics provided in RDS signals, connect a tape deck, and preset 30 stations. It's compact, feels like it's built to last, and gives the impression that it's worth every penny. Add some small two-ways of the bookshelf variety—at, say, $249/pair—and you have decent sound for the non-hobbyist at a not-too-painful $799.

Sure, some people will still feel they're being taken, but nothing will ever change their minds. And I'm beginning to wonder if we should even bother with the sort of kvetch who thinks a cup of coffee still costs 10¢. Basically, Grandpa Walton can kiss my butt. I'm sick of apologizing for bargains, let alone shots at the state of the art.

So enter a CD/integrated amp for those who would be ashamed not for spending too much but for shelling out too little. Think of a brand as far removed as possible from a mass-market name like Sony. Let's make it easy: a company that held out against CD longer than most, is best known for a turntable, and—despite offering multi-room and multichannel components—is still perceived (however incorrectly) as hair-shirt audiophilia at its most recalcitrant. Yup, it's Linn that has produced a CD/integrated amp. And it's actually kinda cute. Or, in Linn parlance, kute.

Called the Classik (unbelievably, the company resisted calling it the Klassik), Linn's alternative to the Sony RXD-700 answers a slightly different question. For every friend who wants to know what his all-thumbs, low-rent brother-in-law should buy, there's usually one who wants "something decent"—not necessarily a potential audio casualty but someone who knows that there's life beyond the lowest common denominator.

Anyway, the Linn Classik is something that, 10 years ago, would have been a conceptual impossibility. Not technically, but in terms of Linn philosophy. If anything, the Classik presented less of a design challenge than the RXD-700 because it doesn't have a tuner section, but I don't recall any products circa 1988 that placed a CD player and an integrated amp in the same chassis. Or maybe I was too much of a snob to notice.

Linn has opted for a lower, more square enclosure, the Classik occupying a space of 12½ x 12¾ x 3⅛ inches; think of a stack of

two dozen LPs, and you're there. Pretty compact, and yet the Classik's box houses a Linn-made CD transport and delta-sigma D/A converter, a preamp with four line-level inputs, and enough other features to call to mind the term "budding audiophile."

No way were Linn's designs going to produce something that would come back to haunt them. (Snotty journalists such as I revel in our long memories, and nothing would please me more than to attend a Linn press function in 2010 to remind Ivor Tiefenbrun that the company wasn't always about moving-coil cartridges and single-speed turntables.) But this one-box beauty looks like it's been made with the Right Stuff. Linn has been working with surface-mount board technology and using microprocessors longer than the company's die-hard purist following would care to admit. And it's paid off in savings of space and cost. As a result, the Classik is rated to deliver 75 watts/channel into 4 ohms, it can drive two pairs of speakers or be set up for bi-wiring, and it has a preamp output that lets you use a second power amp for biamping or running a second zone.

Masochism, too, has been abandoned by Linn, once known for minimalism to the point of self-abnegation. While remote control is a given, the Classik offers a feature also found on the Sony that will be loathed by those who swallowed Linn's corporate guff about "no digital watches allowed in the listening room": an internal timer, which ain't mechanical, let alone analog. And, shock! Horror! There are even bass and treble controls. On a Linn product!

Does this come cheap? Relatively speaking, yes. With a retail price of $1,700 in the U.S. (only $80 more than it costs here in the U.K.), it's the cheapest way for a Yankee Linnophile to leave wannabe status behind. And there's almost price parity! Looks like I'm going to have to stop bitching about the strong pound.

As one once so anti-Linn that I refused to wear plaid and wanted Scotland to secede from the planet, I don't know what gives me greater satisfaction: seeing Linn produce a functional, practical, and convenient alternative for those who want to go upscale but don't want separates or seeing Linn contradict nearly all of its 1980s dogmas in one fell swoop. Whatever. I'm utterly in love with the Classik for its clock alone. A

COREY GREENBERG

ALPHA BITS

PSB's Alpha family: the Mini, the Mite, the Midi, the A/V, and (at bottom) the Subsonic 1

Ah, the PSB Alpha minispeaker. Even in an age where every new product seems to effortlessly lay down a spoor of JQs (jizz quotes), the $219/pair Alpha has enjoyed an almost unheard-of level of boosterism among the hi-fi press. The Alpha's laundry list of JQs speaks for itself: "The greatest hi-fi bargain of the past 50 years!"; "Steak tartare performance for the price of raw beef—bravo, PSB!"; "I sawed my own hand off, I was so impressed! Also, my brother bombed an abortion clinic and I am insane, but these speakers are still a heckuva value!"

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But even when it seemed like every reviewer in the game was tripping over himself to rave about the little PSBs, I could not quite bring myself to join the cult of the Alpha. I mean, I liked this speaker okay, but it didn't really strike me as being in the same league with similarly priced minispeakers from Paradigm and NHT, to name two. The Alpha, though certainly an excellent value, lacked the kind of uncolored midrange, image focus, and treble detail that mark the best of the $250-and-under budget kings. The tweeter, I think, was the main culprit—the same inexpensive, half-inch polydome driver found in many budget speaker systems. It tends to get hard and spitty too fast for my taste, and it lacks the smoothness and detail of the better 1-inch domes used in, for instance, the $250/pair NHT SuperZero.

FOR $250/PAIR, PSB'S NEW ALPHA A/V IS A SUCCESSFUL UPDATE OF THE ORIGINAL ALPHA AND A GOOD VALUE.

What the Alpha *did* have was an instantly likable frequency response that gently bumped up the low and high ends, giving the impression that the speaker was both ballsier in the bass and more crisply detailed than it really was. It didn't go gracefully loud enough for sustained heavy rock, and the rez wasn't the highest, but its combination of smiley-face sonics and smiley-face price firmly established the little ported Canuck as a certified hi-fi classic. It was the modern incarnation of the legendary Boston Acoustics A40, another cheapie but goodie that bothered many a college student's dorm neighbors (including my own).

Even though unshielded, the Alpha found its way into enough home theaters over the years that PSB's Paul Barton decided it was high time to create an entire line of Alphas especially for surround sound. The pioneering Alpha is now superseded by a whole barrel of Alpha monkeys—the $249/pair Alpha A/V, the $199/pair Alpha Mini, the Alpha Mite ($169/pair), the Alpha Midi center channel ($119 each), and the $439 Alpha Subsonic 1 powered subwoofer. The new surround-minded Alpha satellites all have shielded, poly-coated paper woofers and half-inch poly-dome tweeters said to offer smoother re-

TC loudspeaker cable

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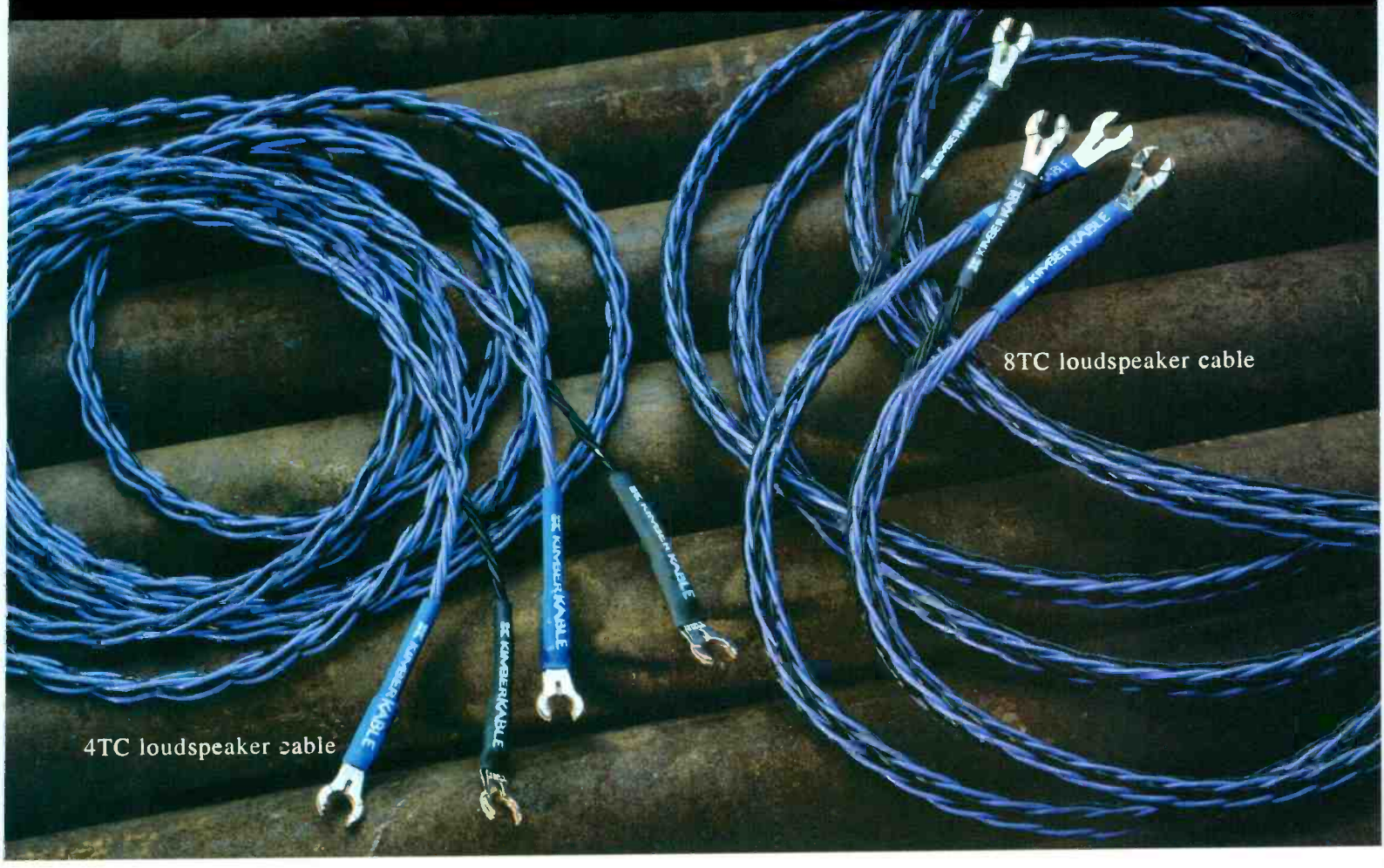

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sponse than the original Alpha's polypropylene woofer and older tweeter. PSB further claims enough tone-cloning across the line that a seamless sonic match can be realized from any mix of these speakers.

The breakdown of the line seems pretty logical. You may still be able to find the original Alpha for $200/pair, but for 50 clams more you can get the new Alpha—the 6½-inch ported Alpha A/V, with better claimed performance and freedom from TV purpling. Like all of the new Alphas, the A/V comes in two finishes: a no-frills vinyl wrap PSB calls Black Roughcast (sounds like a character from *Boogie Nights*) and a reddish wood-esque look it calls Dark Cherry (Black Roughcast's longtime costar, both on and off the screen).

If All-Nite Pawn coughed up only 200 bills for that set of Porsche hubcaps you "found," there's the Alpha Mini, which is a third mo' svelte than the Alpha A/V and has a smaller, 5¼-inch, woofer (yet the same rated 68-Hz bass extension as the larger A/V). The $119 Alpha Midi center channel is essentially an Alpha Mini tipped over on its side, with a bit of response tailoring to compensate for TV-top placement. Think of it as a woofer/tweeter/woofer horizontal center channel, but without one of the woofers. Funny thing is, in a pinch I've tried tipping over other minispeakers to make a "hillbilly center channel," but they've never sounded very good that way: The timbre changed too radically when the speaker was on its side, which made for a lousy match to the main pair. But the response tailoring in the Midi lets it sound just like the Minis, making for a seamless, coherent spread across the front. The Midi also timbrally matches the A/V—but not the Mite (more on this later).

Speaking of which, 30 bucks further down the food chain gets you the littlest Alpha, the Alpha Mite. With its 4½-inch woofer and a cabinet less than half the size of the A/V's, the Mite is basically PSB's answer to the NHT SuperZero, longtime king of the budget, bassless minispeakers. Whereas a partnering subwoofer is a judgment call with the larger Alphas, consider it mandatory with the Mite. As with any speaker that's got a woofer smaller than the average orange, the Mite sounds a mite brite on its own.

I JUDGED THE PSB ALPHA SUBSONIC 1 TO BE AN EXCELLENT, BUDGET-PRICED SUBWOOFER.

To complete the Alpha home theater line, PSB proffers the Alpha Subsonic 1, a ported, 65-watt powered sub that has a 10-inch driver and high- and low-level inputs. And it has a circuit that automatically turns the sub on in the presence of an audio signal and off when the party's over. (I don't know about you, but I'm getting to the point where I'm starting to like any sub that has this no-brainer feature and hate every one that doesn't. It's such a nice convenience, I don't know why every sub doesn't have it as standard issue.)

Normally, I'd audition budget-priced speakers with an A/V receiver, which most people would likely use them with, rather than my high-end separates. But on first listen, the PSB Alpha A/Vs sounded quite a bit better overall than the original Alphas, enough so that I felt like hearing what they could do in my usual he-man rig: Theta Digital's Casablanca surround preamp and Data III LD/CD transport, a Toshiba SD-3107 DVD player, a Rega Planar 3 turntable with a Grado Reference cartridge, a McCormack Audio Micro Phono Drive MM/MC stage, Aragon 8008 amplifiers, Kimber 8TC speaker cables and Silver Streak interconnects, and Audio Power Industries Power Pack AC line filters. The Alpha Midi center channel perched atop a big Pioneer Elite Pro-1009 rear-projection TV, while the satellites sat on PSB's $89/pair SP-25 wooden stands, which raised them about 2 feet.

Whether I listened to music or movies, it was obvious that the new Alpha A/Vs are a cut above the originals. The older Alpha's smiley-face response curve has been replaced with more of a Mona Lisa flat line. The midrange is considerably smoother, and the new tweeter endows the A/V with a cleaner and more sophisticated high end. I still don't hear quite the same focused, holographic imaging I do from the budget-priced NHTs and Paradigms, and the A/V doesn't go significantly louder before cramping up than the classic Alpha. But held within its limits, this is a much more refined and neutral speaker than the original.

That's the good news. The gooder news is, the $50-cheaper Alpha Mini is actually the better-sounding speaker! It's got a hair less bass, but what you gain is a livelier and more detailed midrange. Vocals, especially, sound much more natural and coherent. Although I didn't hear any timbral difference between the A/V and the Mini on pink noise, on music and movie soundtracks I found myself strongly preferring the sound of the smaller,

less expensive Minis. They come alive in a way that the larger A/Vs do not.

Of course, using the Alpha Subsonic 1 subwoofer to handle frequencies below 100 Hz largely moots any low-end differences between the Alpha A/V and the Alpha Mini. I think the Subsonic 1 is an excellent, budget-priced sub. It has much more slam and finesse than I would normally expect from an under-$500 subwoofer.

It was obvious PSB spent some time knitting this new Alpha line together to work in concert, as seamlessly integrating the sats with the sub was pretty much a matter of hooking them all up and dialing in the right amount of woof. Usually I spend a good hour or so trying to tweeze one of these budget-priced home theater systems into sonically acceptable shape, but the Alpha rig sounded good from the get-go.

As for the li'l Alpha Mite, in *this* after-school special, the runt of the litter doesn't wind up stealing the show (and along with it, our hearts). The Mite might share the same tweeter as other speakers in the new Alpha line, but it doesn't share the same sound. It's got a more nasal midrange than

TWO PAIRS OF MINIs, A MIDI, AND A SUB 1 MAKE ONE OF THE BEST UNDER-$1,000 SETUPS I'VE HEARD.

the A/V and the Mini, so if I did the logical thing and used a pair of Mites for the surrounds, I wound up with a system where a pink-noise test signal sounded very different when it cycled back to the surround speakers, a difference that was distracting on movie soundtracks and multichannel music. The Mite isn't a bad little mini for the money, but we're talking about a lousy 30 bucks' difference here! I just *lost* 30 bucks' worth of my time typing that sentence! There, lost another 30 bucks. Lucky for me, I can afford to throw away—well, now we're up to 90 bucks to make a point. If you can't make the leap from spending $169 to $199 for a much better-sounding pair of speakers, do us both a favor and put down the mag before someone gets hurt, okay?

For $249/pair, PSB's new Alpha A/V is a successful update of the original Alpha and a good value. To my ears, the $199/pair Alpha Mini offers even better sound, and two pairs plus the matching Alpha Midi center channel and Alpha Subsonic 1 sub cost just $956, making for one of the best under-$1,000 surround setups I've heard. Okay, might as well throw my hat into the JQ ring: "Are the new PSBs good? Alpha-gedda-boutit!" A

Sound reproduction in living rooms is fairly straightforward and reasonably well understood—except for the propagation of bass. Most audio enthusiasts by now know that positioning speakers away from walls (coupled with some absorption by soft, upholstered furniture) tends to make the midrange clearer, the imaging more precise, and the treble smoother and less inclined toward stridency.

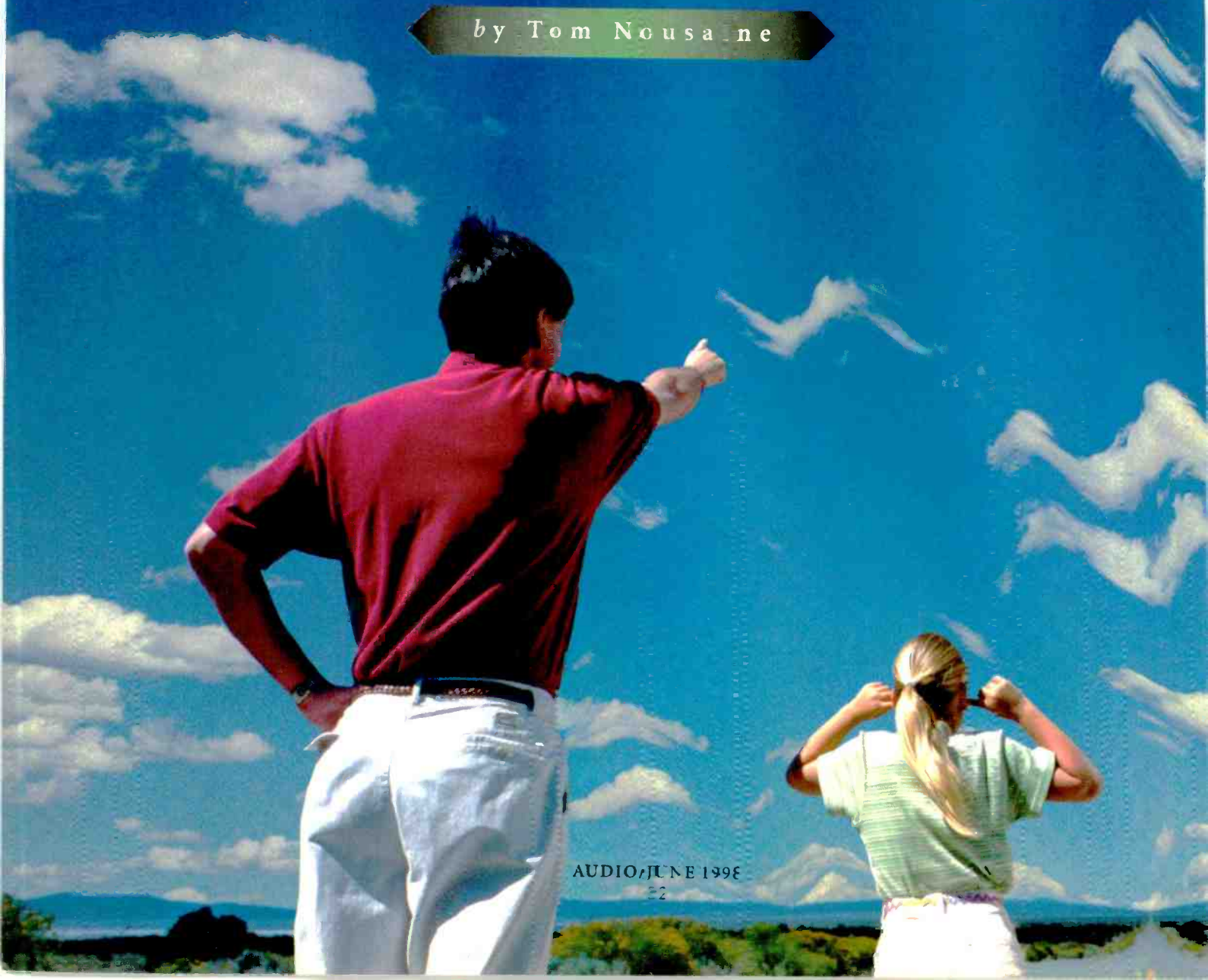
But low-frequency reproduction still confounds many of us. For one thing, I often hear audiophiles claim that a small room cannot support low bass because the wavelengths are too long. The theory is that if the wavelength is longer than the room's longest dimension, the sound cannot be reproduced; i.e., to be heard, a sound at 20 Hz would require a room at least 28 feet long (half the tone's wavelength) so that the frequency would "fit."

But if that's true, why do vans and cars with elaborate sound systems pound so loudly? And how can people wearing closed-back headphones hear anything below 2 kHz? To get on the right wavelength, so to speak, let's analyze what happens at low frequencies in real rooms.

by Tom Nousaine

A ROOM WITH A MODE

In free space (outside), sound gets absorbed, refracted, diffracted, and reflected when it strikes an object or surface. This also occurs inside, but be-



cause rooms have opposing walls, conditions are congenial to the excitement of resonances. The resulting resonances, or room modes, are called standing waves. The frequencies at which they occur are determined by the room's dimensions and the sound's wavelength. For example, in a rectangular room measuring 22 x 12 feet, a standing wave of 25.6 Hz will develop between the end walls. This is called a normal mode. Another normal mode at 47 Hz is excited by the side walls, and still another, at 71 Hz, forms between the floor and an 8-foot ceiling. These are called axial modes, and there are always three of them related to basic room dimensions.

Axial modes are usually the most powerful and energetic of room modes. (Indeed, in a lecture delivered recently to custom installers of A/V components, Dr. Floyd Toole, corporate vice president of engineering at Harman International, noted that the behavior of a loudspeaker below 300 Hz is *dominated* by the room.) Axial modes also have harmonics and secondary modes above the fundamental frequency. Other modes, tangential and oblique, are energized when sound is reflected from more than one wall, but they are always of higher frequency than the lowest axial mode.

Remember, too, that sound is best described as wave motion and is not accurately represented by the analogy of a tennis ball being bounced (reflected) off a wall. If you imagine your room filled with a liquid medium like water, you will get a better picture of how sound energy moves.

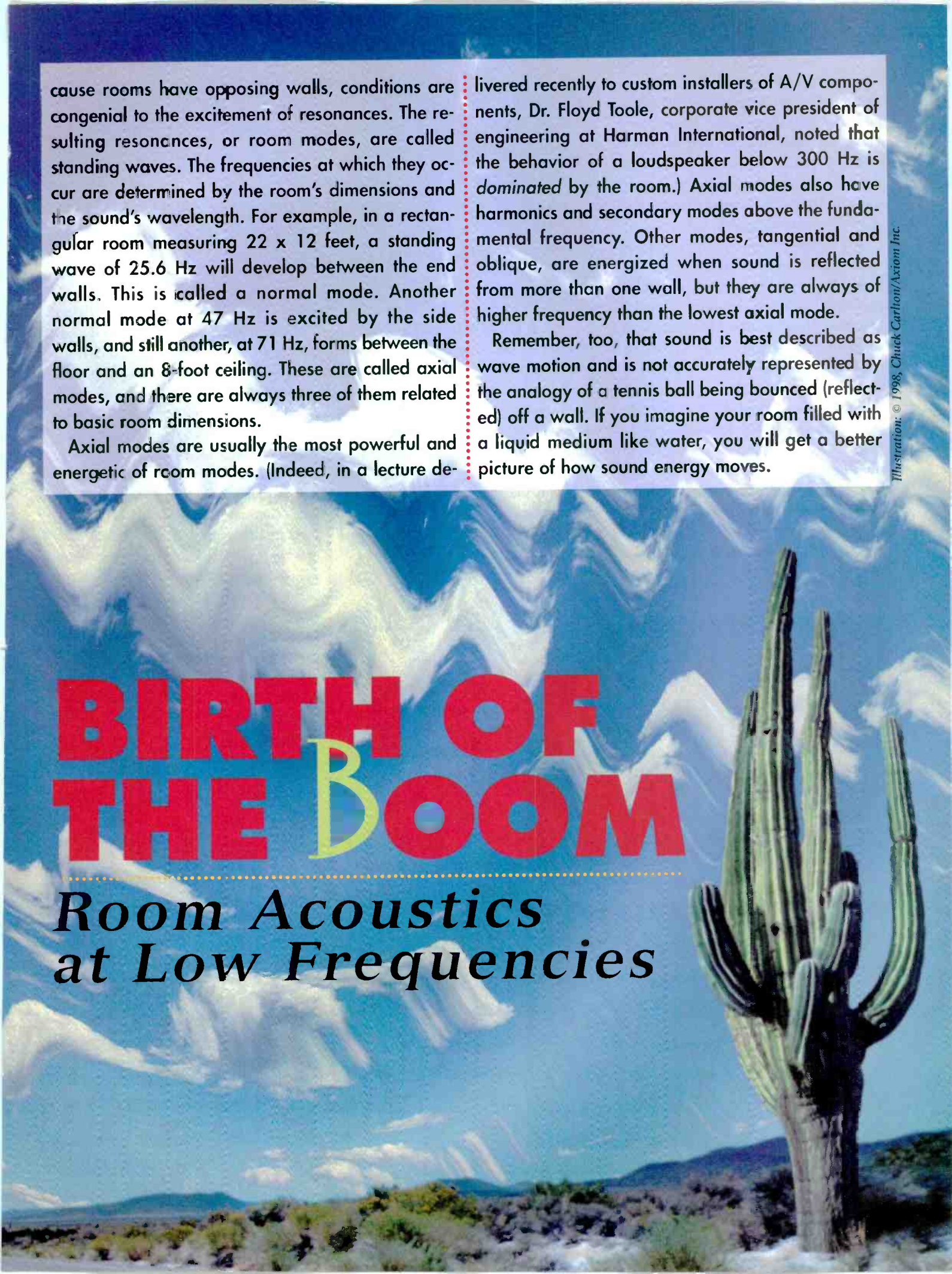


Illustration: © 1998, Chuck Carlton/Axiom Inc.

BIRTH OF THE BOOM

Room Acoustics at Low Frequencies

Standing waves occur at high frequencies, too. The wavelength of a 1-kHz tone, for instance, is about 1 foot. If you play a 1-kHz sine wave, you can hear the tone's intensity change when you move your head. But because the wavelength is short, the sound is evenly distributed and seems equally loud throughout the room.

At low frequencies, however, standing waves cause an obviously uneven distribution of energy, and it is these modes that play havoc with bass response, producing bass boominess in some locations of the room and leanness in others. For example, if a 25-Hz sine wave were played in the aforementioned 22-foot room, high sound pressure would develop near the end walls and very low sound pressure (a null) would be created in the middle of the room. Play any low-frequency sine wave (a single frequency) in the modal region of a room, and the apparent loudness will vary wildly as you walk around: It will be loud in some places and practically inaudible in others.

An equalizer cannot in deep-bass response that room modes.

MODAL PATTERNS

Each of the room modes will have a particular sound pattern. Because axial modes are relatively widely spaced (in our example, a spread of 22 Hz between the first two), there can be radically uneven sound distribution at frequencies in the listening room's modal range even when you play a pink-noise test signal (which has equal energy in every octave) or music. As a result, there will be unequal loudness at different listening positions at low frequencies.

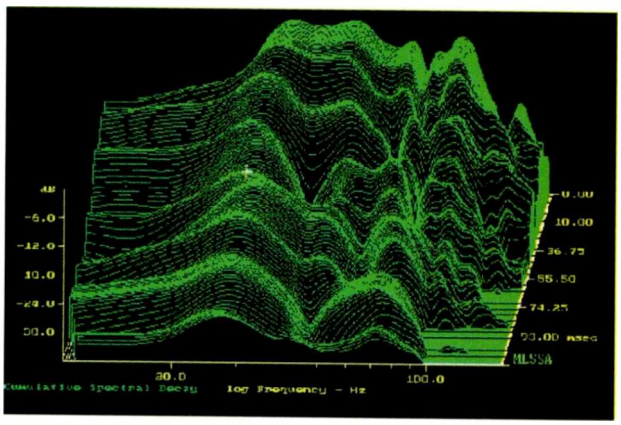


FIG. 1
Waterfall plot of modal decay in a room; note strength and duration of lowest room mode.

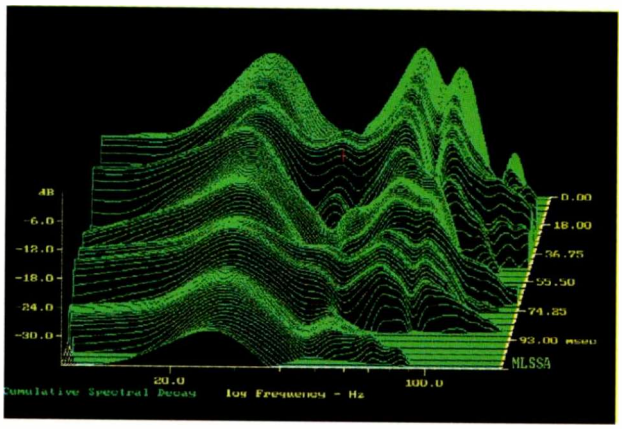


FIG. 2
Modal decay pattern of speaker at left stereo position; note that 47-Hz mode is not strongly excited, causing a hole in the response.

The problem is exacerbated after the signal stops. Once excited, a room mode tends to decay at its own rate, which may not be the precise frequency of the original sound. Therefore, room modes may color bass sounds more severely than the frequency response alone might suggest. Figure 1 shows the decay pattern of a noise signal in our sample room. Note how the lowest mode continues of its own accord.

As frequency increases, things get progressively better. Modal energy is more evenly distributed because modal patterns become denser when wavelengths shorten. In the range of 200 to 300 Hz, there are enough modes and wavelengths that energy becomes fairly equally distributed in a room. In the region of 150 to 200 Hz, the pathlengths of individual reflections (such as floor bounces) begin to cause problems.

ROOM BOOM

When room dimensions are the same or exact multiples of each other, modes can pile up at certain frequencies, creating room boom. Very small rooms are particularly susceptible because they tend to be cube-shaped. Therefore, energy increases between 60 and 80 Hz because the near-cubical dimensions produce modal patterns that cluster near the 70-Hz floor/ceiling mode generated by a room with an 8-foot ceiling.

Thus far, the modal region in our sample room has been identified as falling roughly between 25 and 300 Hz. But what happens below that range, in the deep subwoof region? Surprisingly, the room reinforces frequencies below the lowest room mode. At the very lowest frequencies, the room is our friend. That's why your voice sounds so

fix holes are caused by

deep and resonant when you sing in a small space, such as a shower. It's also why loud bass is possible in cars. The smaller the space, the higher the frequency of the lowest normal mode, so bass reinforcement starts at a higher frequency.

Below the modal range, the room becomes a pressure chamber and a woofer's cone movement pressurizes the entire space. Visualize it this way: At very low frequencies, the subwoofer is acoustically close to all six room boundaries. In small spaces, such as my subcompact car, the reinforcement effect begins at 70 Hz; then, as frequency decreases, sound pressure level (SPL) is reinforced by 12 dB per octave. In my car, a long-throw woofer in a box of 1 to 1½ cubic feet will easily produce in excess of 120 dB SPL at 20 Hz; significant output is possible even at 10 Hz. Most audio enthusiasts have never heard 30 Hz in their homes. In a car, you can barely escape it!

But although getting deep bass is easier in a car than in a room, the midrange is more problematic because the modal region is higher in frequency. In our sample living room, the modal region extends from 25 to 300 Hz. In my car, it's in the range of 70 to 600 Hz, making spectral uniformity and imaging more difficult to achieve.

In short, and contrary to the old wives' tales, the smaller the room, the easier it is to get deep bass! And the easier to get high output. In a large room, on the other hand, bass reinforcement begins at a lower frequency and more energy is necessary to achieve a given SPL.

Does a large room offer any advantages? Sure. Subjectively, a larger room has more evenly distributed bass. Because the modal activity starts at a lower frequency, the modes get denser more quickly and concentration of standing waves at upper-bass frequencies is less of a problem. And because it takes more sound to energize larger spaces, the modal peaks will seem less emphasized.

FIG. 3
Frequency response, with subwoofer placed in a corner, at three different seats: center of sofa 5 feet from back wall (yellow curve) and end of sofa and seat halfway into room (red curves).

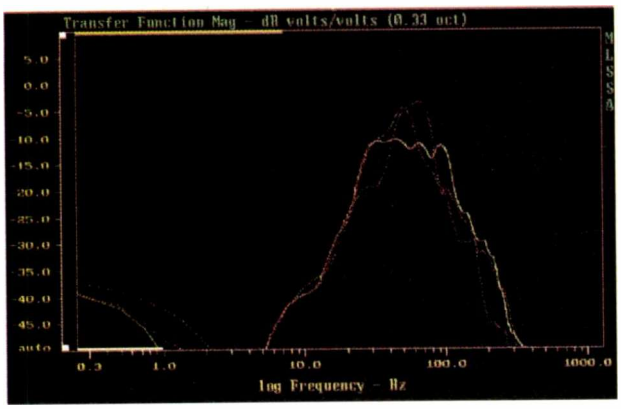
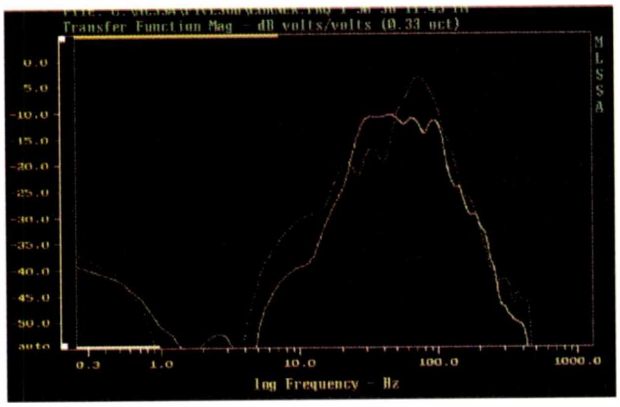


FIG. 4
Frequency response of single corner subwoofer (yellow curve) vs. response of five distributed subwoofers (red curve); energizing room from several different non-corner locations worsens response.



SMOOTHING OUT THE HUMPS

How do we make the bass smoother in a listening room? We already know that absorptive material, strategically placed, helps stifle high-frequency reflections and echoes. Absorption can be effective in soaking up bloated bass as well, and the best way to achieve it is by having pliant walls. A common audio cliché is that we need concrete walls to keep the bass in the room. Although it is true that stiff, heavy walls keep more energy in the room, they also make the distribution of energy in the modal range much less even. Thinner walls increase absorption in the modal range and make the modal peaks less obvious.

For audio purposes, half-inch drywall mounted on 2 x 4-inch studs, plus pliable ceilings, are better than something like concrete. Certain soundproofing methods will be better than others, too. Techniques that rely on resilient wall-mounting will be sonically better than those that use mass alone. The penalty, of course, is that more acoustic power (cone displacement and amplifier power) is required to maintain overall sound pressure level.

Are bass traps effective? They can be. For the most part, resonator devices have to be large and tuned to specific frequencies. Therefore, detailed measurements must be made prior to design. All the devices intended to work at 100 Hz and below are large and physically unattractive. Make sure that you have return privileges before spending money on low-frequency room treatments of any kind.

Moreover, you can be confident that acoustic wall treatments and other objects of small size will not change the bass in your

listening room. Nor will a large chair or sofa modify standing-wave patterns. And neither will wedges or panels of acoustic foam.

One of the least expensive, yet most effective, ways to smooth out in-room bass response is through careful speaker placement. Let's use our 22 x 12 x 8-foot room as an example. If a speaker is placed 3 feet from the left side wall and 4 feet out from the front wall (an excellent location for one channel of a stereo pair), what will a centered listener seated 5 feet from the back wall hear? At upper frequencies, he will hear clean sound with excellent imaging. But at subwoofer frequencies (Fig. 2), he'll get a big cancellation (or suck-out) in the range of 40 to 50 Hz, because a speaker placed at that location barely energizes the second normal mode (47 Hz).

There is a potential solution, however. Recall that the problem at low frequencies is one of low density of modal activity.

TABLE I

Theoretical ratios for the dimensions of rooms, taken from F. Alton Everest (see "Further Reading"). Assuming an 8-foot ceiling, only a few of these ratios will result in room dimensions of acceptable size. (Everest also provides a simple technique for predicting modal spacing and density of any given room-dimension ratio.) Anyone planning new construction may wish to consider these ratios. Enter the desired ceiling height in place of "1," then multiply it by the figures in the width and length columns to calculate the room dimensions.

THEORETICAL ROOM RATIOS

Height	Width	Length
1	1.14	1.39
1	1.28	1.54
1	1.6	2.33
1	1.4	1.9
1	1.3	1.9
1	1.5	2.1
1	1.5	2.5
1	1.26	1.59

The least expensive at low frequencies is achieved

Thus, putting a subwoofer in one corner of the room is a good solution. It will energize the maximum number of modes and significantly smooth bass response in many rooms. Output still will not be ideal at all locations, but it will be as smooth as possible (Fig. 3).

MULTIPLE SUBWOOFERS

Is the use of multiple subwoofers to differentially excite modes and thereby smooth bass response an answer? Occasionally yes but usually no. Modal patterns are a function of the room's dimensions. Corner placement excites the maximum number of room modes. Any alternative placement of one or more subwoofers can only fail to energize or possibly cancel certain modes.

If the problem is insufficient density of a room's standing waves, cancelling or attenuating some of them seldom produces the intended result. Indeed, my research shows that placing five subwoofers at optimal speaker locations in a surround system produces significantly *worse* results than a single subwoofer in a corner (Fig. 4).

Another alternative is giving each listening position its own subwoofer. Putting the listener in the direct field of the subwoofer can work well. Bear in mind, however, that modal patterns are a function of the room, so if you give yourself the subwoofer, you will make things worse at other listening positions—unless, of course, you are sitting in the corner.

Floyd Toole and other researchers have found that careful placement of two subwoofers can in some cases produce optimal results for a given listening position. However, your chances of getting optimal results without test equipment are poor. The combinations and permutations for placing two or more subwoofers in a room are virtually endless. Trial and error may take a long, long time.

TO EQ OR NOT TO EQ

Is equalization a remedy? Seldom a complete one. *Modal patterns are a function of the room.* You cannot fix a null with equalization, because the room is preventing excitation of energy in the null. Consequently, pouring more power into the speaker will not produce more sound in a null, and it may well worsen the modal *peaks* in other locations. At frequencies in the range of the lowest normal modes, the major problem will be holes in the response between modes, and they cannot be fixed with an equalizer. All you can do is trim the peaks. Nonetheless, this may yield a significant improvement.

When a room produces stacked modes that cause a buildup of energy at a given frequency, putting less energy into the speaker in that range can be helpful. For room-boom troubles that develop in the range of 60 to 80 Hz, staggering the crossover from a subwoofer to the main speakers may help. For example, lowering the subwoofer crossover point to 40 or 50 Hz while raising the high-pass filter to 100 Hz or higher will deliver less energy at the offending frequencies.

THE IDEAL ROOM

Do some room dimensions work better than others? Look at the question this way: At higher frequencies, room modes are not a complication because there are lots of them, densely distributed. So, in an ideal room we want dense, evenly distributed modal patterns.

Are there any magic ratios for room dimensions that we can follow to get evenly

method of absorption through flexible wall surfaces.

spaced modes? Acousticians have calculated sets of room dimensions that are purported to work optimally (Table I). However, most of them result in very small rooms if you are restricted to an 8-foot ceiling. For example, one preferred ratio (1:1.14:1.39) yields a room measuring 9 x 11 feet if you assume an 8-foot ceiling. I have measured the response in rooms of this size, and they usually have severe room boom between 60 and 80 Hz.

I have been in several more practical rooms where excellent performance could be achieved. One was 12 x 22¼ feet and had an 8-foot ceiling. In another, whose dimensions are 13 x 23 feet with an 18-foot cathedral ceiling (average height of 12 feet), the sound is terrific at low frequencies in a variety of seats. This particular room has several openings and alcoves, and its height is uneven. And my friend David L. Clark, who first explained the transfer function and room reinforcement to me, has an excellent room that's about 20 x 30 feet.

Are canted walls a solution? The theory is that an inclined wall will have an infinite number of modes and therefore contribute to smoother response. Nope. A tilted wall will certainly prevent flutter echoes at high frequencies, but in the bass region, it just shifts the frequency of the mode by an undetermined amount. Such a room will still have three primary modes, and it will be harder to determine in advance at what frequencies they will occur.

CONCLUSIONS

Rooms interfere with music reproduction at low frequencies by causing unequal distribution of sound. The primary cause is the interaction of low-frequency sound with room dimensions. As a rule, standing waves cannot be fixed through the use of equalization, although it may be possible to tame some of the modal peaks. Good speaker placement is by far the easiest and best remedy. Absorption at low frequencies is helpful for smoothing in-room response. The least expensive method of absorption at low frequencies is achieved through flexible wall surfaces. On the other hand, at extremely low frequencies (below the frequency of the lowest axial mode), the room provides bass reinforcement of 12 dB per octave as frequency falls.

As with just about everything else in life (and, especially, in audio), your quest for better sound at low frequencies will require you to make tradeoffs. To that end, think of your listening room as both your friend and your foe. I have been in dozens of excellent-sounding rooms of many different shapes and sizes; speaker placement and setup often seem to be greater limitations than the room itself.

Overall, I believe that listening rooms at low frequencies are more alike than they are different. While your bathroom, your bedroom, and your listening room may all differ acoustically, it is primarily because their dimensions differ so significantly. My guess is that the typical North American A/V enthusiast has a fairly common set of acoustical conditions in his listening room or home theater: an area of 250 to 300 square feet with room-dimension ratios of approximately 1:1.5:2:5, a carpeted floor, ¾-inch drywall on 2 x 4-inch studs, two doorways, and usually a few windows. Such a room gives darn good sound. Although the room itself is a major contributor to the way music sounds in your home, the common assumption that it is a major impediment to high-quality sound at low frequencies is, in my opinion, grossly overstated. A

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THE AUDIO INTERVIEW

Michael Kay,

ONCE UPON A TIME, a pundit remarked that nothing happens in the business world until somebody sells something. If true, then you would have to say that Michael Kay is a man who makes things happen. In the hi-fi business, it's safe to say nobody has sold high-end components for so long with so much finesse as the proprietor of Manhattan-based Lyric Hi-Fi.

Kay's real name is Kakadelis. (He shortened it to avoid repeatedly spelling it.) He was born on the Greek island of Lesbos in 1923, to a father who imported groceries. In 1942, shortly after the German occupation led to an early graduation for his high school class, Kakadelis left home for a refugee camp in Cyprus and then went to Palestine as a uniformed soldier. He volunteered to serve in a commando unit in the spring of 1943 and fought with it until August 1945, harassing the enemy in various parts of Greece. The aim was to divert as many German troops as possible from the main war theaters.

After the war, Kakadelis worked as a driver for the American Mission to Greece and, between 1947 and 1951, studied at a small technical college in Athens, where he earned a degree in electronic engineering. He subsequently signed on as a technician at the government radio network, where he remained until 1955, helping to build the Radio Station of Athens, Greece's largest.

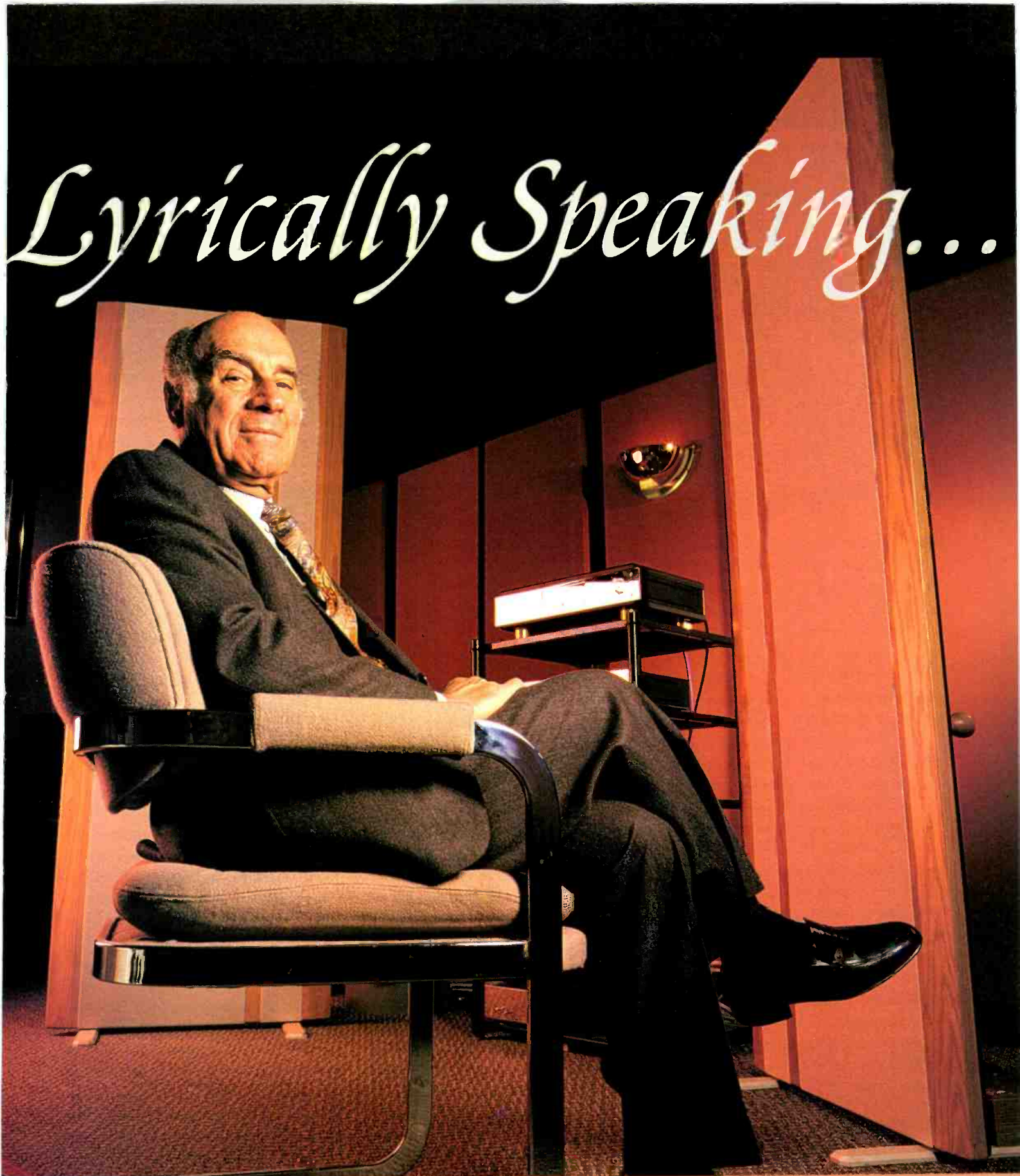
Though his accent retains the flavor of his native country, Kakadelis emigrated more than 40 years ago, to Canada in August 1955 and to New York a few years later. The year 1959 proved pivotal, when his life changed in two major ways: During a trip to Baltimore, he met a first-generation Greek-American, Catherine Mentis, whom he married in a matter of weeks, and he bought Lyric, where the two have worked ever since.

Mike Kay is a member of the Audio Engineering Society and in 1996 became the first retailer inducted into the Academy for the Advancement of High End Audio's Hall of Fame. In addition to the Manhattan store (a few blocks from where he and his wife reside), Kay operates a Lyric branch in suburban White Plains, N.Y. *D.L.*

by David Lander

I like to help brilliant people design products

Lyrically Speaking...



Photography: ©1998, Kevin Knight

that are unique and benefit the home listener.

THE AUDIO INTERVIEW

Forty years ago, most dealers had no

An early Lyric installation job; note the integration of the TV with the audio components.

Kay turns the dials on a Lyric console setup.

What led you to this side of the Atlantic?

I came because I couldn't make anything work in Greece. There was no money. Yes, I had a career, but I couldn't get any satisfaction out of the economics. Greece was devastated, so I said, "Let me get out of here and go someplace where I can possibly do something about it." I had choices—to go to Canada, to Africa, to Australia. I chose Canada. From the research I did, Canada appealed more to me than anyplace else. The one place I didn't want to go was the United States, because I had worked with American guys during the war and I knew it was a lot of hassle. They were hard-working, and I said, "Me? A European? Why do I need that?" Canada was faster-paced than Europe but not as fast as the United States. So I went to French Canada, to Quebec. It was part European and part American, and it was suited much better to me.

You worked in a brickyard, didn't you?

At the beginning, because I couldn't find any other work. My English was elementary. I went to Marconi of Canada, and the guy told me, "Learn English and come back. I can use you." I couldn't even understand what he was saying. I had to remember his words. I went home and opened my little book [of English], and I found it and said, "Oh, this is what he meant."

What did that first job pay?

A dollar twenty-five an hour, my friend. In 1955, it was a lot of money. I was renting a little apartment, an efficiency with a kitchenette. I was paying, what, six, seven dollars a week for that? Food was cheap. Everything was very inexpensive, so you could make ends meet. It was kind of tough, but it didn't last very long—two months, and then I got sick. When I got back on my feet, I found an indoor job in Montreal—washing dishes in a restaurant, which is a very pretty thing to do for a dollar an hour, a little bit less. But it was okay. I met, of course, other Greeks, and one of them tells me one day, "You know something, there's a Greek engineer who took his degree here, and he has a store called Kyma Electronics [Kyma means wave], and he's looking for somebody." I went and talked to him, and he hired me immediately. In about six months, he made me a partner; I got 25% of the company. Unfortunately, in April 1958, the United States economy had a small wavering. You couldn't call it a recession; it was just a wavering. But in Canada, we had double pneumonia, *economic* double pneumonia. In April, our whole gross business was about $3,000, and I said, "It doesn't make sense. If those people sneeze and we get damn pneumonia, I'm going to go down there." And that's what I did. I moved to the United States and came to New York and a friend of mine, an electrician, introduced me to the owner of Lyric.

You've said that the owner's physical disabilities led him to sell you the business.

He had been an officer in the Greek army and had been wounded during the guerrilla war [the post-World War II Communist insurgency in Greece]. The government sent him to the United States for reconstructive surgery; he had dozens of operations. I worked for him at Lyric for the first month to see how they did things. The two salesmen on the floor were me and Dick Shahinian [the speaker designer].

What lines did you carry back then?

Fisher. Sherwood. Bozak. Marantz. Shure. Pilot. KLH. AR. Rek-O-Kut. Garrard. I started out immediately importing Garrards.

Was that before British Industries, the longtime Garrard importer, got started?

British Industries was here, but I brought the turntables in "underground." When the Garrard Model A became available—in 1959, I think—everybody was looking for one. I paid somebody $5 more in England, and he sent me about a hundred of them. I had Garrards from here to eternity. I had a cabinet-making company on the side, with four employees, and I was putting systems together in those cabinets. I called Shure Brothers and bought Shure M7DM cartridges for $7 wholesale instead of about $25; that was a manufacturer's price. So I was able to compete very favorably in the market.

You pioneered custom installation. Who else in New York City was doing that sort of thing 40 years ago?

Liberty. [Now-defunct Liberty Music was a dedicated custom-installation specialty

idea. The only thing they knew was how to sell pieces.

store.] And I was making cabinets for Liberty. I had the best organization. I had the engineering, the custom installers, and the custom manufacturers of cabinets all within Lyric.

The engineering being you?

Yes. I could design; I could fix. I had two employees who would deliver and hook up in homes—run wires, put in another pair of speakers. You see, I knew those things. Most of the dealers who were around had no idea. The only thing they knew was to sell pieces: This is an amplifier; this is a record player. The most they'd do is put the record player together, installing the arm and the cartridge. But I knew how to do multi-rooms in those days. Not remote controls. Remote controls came later, and we designed our own—primitive, but those were primitive days. We did all these things, from A to Z. I'd design a system. The cabinetmakers would make the cabinet, put the equipment in, deliver it, hook it up, and maybe put in another set of speakers or have a television inserted in the center.

So your cabinets were all custom-made.

All custom-made. Absolutely all of them. But most were reasonably inexpensive—$200, $300 for a straightforward modern design with oil finish.

Weren't you a subcontractor for Marantz?

Yes, I was doing their cabinet work, manufacturing cabinets for their amps and preamps.

And for Sherman Fairchild [the semiconductor pioneer, who was also a serious hi-fi hobbyist and a manufacturer of audio equipment].

I was doing the bases for Fairchild record players and the cabinets for their preamplifiers. The hi-fi manufacturing community was a small society. From 1955 to '65, there were very few people.

You made speaker cabinets as well, didn't you?

I was the king of Bozak. In those days, Rudy Bozak was not making cabinets; he was selling only raw speakers—he'd give you the drawings to build your own cabinet. We used to build an 8-foot cabinet in eight hours, in one day's work. We'd cut it in the morning and finish it at night. And the next day we'd deliver it. It was very profitable. Of course, equipment was not as expensive as today.

Still, you were selling the high-end components of the era.

Yes. You would put in Marantz and put in Rek-O-Kut, and Sherwood was considered high-end.

How did people come to learn about Lyric Hi-Fi 35 years ago?

Word of mouth, mostly. And I used to put notices in the Merchandise Offerings in *The New York Times*' classified advertising section.

That was a forum for audio advertising for many years.

Yes, it was. It was affordable. And then we used to advertise the cabinets we were capable of doing in *The Times*' Arts & Leisure section. In those days, it was inconceivable that any woman would allow you to put in all this equipment without housing it in a cabinet. You see, that's the last of the Mohicans [points to a carved, 7-foot Moorish-style cabinet, built in the late 1970s, in an adjacent room of his apartment]. You know how much we used to sell that thing for? Finished and installed, for $1,000. The finish today is $2,000 on that, never mind the work to make the cabinet. It used to take about five or six days to build it, and then I'd give it out to a finishing shop to lacquer.

You never carried JBL, or James B. Lansing as the line was called then.

Kay at one of his first setup jobs, circa 1959.

All Lyric cabinets were custom-made but relatively inexpensive.

Lansing, in those days, was not a high-quality speaker. And Graybar, which was a distributor here, made everybody who had a couple of dollars a dealer. Give them a couple of dollars, and they'd ship to you. So we didn't bother with it. KLH, AR, and Bozak were the high end then, not Lansing.

Why did you never become a McIntosh dealer?

The company rep had a grudge against my predecessor, who once threw him out of the store.

High-end, as we now know it, was born in the late 1960s. How did your business evolve in that period?

In the late '60s, we moved into the more elaborate amplifiers—Hadley, Marantz, SAE, and Great American Sound. Speakers became more demanding, and you needed

I like music. And I like products that

more than a little receiver or an integrated amplifier of 25 to 30 watts.

The speakers were the force that drove the industry.

Always. The speaker drives the sale. The speaker will drag the equipment behind it; the equipment never drags the speaker. How many times have I told customers, "You start with the speaker. You select your speaker, a speaker that suits you." All speakers are distorted; none of them is perfect. It's the nature of the beast.

What moved system sales the next step up the price ladder?

A bigger speaker. Actually, it was just 20 years ago when Arnie Nudell first introduced the Infinity Reference System, which was the first really demanding speaker. It was $20,000; nobody ever heard of a $20,000 speaker in those days. Prices ranged up to three, four, five thousand, and all of a sudden Arnie dared to bring out a speaker for $20,000 with an amplifier for the woofer and four columns. The first year, Lyric sold 37 of them.

Thirty-seven?

Yes. Of course, it wasn't $90,000 [the price of Nudell's current flagship speaker, the Genesis I].

That was phenomenal.

Yes. It was absolutely phenomenal.

What did customers who paid $20,000 for loudspeakers spend on their entire sound systems?

Between 40 and 50 thousand, depending.

Who were they? Certainly not run-of-the-mill hobbyists.

Not anymore, no. They were music lovers who got involved and were demanding more and more, better and better. Businessmen, doctors. Not engineers, really; engineers don't spend that kind of money. See, Bozak and James B. Lansing did not move their lines up; they just stayed still. In our business you cannot stay still very long. Arnie was clever enough to be seeking better and better and better until he reached the IRS, which gave him notoriety all around the world.

Applying the finishing touches at the cabinet factory.

An early '70s setup.

Lyric is known around the world as well. How far away have you or your people gone to do installations?

Texas. South America. All the way down to Brazil. The Bahamas. We've done a couple of installations in the South of France. And a few in Italy.

You've also sold systems to Japanese customers. How many?

In Japan, they put the equipment up themselves. But we've had two or three. They're still customers of mine. We're now in the middle of selling one of them a Genesis I. He's building a new house, and he needs something better, he says.

You've provided capital for a couple of well-known industry people. Back in the early '80s, you teamed up with Dick Sequerra, who designed both the Marantz and Sequerra tuners, for a project. Didn't that stem from your longtime fascination with ribbon speakers?

I told Sequerra a story that a college teacher told me about the ribbon phenomenon. Sequerra said to me, "Let me read about it and see what we can do." When he did, he said, "I think we can experiment and do something with it." I said, "Okay. I'll go along with it. I'll finance it, you work on it, and we'll market it if we can finish it." We did it. We didn't have a bass section yet, but Mr. Harry Pearson, who listened to it, thought it was the best ribbon speaker. He wrote about it.

But it never saw the light of day.

No. I killed it after two or three years. Dick is a very expensive designer.

You also provided capital for Mark Levinson before financial circumstances resulted in the Levinson name being acquired by a new company, Madrigal Audio Laboratories.

I like to help brilliant people design products that are unique and benefit people who listen to music at home. My mission, in a way, is to develop products that are as close to real music as possible. When I saw that Mark had that flare and that glow in his eyes, I went wholeheartedly along with him. I helped in every way I could, giving him ideas about what we would like to have, what pricing would be, and how to market these things. I would listen to all new products and give my opinion. Whenever I saw the spark, I was more than willing to help. I wanted distinction. I did not want general-public stuff; that is somebody else's expectation. I wanted

produce music, not for two days but for a long time.

products that would eventually be classics, because I like music. And I like products that produce music, not for two days but for a long time.

I know that, for many years, you've had a subscription at Carnegie Hall, which means you actually listen to live music. Have you ever done any recording?

When I originally worked for the Greek network, I worked for a little while for Dimitri Mitropoulos. We were young kids in those days. He was the director of the national Greek orchestra, and we used to record him. I was not a musician, though I was close to a lot of music people.

Lyric's installations run the gamut, including this stacked A/V setup.

You had an equity position in Madrigal up until the time it was sold to Harman International, did you not?

I did. Yes.

Have you had an equity stake in other hi-fi companies?

Only a few hundred shares of Carver stock. I bought them when the company went public and sold them about a year later. At a loss.

But for five or more years, you did have a small importing and distributing company. Among other components, it handled Accuphase electronics and Cabasse speakers. And Koetsu phono cartridges.

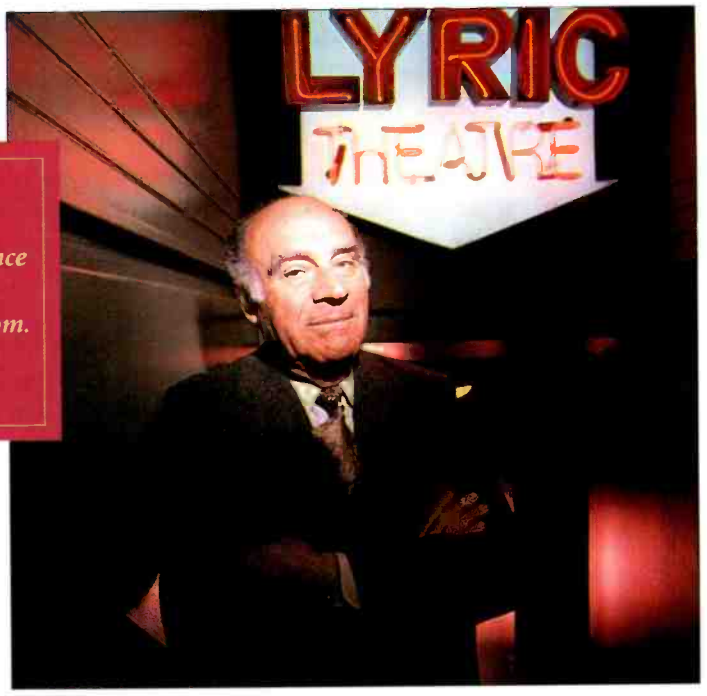
Koetsu was my favorite cartridge. I discovered it in the late '70s. Somebody brought it to the West Coast, and a customer of mine had it. He said, "I've got this cartridge, I don't know what it is. Let's listen to it." I put it in a record player, and I was really surprised at how good this thing was.

You've said that you discovered the cartridges were handmade in very small quantities by one man in a village outside Tokyo. How did you connect with him?

I called my friend, Yasu Nakanishi [a Japanese importer of high-end audio gear], and said, "Yasu, I don't know who this guy is. I don't speak Japanese, and he doesn't speak English. Why don't you see what he does, and let's see if we can bring these cartridges to the United States." A few days later, Yasu calls me back and says, "I made an agreement with him. All his production, minus something he sells to Asia, comes to me and then I'll send them over to you." I said, "Fine. Beautiful."

Ultimately there were a few Koetsu models. The entry-level model was the Black, I believe. How much did it cost?

The Black was a marvelous $700 cartridge, and we also had the Rosewood. The cartridges that were more linear, more beautiful, he would sign. The Rosewood Signature was $3,000.



Kay at the entrance to Lyric's home theater demo room.

You just turned 75. Though you take more time away from Lyric than you used to—spending it with your son and his family, as well as family members in Greece—you don't seem to be longing for retirement.

I don't want to go to Florida and go fishing everyday, to do nothing.

What keeps you working so hard? No one who knows you well would say money is the driving force. In fact, I once watched you talk a very eager potential customer out of trading up because you knew the expensive receiver that he was almost panting to buy wouldn't give him better sound.

Customers need help; I like to help them. People go into a store, and the salesman asks, "Cash or charge? You want to upgrade? Of course, of course. Cash or charge?" That's not me. If it does not make sense technically and sonically, I don't want the sale. I've said many times that the most difficult part of being a salesman is to say no to a sale. But if you respect yourself, you have to say, "No. Don't do that. It's wrong."

If money doesn't motivate you to continue working, what does?

People. Ideas. Music motivates me to the extreme. Money is a kind of measurement that people use to show what their work is worth. That's not a measurement for me. As long as I have a good plate of pasta and a glass of wine, I'm very happy. A

EQUIPMENT PROFILE

D. B. KEELE, JR.

VELODYNE HGS-12 POWERED SUBWOOFER

The last Velodyne subwoofer I evaluated for *Audio* was the F-1500, in my "Subwoofer Shoot-Out" article (November 1992). At the time, I called it "the cleanest low-frequency reproducer I've ever heard." Although no longer made, it remains one of my reference subs. Velodyne now has an extensive line of subwoofers, priced from $499 to $2,499, many of which, like the F-1500, use motional feedback to keep distortion low.

The new HGS subwoofers, while continuing Velodyne's traditional use of feedback, use innovative Dual Tandem drivers and break new ground in the design of their internal amplifiers. And, like the Sunfire True Subwoofer Mark II (*Audio*, November 1997), the HGS models are designed to have the acoustic output and bass extension of large subwoofers even though they're in relatively small cabinets. The HGS-10, which has a 10-inch driver, is almost exactly the same size as the Sunfire; the HGS-12, reviewed here, has a 12-inch driver and a slightly larger cabinet.

Back in the early '70s, Neville Thiele and Richard Small wrote pioneering technical papers that described the theoretical tradeoffs of changing a direct-radiator woofer's characteristics. These papers—which, by the way, are still available in a series of four loudspeaker anthologies published by the Audio Engineering Society (212/661-8528 or www.aes.org)—demonstrated that if a woofer's cabinet size is reduced without changing its frequency response and acoustic output capability, its efficiency will go down and its power handling will increase. For example, if the cabinet volume of a subwoofer is reduced by a factor of 10 without also cutting its bass response or output, its efficiency will drop by a factor of 10 and its input power rating will increase by 10. As a result, the smaller speaker's bass driver (assuming it's the same size as the larger speaker's woofer and has the same excursion capability) will have 10 times greater moving mass, 10 times more power-handling capacity, and a magnet whose flux density is increased 3.16 times (the square root of 10)—a serious design challenge. [For another viewpoint, see this month's "Spectrum."] And the amplifier that drives this smaller woofer will have 10 times the normal power rating, i.e., 1,000 to 3,000 watts instead of the 100 to 300 watts of the amplifiers in typical powered subwoofers. But solving these problems, as Sunfire and now Velodyne have done, gives you a compact, relatively light subwoofer—a great advantage in most homes.

Velodyne's solutions are not exactly the same as Sunfire's, however. To begin with, the HGS-12 is a closed-box design and uses servo feedback. Its driver and amp also incorporate a number of unusual design features. Its High Gain Servo (HGS) motion-control system uses a small accelerometer on the woofer's voice coil to monitor the driver's movement. Using feedback from this accelerometer, the woofer's motions can be corrected to follow the amplifier's input signal more exactly. This process reduces distortion significantly. (Velodyne says it may be as much as 30 times lower than the distortion of a subwoofer without servo control.)

The HGS-12's massive 12-inch woofer has two voice coils operating in separate magnetic gaps. Velodyne calls this structure, which is unlike any I've seen before,

Rated Frequency Response: 20 to 120 Hz, ±3 dB.
Dimensions: 14 in. H x 14½ in. W x 14 in. D (35.6 cm x 36.8 cm x 35.6 cm).
Weight: 51 lbs. (23.2 kg).
Price: $1,999 each.
Company Address: 1070 Commercial St., Suite 101, San Jose, Cal. 95112; 408/436-7270; www.velodyne.com; velodyne@earthlink.net.

Photos: Michael Groen

Dual Tandem design. (The company originally used it in the F-1800RII, in 1996.) Both coils are wound on a single former, 3 inches in diameter, which passes all the way through the driver, from front to rear. One coil is conventionally positioned in the magnetic gap at the front of the two-piece magnet assembly; the other coil is in the rear, where the driver's backplate ordinarily would be.

This extra-long coil former is stabilized by two spiders—one positioned normally, in front of the magnet assembly, the other at the back of the driver. The two halves of the magnet have opposite orientations so that their magnetic fields buck each other, reducing stray magnetic fields (though not enough for Velodyne to claim the HGS-12 is shielded). Because the magnetic flux lines in each gap run in opposite directions, the two voice coils are wound in opposite directions as well. Velodyne claims that the resulting push-pull operation cuts distortion in half. The dual voice coil also doubles power handling, and Velodyne doubles it again by allowing cooling air to flow through the voice coils and by putting half of each voice-coil winding inside the former. The cone, of very stiff paper, is held in place by the front spider and by a large, very stiff, single-roll rubber surround.

THE HGS-12 IS ONE OF THE FEW SUBWOOFERS YOU CAN PICK UP AND MOVE AROUND WITHOUT A HAND TRUCK.

The HGS-12's amplifier is a high-efficiency switching (Class-D) design with a nonswitching power supply. Like the Sunfire's, this supply operates directly from the AC line rather than through a transformer. The amplifier's rated switching frequency is 140 kHz, and its output section has six transistors. Unlike other Class-D amps, Velodyne says, this one has an Energy Recovery system that monitors energy in the output inductor (which filters the output signal to remove the switching frequency) and uses the resulting information to tell the positive and negative output devices when to switch on and off. This is said to reduce RF from the amp, a potential source of interference. It is also said to reduce heat, making an already efficient type of amplifier even more so.

The Velodyne's built-in amp has a limiter, to prevent the amp or the speaker from being overdriven. There's also protection circuitry to keep the amp from overheating and to safeguard it against excessive drops in power-line voltage. For further protection, there's a 12-ampere fast-blow fuse.

The amplifier's low-level and power-output circuits are on separate boards. An aluminum cover on the larger board acts as a heat sink for the power transistors and limits access to the dangerous power-line voltages inside. This cover, which is attached to the rear of the HGS-12's cabinet, carries the subwoofer's connections and controls.

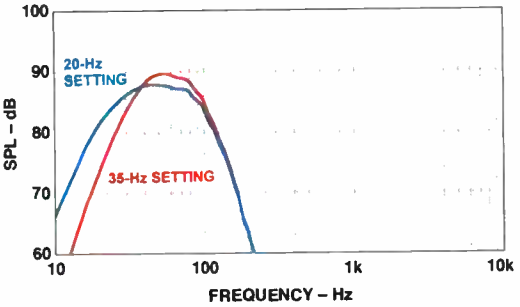
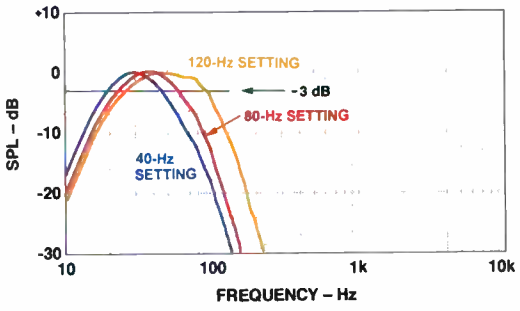
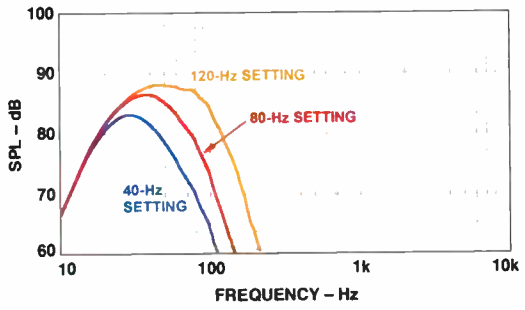


Fig. 1—Frequency response at 120-Hz low-pass setting, for both infrasonic filter settings.



A



B

Fig. 2—Effect of low-pass filter setting on bandwidth (A) and output level (B); see text.

Knobs are provided to adjust the low-pass filter frequency (calibrated from 40 to 120 Hz) and volume. The low-pass crossover filter, whose initial slope is 12 dB/octave and steepens to a final 48 dB/octave, can be switched out if your preamp or processor has its own low-pass subwoofer output. Other switches control polarity (0° or 180°), the frequency of a high-pass "Subsonic" filter (20 or 35 Hz), and power. When the power switch is set to "Auto," the subwoofer will turn itself on the instant an input signal arrives and turn itself off after several minutes without a signal; in its "On" position, the sub is always on.

The HGS-12's line-level stereo inputs feed signals to the subwoofer amplifier through a summing network and to a pair of stereo line output jacks via a high-pass filter, which is a passive design rolling off at 6 dB/octave below 80 Hz. No speaker-level connections are provided. An optional remote control for power, volume, and muting is in the works; an input is provided for the remote's infrared sensor. The power cord is detachable.

Measurements

Velodyne sent me two HGS-12s, so I compared their frequency response. With

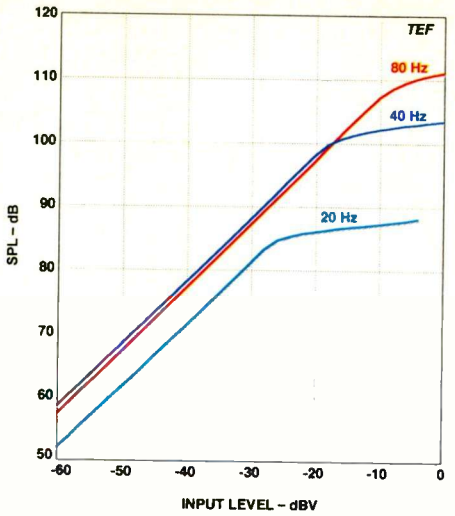


Fig. 3—Limiting thresholds.

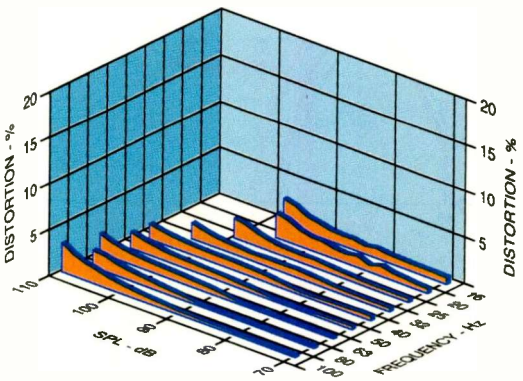


Fig. 4—Harmonic distortion vs. SPL and frequency.

the high-pass "Subsonic" (infrasonic) filter set to 20 Hz and the low-pass at 120 Hz, the subs matched within a close ±0.5 dB from 10 to 120 Hz.

Figure 1 shows on-axis frequency response for both settings of the infrasonic filter. (Although these curves combine ground-plane and near-field measurements, the indicated SPL is equivalent to a 1-meter measurement taken in a true anechoic free-space.) The subwoofer's volume control was at its mid-position, and the input signal level was 25 millivolts rms. The low-pass crossover control was fully counterclockwise, at the indicated 120-Hz position, and the crossover was switched in.

Both curves in Fig. 1 have fairly standard bandpass characteristics. The span between –3 dB points is 26 to 94 Hz when the filter is set to 20 Hz and is 36 to 90 Hz when it's set to 35 Hz. The curve for the 35-Hz setting peaks about 1.5 dB higher than the 20-Hz curve.

The low-pass filter's effect on bandwidth is seen in Fig. 2A. The HGS-12's passband covers about one octave with the low-pass control in its 40-Hz position (fully counterclockwise) and slightly less than two octaves when set to 120 Hz, the other end of the control's travel. The –3 dB points are 20 and 45 Hz with the low-pass control at its lowest position, 24 and 60 Hz when it's at mid-rotation ("80 Hz"), and 26 and 94 Hz when it's fully clockwise. These curves have been normalized to place their peak levels at 0 dB, because changing the position of the low-pass filter's frequency control affects output level. As you can see in Fig. 2B, whose curves are not normalized, the level change amounts to about 5 dB across the control's range; however, you can compensate for this by adjusting the subwoofer's volume control.

To explore the effects of the HGS-12's limiter, I tested the subwoofer's input-vs.-output linearity at three frequencies. The input levels, plotted for clarity in Fig. 3 in dBV (dB re: 1 volt rms), varied from 1 millivolt to 1 volt; the low-pass control was set at 120 Hz, the infrasonic filter to 20 Hz, and the volume control at its middle position. Up to the point where the limiter kicks in, each curve is extremely linear. The limiter's threshold rises with frequency, because the woofer's excursion diminishes at higher frequencies and so need not be restricted as aggressively. (With the infrasonic filter switched to the 20-Hz position and the low-pass control at its highest, 120-Hz, setting, the maximum woofer excursion occurred at 18 Hz.) The HGS-12's limiter set the maximum excursion to about 1.1 inches, peak to peak, no matter how hard I drove it. Above its threshold, the limiter's compression ratio appears to be about 8:1, so output increases only about 1.25 dB for each 10-dB increase in input. The 20-Hz curve terminates at an input level of –4 dBV (0.63 volt rms) because the HGS-12 started sounding harsh at that level. However, the harshness did not set in until the input level was far higher than it would be in normal use.

To see how the HGS-12's harmonic distortion varies with frequency and output level, I measured it over an output range of 70 to as much as 110 dB for each test tone's fundamental frequency, room gain included. The distortion levels seen in Fig. 4 are the ratios between the power of the fundamental and the first 10 harmonics, expressed as a percentage; this method yields readings that are very close to the total harmonic distortion (THD), which would include the eleventh and higher harmonics.

In Fig. 4, you can see the limiter's effects at each test frequency. For example, although the HGS-12 can generate 110 dB at 63 Hz, the limiter caps 20-Hz output at about 96 dB. At the highest output levels, the distortion is less than 3% at all the tested frequencies. It reaches just 2.7% at 16 Hz at the highest SPL before cutoff and only 1.7% at 32 Hz. The second and third harmonics predominated at most frequencies and levels. The only subwoofer I've tested whose distortion was lower than the HGS-12's was Velodyne's own F-1500.

THE ONLY SUBWOOFER I'VE MEASURED WHOSE DISTORTION BEAT THE HGS-12'S WAS ANOTHER VELODYNE.

To literally see the limiter's effect, I used an oscilloscope to observe output waveforms for 20-, 40-, and 80-Hz signals at input levels below and above each frequency's limiting point. Only at 80 Hz were changes visible. The output tone burst just below limiting (Fig. 5A) closely matches the tone burst 10 dB above limiting (Fig. 5B). When the input is 20 dB above limiting (Fig. 5C), however, the tone burst's envelope flattens out so that it no longer rises much in the middle and its later negative half-cycles are distorted. These distortions, though clearly audible, would rarely occur in normal use.

The HGS-12's short-term peak sound output capability as a function of frequency (measured using the same 6.5-cycle, shaped tone burst as in Fig. 5) can be seen in Fig. 6. At each frequency, I increased input level until peak output level reached the maximum SPL set by the limiter. (In every case,

the tone burst sounded very clean and powerful at all levels up to and even significantly above limiting.) With room gain, the maximum peak output starts out fairly strong, 99 dB SPL at 16 Hz, and then rises quickly before reaching its peak of 114 dB at 60 Hz. At higher frequencies, the maximum output drops somewhat. On the basis of its output alone, I'd rank the Velodyne HGS-12 in the top half of all the subwoofers I have tested, but its low distortion places it at or near the top of my list.

Use and Listening Tests

When I unpacked the Velodyne HGS-12, I was pleasantly surprised by how small and light it was, compared to most other high-performance subwoofers. It's one of the few you can pick up and move around without a hand truck.

I was very impressed by the HGS-12's looks. The cabinet's beveled edges and black gloss finish (which covers every side of the cabinet, including the rear and bottom) set it apart from most other subwoofers. The front is covered by a serious-looking grille whose inch-thick frame of high-density fiberboard is covered by black cloth. Four plastic glide feet, ¾ inch in diameter, are attached to the bottom.

When the grille is removed, the HGS-12's driver—with its unusually wide surround and large, 6-inch, dust dome—looks very distinctive. It closely resembles the driver in the Sunfire True Subwoofer; among other things, the materials of the cone and dome in both the Sunfire and the Velodyne are very rigid. In fact, the Velodyne's drive system is so stiff that it seems immovable—yet when it's used, the woofer does move, and moves extremely well!

SMALL AS IT IS, THE VELODYNE HGS-12 HAS BASS EXTENSION AND OUTPUT RIVALING THOSE OF LARGER SUBS.

The HGS-12's compact but well-written owner's manual adequately covers all aspects of the subwoofer's operation. For example, the manual suggests placing the sub on the same plane as your satellite speakers. It also points out that corner placement will usually provide the greatest output and the deepest low-frequency extension.

For most of my listening, I evaluated the HGS-12 in a stereo setup, not my home theater. This system contained several of my usual components, including a Crown Macro Reference amplifier, a Krell KRC preamp, and an Onkyo CD player. I used a pair of Wharfedale MFM-5s [also reviewed in this issue] as "satellites." To get around having to use the HGS-12's internal high-pass filters for the Wharfedales, I put passive high-pass filters in my preamp's tape loop and complementary, beefier filter networks at the amp's output to derive line-level signals for the subwoofer. I did this to avoid running unbalanced line-level signals from my preamp to the subwoofer, as my preamp has only balanced main outputs.

The HGS-12 proved to be an excellent all-around performer, with usable extension down to 16 Hz. The subwoofer I used most often for comparison was the Sunfire True Subwoofer Mark II; though smaller and considerably less expensive, the Sunfire is somewhat similar to the Velodyne in design. However, the HGS-12 provided good competition for even the larger subwoofers that I had on hand. I was quite impressed by its very clean output at all frequencies. It was eminently capable of rattling all the loose objects in my listening room when turned up high. The cabinet was quite rigid and exhibited no noticeable wall vibrations.

I listen to country music every now and then, so before my comparative listening, I played Brooks and Dunn's *The Greatest Hits Collection* (Arista Nashville 18852). The Velodyne's strong, tight bass line did justice to this duo's music, even when I played it quite loud.

To compare the Velodyne with the Sunfire, I placed the two subwoofers side by side near the right front corner of my listening room's

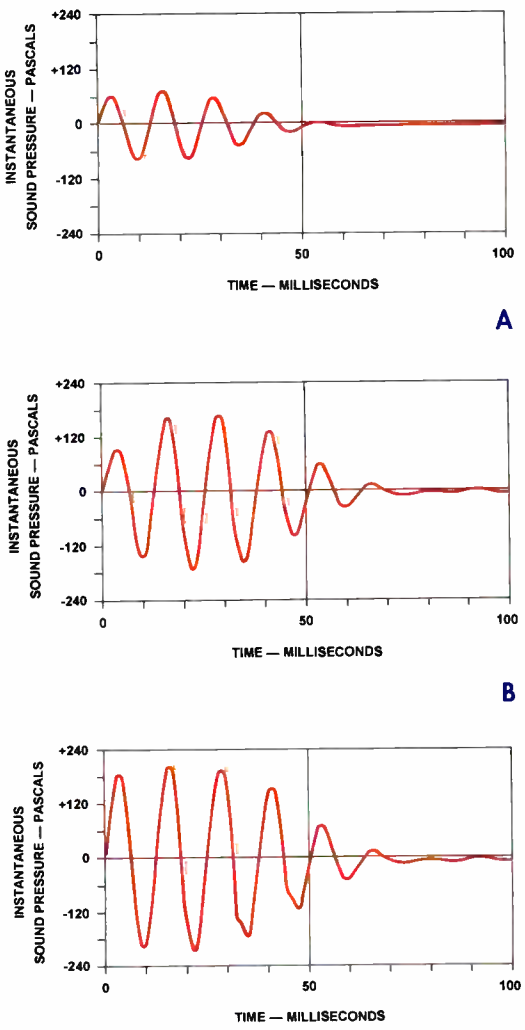


Fig. 5—Limiter's effect on 80-Hz tone burst just below limiting threshold (A), 10 dB above limiting (B), and 20 dB above limiting (C).

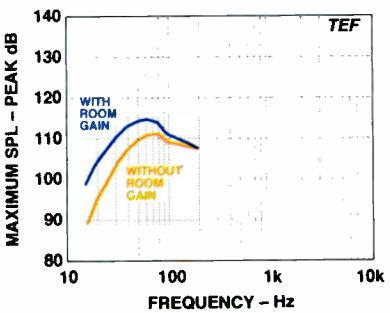


Fig. 6—Maximum peak sound output.

floor, on a line angled 45° from the walls. I set the Sunfire's low-pass crossover control to 75 Hz and the Velodyne's to 80 Hz. Next, I adjusted both subs' volume controls until their output levels were the same on pink noise in the 31-Hz octave band.

On a broad selection of recordings containing deep bass, the two subwoofers sounded quite similar at moderate levels. Only at levels loud enough to activate the subs' limiters did differences become evident. In general, the Velodyne could play slightly louder, and often cleaner, than the Sunfire. The cleanliness of the Velodyne's output was most evident on music containing high-level bass that wasn't masked by information at higher frequencies, such as solo bass guitar or organ pedal notes sounded alone.

On third-octave, band-limited pink noise, both the Velodyne and the Sunfire had very similar bass extension, though only the Velodyne had any usable output in the 16-Hz band. Not that you can hear 16 Hz, of course—you just sense the presence of such deep bass with your body and hear the rattling of objects in the room.

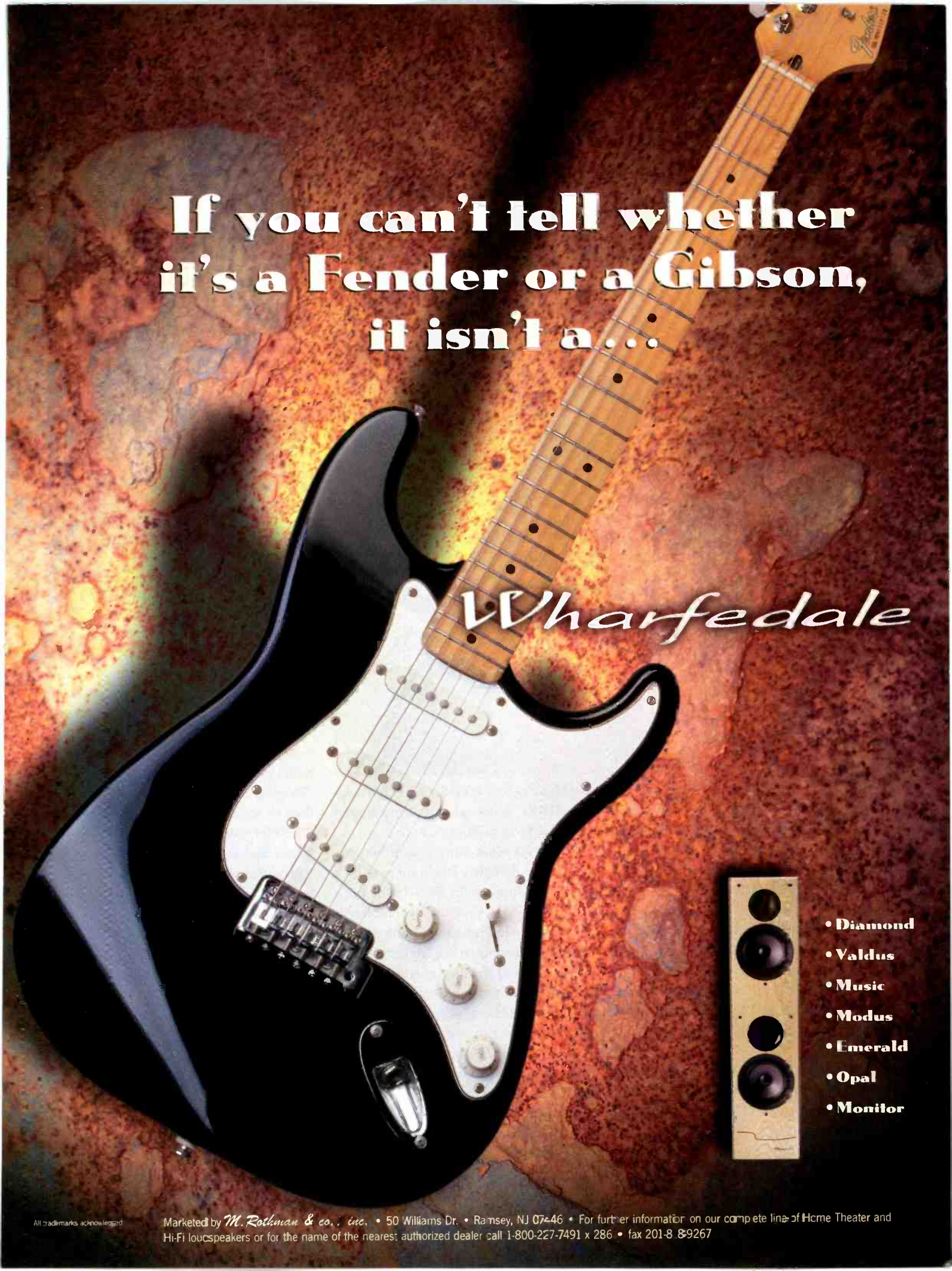
On all my usual low-frequency demo discs, the Velodyne performed up to and sometimes beyond my expectations. It could closely track the acoustic bass line on a well-recorded jazz piece, could reproduce room-shaking sound effects very effectively, and was particularly adept at cleanly reproducing high-level pipe-organ pedal notes.

WHEN TURNED UP HIGH, THE VELODYNE HGS-12 COULD EASILY RATTLE EVERY LOOSE OBJECT IN MY LISTENING ROOM.

When I did try the HGS-12 in my home theater, it performed very well, particularly in comparison to the larger subwoofers I normally use. I couldn't resist stacking the two HGS-12s Velodyne had sent me and using them together. The resulting combo easily blew away all the larger single subwoofers I had on hand, and two HGS-12s are easier to move around and position than one large sub. (At $4,000 for the pair, however, this setup would not be the most cost-effective deep-bass system you could buy.)

I managed to trigger the HGS-12's thermal shut-down circuitry just twice: when I played a recording by AC/DC at near rock-concert level and when I played the helicopter sequence on *The Digital Domain* (Elektra 9 60303, a somewhat dated but still extremely good demo disc). When I set volume level very high for these sustained high-level bass tracks, the HGS-12 simply stopped playing, then resumed a few seconds later. (This did not happen very often, however—only on these tracks and only at very high volume.) Even so, the Velodyne significantly outperformed the smaller Sunfire on the AC/DC recording, producing louder, punchier, gut-thumping sound from the kick drums.

The Velodyne HGS-12 was an excellent performer whose output and bass extension were competitive with those of much larger subwoofers. With its compact size, sturdiness, good looks, and low distortion, it warrants serious consideration. A



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EQUIPMENT PROFILE

EDWARD J. FOSTER

SONY DVP-S500D DVD PLAYER

Sony's 1998 DVD product line includes two new single-disc players, the full-featured DVP-S500D—the subject of this review—and the basically similar, but $100 less expensive, DVP-S300D. The major differences between them are the provision of component-video outputs on the DVP-S500D and its internal 5.1-channel Dolby Digital (AC-3) decoding. The DVP-S500D also has a "variable coefficient" digital filter (more about that later) and a more elaborate remote. Both players offer composite- and S-video outputs.

As with most other DVD players sold in the United States, the DVP-S500D handles audio CDs and Video CDs as well as DVDs coded for Region 1. It doesn't recognize CD-ROMs, Photo CDs, or other "data" discs. Thanks to the dual-laser pickup favored by Sony, the DVP-S500D does recognize CD-Rs, which players using single-laser/dual-focus pickups do not.

Except for what Sony calls a "shuttle ring" on the far right of the front panel (it's also on the remote), the DVP-S500D has a conventional look about it. The disc tray is centrally located, just above a rather more informative than usual display. Between the shuttle ring and the display is the normal complement of transport controls, including "Prev" and "Next" skip-search pads. Below the shuttle ring are three buttons labeled "Title," "DVD Menu," and "Return," and to its upper right is an illuminated button labeled "Jog." The same buttons appear on the remote, near the equivalent (but somewhat larger) shuttle ring. "Title" and "DVD Menu" call up their respective on-screen menus if the disc that is being played supports titling and menuing and distinguishes between them. "Return" takes you back to the preceding selection screen and, when the Sony is playing Version 2.0 Video CDs, serves as an interactive return key.

The shuttle ring is a two-part affair: a rotating ring around the periphery and an inner button that depresses to the left, right, up, or down to direct the cursor through menus. The center of the button is pressed to enter a choice. In its normal mode of operation, the shuttle ring is used to vary playback speed from fast forward at 30 times normal speed to reverse at the same rate. In between are stops at 10 times normal, two times normal, normal play, a choice of two slow-play speeds, pause, and then reverse play at each rate except normal. The "Jog" button converts the shuttle ring into a jog control that enables frame-by-frame playback. The "Jog" button lights to show this mode, and the ring returns to normal shuttle operation after about 20 seconds if it is not used.

THE DVP-S500D PROVIDES INTERNAL 5.1-CHANNEL DOLBY DIGITAL DECODING.

To the left of the display (and on the remote) are four buttons—"Shuffle," "Repeat," "Program," and "Clear"—that initiate random or repeated playback and program the S500D for ordered playback of as many as 99 titles, chapters, or tracks, depending on the type of disc that is loaded. At the far left, below the "Power" bar, is a headphone jack and accompanying "Level" knob.

In addition to the controls mentioned previously, the remote offers a "Display" button that cycles through three on-screen displays (plus "off") and a "Time" button

Dimensions: 17 in. W x 3¾ in. H x 12¾ in. D (43 cm x 9.5 cm x 32.5 cm).
Weight: 8.8 lbs. (4 kg).
Price: $599.
Company Address: Sony Dr., Park Ridge, N.J. 07656; 201/930-1000; www.sel.sony.com.

Photos: Michael Groen

that cycles through four different status readouts in display modes 1 and 2. You have a choice of viewing the playing time of the current chapter, the remaining time of the current chapter, the playing time of the current title, or the remaining time of the current title. Of the first two display modes, the Mode 2 option is the more informative. For example, it shows the current audio format—whether you are hearing discrete 5.1-channel surround, two-channel matrix surround, two-channel PCM, etc. It also shows which speakers are active and your subtitle, audio language, and viewing angle selections. Mode 3 displays the playback bit rate and might interest the technically inquisitive.

The remote also has buttons for configuration selection: "Audio Change," "Angle Change," "Subtitle Change," and "Subtitle On/Off." There are specific buttons (including "AV VOL") to operate Sony A/V receivers, as well as others that are dedicated to controlling TV operation: independent volume buttons, channel up/down pads, and a numeric keypad that, among other things, is used to enter parental lockout codes and language codes and to adapt the remote to operate TVs from other manufacturers. With the keypad, you can also directly access DVD tracks and chapters.

Although all jacks on the DVP-S500D are base metal, Sony is generous with them.

D/A CONVERTER PERFORMANCE DIFFERED MARKEDLY BETWEEN THE "SHARP" AND "SLOW" FILTER SETTINGS.

There are two S-video outputs, two composite-video outputs, one array of component-video output jacks, two sets of two-channel audio line outputs, and one array of 5.1-channel audio line output jacks. In addition, there are both coaxial and Toslink optical digital audio outputs to feed an external decoder. Finally, there's an "S Link" jack to interface with compatible remote-controlled Sony components.

The DVP-S500D employs five setup menus that are negotiated via the five-way button in the center of the shuttle ring. The first menu, "Language Setup," gives you a choice of three OSD (on-screen display) languages—English, French, or Spanish—and permits you to choose the DVD menu, audio, and subtitle languages from those available on the disc. "Initial Setup 1," the second setup menu, lets you choose "TV Type" (4:3 letterbox, 4:3 pan and scan, or 16:9), activate the screen saver, change the menu screen background from blue to black, adjust the panel-display brightness, choose among normal operation, unattended operation via a timer, or either of two demonstration modes, and delve into more deeply nested "Parental Control" menus.

"Initial Setup 2" affects the sound characteristics. You are offered a choice of audio filter ("Sharp" or "Slow") and digital output characteristics ("PCM" when the player is connected to an audio component without a Dolby Digital decoder, "Dolby Digital/PCM" when the downstream component can handle an AC-3 signal), and dynamic range control for late-night listening. "Initial Setup 2" also offers the ability to attenuate the analog audio outputs for better mating with the next component in the chain, to give priority to finding the 5.1-channel Dolby Digital soundtrack if one is on the disc (independent of the disc's own default selection), and to choose either stereo or Dolby Surround mixdowns at the two-channel analog line outputs.

The final two menus are for "5.1 Output Setup." The first handles bass management and speaker placement. Icons are used to set the front left and right outputs for "Large" or "Small" speakers and the center and surround outputs (separately) for "Large," "Small," or no speakers. Finally, you're allowed to choose whether or not a subwoofer is included in the system. The idea behind these choices is to route nondirectional bass (below 100 Hz) to the speakers

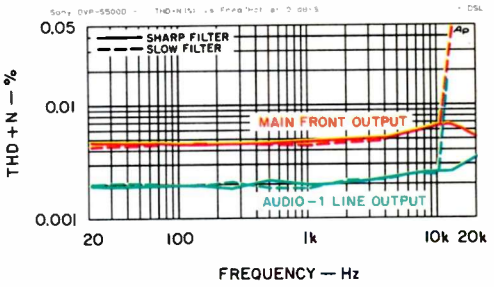
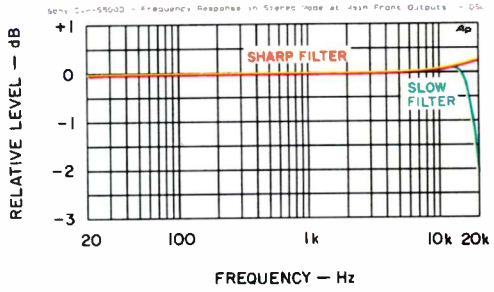


Fig. 1—THD + N vs. frequency at 0 dBFS.



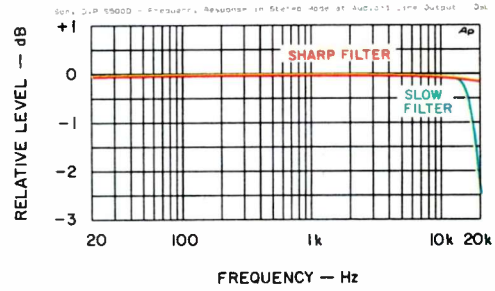


Fig. 2—Frequency response in stereo mode at main front 5.1-channel outputs (A) and two-channel audio line outputs (B).

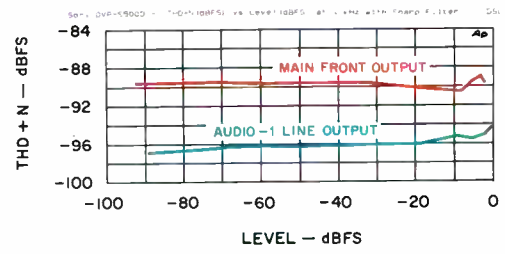


Fig. 3—THD + N vs. level at 1 kHz with "Sharp" filter setting.

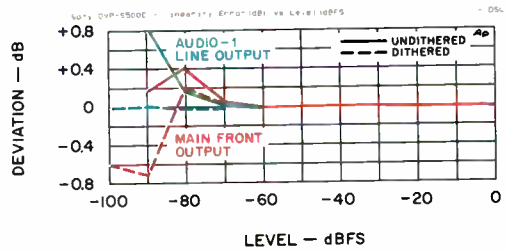


Fig. 4—Deviation from linearity.

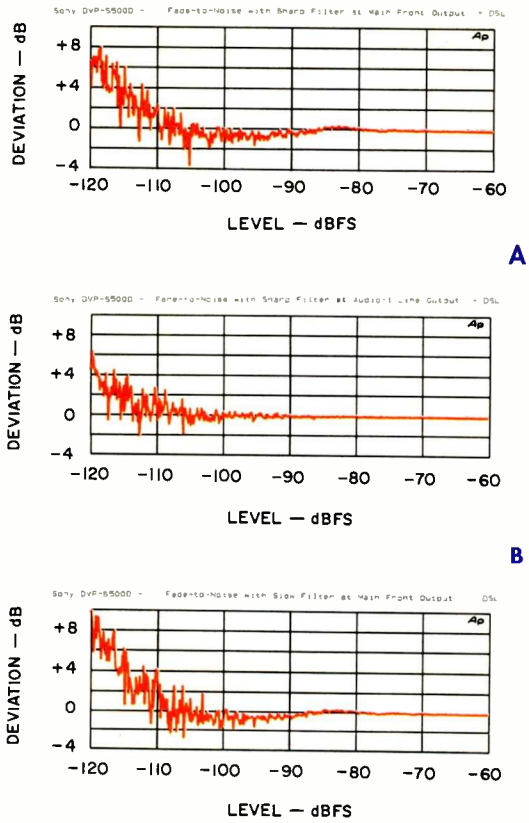


Fig. 5—Fade-to-noise test with "Sharp" filter setting at main front output (A), "Sharp" filter setting at two-channel audio line output (B), and "Slow" filter setting at main front output (C).

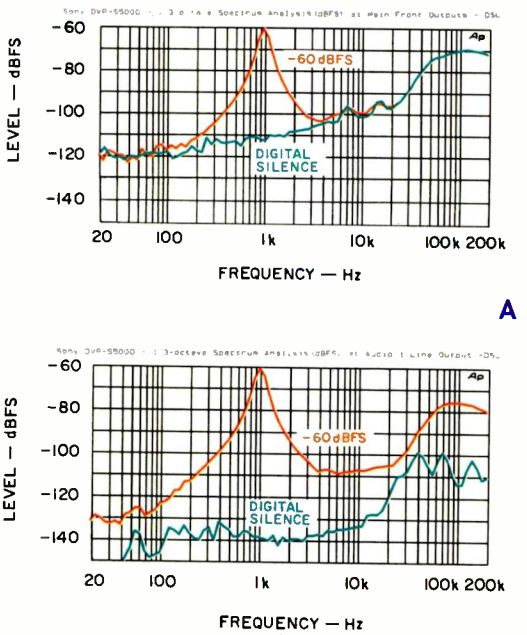


Fig. 6—Noise spectra at main front output (A) and two-channel audio line output (B).

most capable of reproducing it and to fold the center or surround channels into the main front pair if center or surround speakers are not used.

The other half of the first "5.1 Output Setup" screen pertains to the amount by which each output signal is delayed, so that all arrive at the listening position simultaneously. The delays are set in terms of the distances from the main front, center, and surround speakers to the listening position. Distances can be set in feet or meters, 1 foot (0.3 meter) per step. The setup assumes that the listening position is midway between the main front speakers and midway between the surround pair.

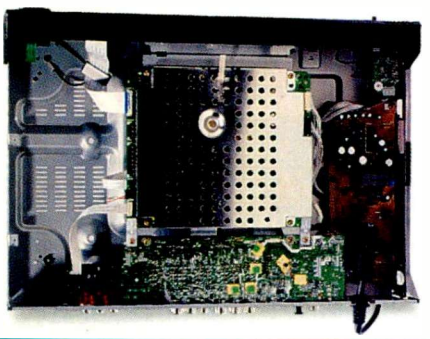
The final setup menu ("5.1 Output Setup 2") gives you the means to adjust relative levels among the speakers via front and surround balance adjustments and center, surround, and subwoofer level controls. The balance controls adjust the left/right balance of the front and surround speakers, separately, over a range of ±8 dB in 0.5-dB steps. Center and surround speaker levels are adjustable in like increments over a wider range: –20 to +6 dB. Subwoofer level is adjustable in 0.5-dB steps from –10 to +6 dB. There's a test-signal toggle on the menu to facilitate making the adjustment.

This final menu also offers a choice of analog output "Mode," which can be set to "Off," "Pro Logic," "VES A," or "VES B." "Off" is the normal choice for Dolby Digital reproduction; "Pro Logic" applies Dolby Pro Logic decoding to two-channel soundtracks. "VES A" and "VES B" use 3D sound imaging techniques to create virtual surround speakers using just the main front pair.

Measurements

As the above suggests, the Sony DVP-S500D would seem to offer a great deal of flexibility in audio processing. On the test bench, it also proved perplexing in certain aspects, and I ended up with reams and reams of data. For one thing, DAC (digital-to-analog converter) performance differed markedly between the "Sharp" and "Slow" filter settings. That virtually doubled the number of measurements right off the bat. There also were notable differences between the data obtained at the main front outputs and that obtained at the two-channel line outputs. Usually, the results are so similar that I ignore the line-output measurements in these reports. In this case, however, I felt many had to be included, which almost doubled the data set once again.

Of course, not every measurement was substantively different, so I haven't included every single one. In general, when only one curve or measurement is shown, it was taken at the main front outputs using the "Sharp" filter setting. I based this decision on the assumption that most people who buy a DVD player with self-contained 5.1-channel Dolby Digital decoding capability intend to use it that way and will connect the player via the 5.1-channel outputs whether they're playing a DVD or a CD. Hence my choice of output sets. As for the filter choice, the "Sharp" position is technically far superior to "Slow" and is the recommended setting in the manual, in any event.



IT'S NOT OFTEN I FIND D/A CONVERTERS WHOSE DISTORTION REMAINS SO LOW OVER THE FULL DYNAMIC RANGE.

Presumably, "Sharp" and "Slow" refer to the slope of the digital filter used to prevent intermodulation between high-frequency audio signals and the carrier. In my opin-

ion, the improved technical performance and sound quality of the latest generation of D/A converters is, in no small part, a consequence of improved filters that essentially eliminate intermodulation altogether. Why one would ever swap a filter that holds

THE DVP-S500D HAS BOTH COAXIAL AND TOSLINK OPTICAL DIGITAL AUDIO OUTPUTS.

distortion at 0 dBFS to well below 0.004% for one that permits more than 7.3% of garbage at high frequencies is beyond me (see Fig. 1). It's certainly not to improve frequency response, for that also takes it on the nose, by 2 to 2.5 dB at 20 kHz, with the "Slow" filter (Figs. 2A and 2B).

When asked about this, a company spokesperson faxed me a copy of a review of a Sony CD player that is sold in the United Kingdom but not here. The player offered a choice of filter characteristics, some of which seemed to impress the reviewer quite favorably. I guess some people will never let objective truth affect their subjective judgment! To put matters into perspective, I hasten to point out that Sony is not alone in pursuing this game, and at least in the DVP-S500D, you can elect to use the "Sharp" filter, which is technically superb.

Figures 1 and 2 exemplify some of the differences I found between the main front and two-channel line outputs. Although the shapes of the THD + N (total harmonic distortion plus noise) curves are reasonably similar, the THD + N at the main front outputs is several times greater over most of the spectrum than that at the two-channel outputs. Not that the THD + N at the main front outputs is really bad with the "Sharp" filter; it isn't. But the THD + N at the two-channel outputs is wonderfully good, and I don't see why there should be this much difference.

Frequency response also differs at the two output sets, though not by much. As you can see from Fig. 2, the treble response tends to rise slightly at the main front 5.1-channel outputs and to fall slightly at the two-channel outputs. None of the curves is ripply, however, which is good. I'm not sure anyone would be able to hear this slight difference in response, although, on technical grounds, I'd have to give the nod to the response at the two-channel outputs.

Figure 3 compares THD + N versus level for a 1-kHz signal at the main front and two-channel outputs. The filter choice didn't have much of an effect at this frequency, so only the curves taken using the "Sharp" filter are displayed. As you can see, THD + N is greater at all levels at the main front outputs than it is at the two-channel audio line outputs, but, just as with Fig. 1, the difference speaks less of poor performance at the main front outputs than of superb performance at the two-channel outputs. It's not often I find DACs whose distortion remains below –94 dBFS over the full dynamic range, and the –86 dBFS measured at the main front outputs ain't too shabby either.

Linearity error (Fig. 4) was also relatively unaffected by filter choice, but it did depend on the outputs used for the measurements. Again, performance proved superior at the two-channel audio line outputs; with a dithered signal, there was no statistically significant linearity error even at –100 dBFS, which is truly remarkable—dare I say, unprecedented! The results at the main front outputs are decent but nowhere near as extraordinary.

The fade-to-noise plots (Figs. 5A, 5B, and 5C) confirm superior linearity at the two-channel audio line output. On the whole, these results tally with the linearity error curves described above: good performance at the main front outputs using the "Sharp" filter and extraordinarily good performance at the two-channel audio line outputs.

These differences may be related in part to greater noise in the main front outputs. The lower curves in Figs. 6A and 6B show

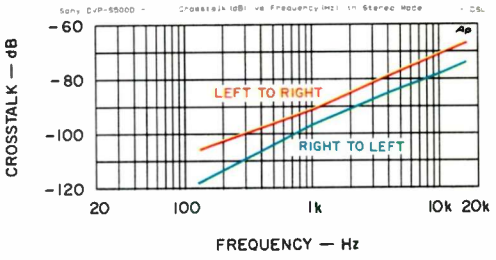


Fig. 7—Stereo crosstalk.

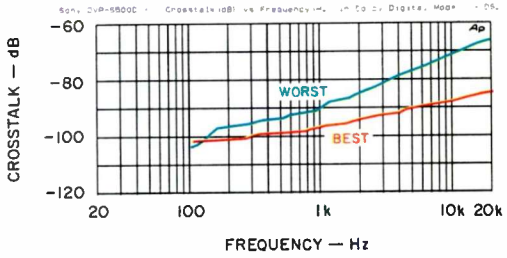


Fig. 8—Crosstalk at Dolby Digital 5.1 outputs.

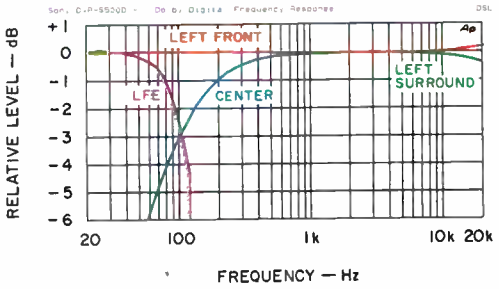


Fig. 9—Frequency response at Dolby Digital 5.1 outputs, all channels set for "Large" speakers.

⅓-octave noise spectra taken using the digital silence track of the CBS CD-1 test disc; the upper curve in each figure is a spectral analysis of the 1-kHz, –60 dBFS signal used to measure dynamic range. The noise spectrum taken at the two-channel audio line output (the lower curve of Fig. 6B) suggests that the DAC has been muted and that the analog output electronics are essentially noise-free. (Note how far beneath the dynamic range curve it is.)

On the other hand, the noise spectrum taken at the main front outputs merges with the dynamic range analysis below a few hundred hertz and above 4 kHz. This suggests that the DAC is not muted or that there is considerably more noise in the output stage. Whether these curves explain the other anomalies or not, they do tend to confirm the huge difference (more than 30 dB!)

in measured signal-to-noise ratio at the two sets of outputs and the substantial (if less remarkable) difference in measured dynamic range.

Stereo channel separation at the two-channel outputs (Fig. 7) was a decent 67.5 dB or more across the measurement range. The channels were balanced slightly better at the main front outputs than at the two-channel audio line outputs, but the difference was negligible. The level was a good bit lower at the main front outputs, and there were differences in output impedance, which suggests two different output-stage designs. I don't consider these factors significant, although they are unusual. Headphone output level was adequate and the output impedance reasonably well chosen. Don't crank the level control up all the way, however, because you can clip the output stage.

The above measurements were made using the CBS CD-1 test disc—i.e., a CD source. For Dolby Digital performance, I use Dolby Labs' own test disc. It doesn't provide as thorough a workout for the converters, but it does let me check distortion in each channel (at 1 kHz and 0 dBFS), channel balance, frequency response, and channel separation through the AC-3 decoder.

Let's start with the easy stuff. Channel separation ranged from a low of 71.1 dB between the right and left front channels to a high of 86.9 dB between the right surround and right front. (I couldn't obtain meaningful figures between the center channel and the main front pair for reasons that will become clear in a moment.) Overall, I consider this degree of channel separation fully adequate. It's unusually uniform, too, over all combinations of channels. The best-case and worst-case crosstalk curves of Fig. 8 are closer together than I usually find, and all the others can be presumed to lie in between. (I'm not sure that this is terribly significant, but it's intellectually satisfying.)

THD + N in each channel was gratifyingly low, albeit, as stated before, the data was taken at only one frequency and level. Channel balance (using the default 0-dB setup all around) was reasonably good, with all channels within ±0.13 dB of one another. But when I got to frequency response and bass management, oddities surfaced.

Although the DVP-S500D setup menu offers the option to use a "Large" center speaker, the player ignores the instruction. Bass below 100 Hz (–3 dB point) gets redirected from the center channel whether you choose the "Large" or "Small" center-speaker icon! If you choose "Large" main front speakers, center-channel bass is redirected to them. If you choose "Small" main front speakers, bass for all three front channels gets routed to the subwoofer output. But under no conditions can you keep the center-channel bass in the center. Because of this, I couldn't come up with a meaningful figure for crosstalk between the center and main front channels. Although the midband and treble crosstalk was okay, there was total blending in the bass.

MEASURED DATA

PCM AUDIO

Line Output Level: Main front outputs, 1.64 V; two-channel outputs, 2.24 V.

Line Output Impedance: Main front outputs, 565 ohms; two-channel outputs, 925 ohms.

Channel Balance: Main front outputs, ±0.07 dB; two-channel outputs, ±0.1 dB.

Headphone Output Level: Maximum voltage, 5.24 V; maximum power at clipping, 24.1 mW into 600 ohms or 26.2 mW into 50 ohms.

Headphone Output Impedance: 160 ohms.

Frequency Response: With sharp filter, 20 Hz to 20 kHz, +0.26, –0.02 dB at main front outputs and +0, –0.13 dB at two-channel outputs; with slow filter, 20 Hz to 20 kHz, +0.1, –2.07 dB at main front outputs and +0.1, –2.47 dB at two-channel outputs.

THD + N at 0 dBFS, 20 Hz to 20 kHz: Sharp filter, less than 0.0068% at main front outputs and less than 0.0036% at two-channel outputs; slow filter, less than 7.18% at main front outputs and less than 7.31% at two-channel outputs.

THD + N at 1 kHz: Main front outputs, below –86.2 dBFS from 0 to –90 dBFS and below –86.7 dBFS from –30 to –90 dBFS; two-channel outputs, below –94.3 dBFS from 0 to –90 dBFS and below –96 dBFS from –30 to –90 dBFS.

Maximum Linearity Error: Main front outputs, 0.41 dB to –90 dBFS with undithered recording and 0.71 dB to –100 dBFS with dithered recording; two-channel outputs, 0.84 dB to –90 dBFS with undithered recording and 0.05 dB to –100 dBFS with dithered recording.

S/N Ratio: Main front outputs, 90.5 dB A-weighted and 80.5 dB CCIR-weighted; two-channel outputs, 122 dB A-weighted and 115.8 dB CCIR-weighted.

Quantization Noise: Main front outputs, –87.4 dBFS; two-channel outputs, –95.1 dBFS.

Dynamic Range: Main front outputs, 89.2 dB unweighted, 92.6 dB A-weighted, and 82.7 dB CCIR-weighted; two-channel outputs, 96.8 dB unweighted, 99.8 dB A-weighted, and 90 dB CCIR-weighted.

Channel Separation: Greater than 67.5 dB, 125 Hz to 16 kHz, at two-channel outputs.

DOLBY DIGITAL (AC-3) AUDIO

Channel Balance, Relative to Left Front Output: +0, –0.26 dB.

Frequency Response: Main front channels, 20 Hz to 20 kHz, +0.27, –0.07 dB; center channel, 100 Hz to 20 kHz, +0.32, –3 dB; surround channels, 20 Hz to 20 kHz, +0.03, –0.37 dB; LFE channel, below 20 Hz to 100 Hz, +0, –3 dB (–6 dB at 122 Hz).

THD + N for 0-dBFS Signal: Main front channels, 0.0045% at 1 kHz; center channel, 0.0049% at 1 kHz; surround channels, 0.0062% at 1 kHz; LFE channel, 0.0033% at 30 Hz.

Channel Separation, 100 Hz to 10 kHz: 71.1 dB or greater.

DVD VIDEO

Luminance Frequency Response, 0.5 to 4.2 MHz: Composite output, +0, –0.5 dB; component output, +0, –0.7 dB.

Luminance Level: +0.2 dB.

Chroma Level: +1.8 dB.

Gray-Scale Accuracy: No measurable error.

Chroma Phase Accuracy: Within 1°.

Chroma Differential Gain: No measurable error.

Chroma Differential Phase: No measurable error.

Since I was working with a prototype rather than a final production sample, I thought this anomaly might be a fluke that would be corrected. However, after much palaver and rechecking on Sony's part, the company not only concurred with my assessment but indicated that this was the way the product was designed and that no changes would be made in production.

I was willing to buy off on what was essentially a matter of misleading menuing. If one were to default to one kind of center speaker, better that the bass always be redirected—i.e., that the center speaker be treated as "Small" even if it were actually large—than to have a physically small center speaker be hit with bass it couldn't handle. Dolby Laboratories suggests that this be the default condition if no choice of center-speaker size is offered, and that was good enough for me.

Imagine my consternation, however, when I found that under certain conditions bass energy remained in the surround channels even when the system was set to use "Small" surround speakers. Whether or not the bass is redirected from the surround channels depends on how you set up the front channels. If you set up both the fronts and surrounds as "Small," bass is stripped from all channels, combined with the LFE signal, and sent to the subwoofer output. That's okay as far as it goes. This is Dolby Laboratories' five-satellite-plus-subwoofer default condition, the most rudimentary of bass-management schemes. If you're not using a subwoofer, the bass gets lost with this arrangement, but if you have no speakers capable of handling it, there's no good alternative.

On the other hand, if you set up the DVP-S500D to use "Small" surrounds and "Large" main front speakers, the bass is not redirected from the surrounds to either the front speakers or to the subwoofer. It remains in the surround channels, where it may potentially overload the surround speakers. I consider this a serious design flaw, especially since large main front speakers with small surround speakers is a very common arrangement—arguably the most common in serious home theaters. With this setup, surround-channel bass must be redirected—into the main front pair if you're not using a subwoofer or into the subwoofer if you do have one. It can't be left where it is.

When Sony confirmed that I was correct and that this was not a prototype defect but would persist in production, I was left at a loss. Sony explained that this was its engineers' interpretation of an early Dolby document, but I presume that Sony knows how to do bass management—the designers just didn't do it right on this product. The only way that I can see to use small surround speakers with the DVP-S500D's built-in 5.1-channel decoding is to set the system up for "Small" speakers all around (even if you're using large fronts) and be sure to have a good subwoofer. What a shame!

THE DVP-S500D'S VIDEO PERFORMANCE WAS EVEN BETTER THAN THE TEST FIGURES WOULD SUGGEST.

For the record, Fig. 9 shows the frequency response of the front left and center speakers, together with the left surround and subwoofer channels, with all speakers set to "Large" and with individual response sweeps run on each channel. Response curves taken on the respective right front and right surround channels were essentially the same as those taken on the left except for slight differences in level. As you can see, the front channels have the same slightly rising treble response found with the test CD, while the surround channels have a slight droop at the very highest frequencies.

I use Sony's test DVD to evaluate video performance. On the whole, the DVP-S500D proved quite competent on the bench. There was a 0.5-dB droop at 4.2 MHz in video frequency response at the composite output and, strangely, a bit more high-end loss on the component output. Nonetheless, it would be pretty hard to discern that amount of detail loss in a real picture. Luminance level was close to the target, chrominance level was a bit high (as usual with DVD players), and gray-scale accuracy, chroma-phase accuracy, and chroma differential gain and phase were within or below my test equipment's measurement limits.

Use and Listening Tests

Hooked up to a large-screen rear-projection monitor, the DVP-S500D's video performance was even better than the test figures would suggest. Not only was the slight droop in video response not noticeable, but, if anything, the DVP-S500D seemed to produce a sharper-than-average picture. Even the narrowest wedges on the Snell & Wilcox test pattern came out crystal clear and had excellent contrast. (These wedges are representative of video response to beyond 5.75 MHz, so that's saying something.) Colors were well saturated, pleasing to the eye, and wonderfully clean. And the DVP-S500D's still-frame, jog-advance, and fast motion were far smoother than I've seen from most other players I've used. So I give the DVP-S500D very high grades for video performance.

From a human-engineering standpoint, I found Sony's shuttle ring difficult to use. It was much too easy to accidentally change a setting as I maneuvered to press "Enter" dead square in the middle, and I often felt unsure of where I had left matters. The shuttle ring on the remote was a trifle easier to use than the one on the panel because it's slightly larger. But it was no gem either, and I have small fingers. Individual pads, rather than a four-way-rocker-plus-center-press, would have been far easier to use, but designers seem to have this love affair with joysticks lately.

To my ears, the "Slow" filter produced thick treble and a noticeable lack of transparency, but the "Sharp" filter sounded great, so who cares? My main complaint is with the bass management provided by the DVP-S500D's 5.1-channel Dolby Digital decoding. To my way of thinking, it's flat-out wrong.

There is, however, a simple way to get around the problem: Don't use the internal decoder. That's easy enough on the DVP-S500D, since it has both coaxial and optical digital audio outputs to link to a downstream AC-3 decoding system. But if you're not going to use the internal decoder, why buy the DVP-S500D? Why not consider the less expensive DVP-S300D instead? Yes, you give up the component-video outputs, but few of us can take advantage of them at this point anyway. And if you put aside the quirks of the S500D's 5.1-channel decoding, you have a very fine DVD player. A

EQUIPMENT PROFILE

D. B. KEELE, JR.

WHARFEDALE MODUS MONITOR MFM-5 SPEAKER

Wharfedale is one of England's grand old speaker companies; in fact, it claims to be the oldest. It was founded in 1932 by the venerable Gilbert Briggs, one of the great pioneers in the loudspeaker industry, who didn't leave the company until 1968. Wharfedale is now owned by the International Audio Group, which also owns Quad. The last Wharfedale speaker I reviewed, the small, two-way Diamond IV, performed very well (August 1991).

The MFM-5, a moderate-sized tower speaker, is second from the top in Wharfedale's Modus Monitor line, which consists of one bookshelf and three tower models. Wharfedale says the MFM-5 is a three-way system, but it is really a two-and-a-half-way: Of its two 7-inch cone woofers, only the upper is active all the way up to crossover, though both are active below 100 Hz. In a true three-way system, the upper woofer would cover just the midrange.

The MFM-5's gently rounded surfaces reduce diffraction and strengthen the front to diminish vibration. The recess surrounding the tweeter is said to form an elliptical horn flare that controls the driver's dispersion both vertically and horizontally. The panel is molded from a blend of ground rock and copolymer plastic, which Wharfedale says is acoustically dead. The design of the molded-plastic grille is also said to minimize diffraction. The cabinet, made of ⅝-inch medium-density fiberboard, is braced by a shelf running around its perimeter, between the two cone woofers. The vent for the bass enclosure is a flared port tube, 2¾ inches in diameter and 6 inches long, that exits near the bottom of the speaker's rear panel.

The MFM-5's 7-inch woofers are long-throw units with stamped metal frames, what Wharfedale calls "mineral-loaded homopolymer cones," and inverted rubber surrounds. Their ferrite magnets, which are not shielded, are 3¼ inches in diameter and ⅝ inch thick; their voice coils are 1¼ inches in diameter. The silk-dome tweeter is 1 inch in diameter.

THE MFM-5s WERE GOOD ALL-AROUND PERFORMERS THAT PRODUCED STABLE IMAGES AND ROBUST BASS.

The MFM-5's crossover filters follow the simpler-is-better rule. The low-pass filter that rolls off the lower woofer (at 6 dB/octave above 100 Hz) uses a single series inductor with a large iron core. The upper woofer is connected directly to the input terminals and relies on its own inherent acoustic rolloff to provide crossover to the tweeter. The tweeter is driven by a 12-dB/octave (second-order) high-pass filter.

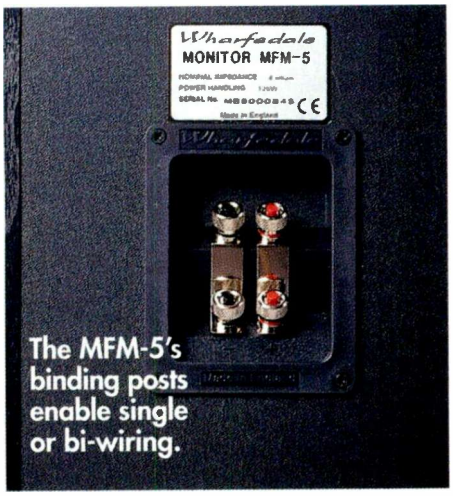
Rated Sensitivity: 90 dB at 1 meter, 2.83 V rms applied.
Rated Impedance: 8 ohms, nominal.
Rated Power Handling: 125 watts.
Dimensions: 33⅝ in. H x 8⅝ in. W x 11⅜ in. D (85.4 cm x 22 cm x 29 cm).
Weight: 30 lbs. (13.6 kg) each.
Price: $1,250 per pair; available in black ash or rosewood vinyl finish.
Company Address: c/o M. Rothman & Co., 50 Williams Dr., Ramsey, N.J. 07446; 800/227-7491.

Photos: Michael Groen

The crossover is on a small circuit board at the rear of the input-terminal connection cup. Connections are of 20-gauge stranded wire, attached to the drivers by clips. The input terminals, two pairs of silver-plated five-way binding posts on standard ¾-inch centers, support bi-wiring; connecting straps are provided for single wiring.

Measurements

In Fig. 1 is the Modus Monitor MFM-5's on-axis frequency response, a combination of ground-plane bass data taken outdoors and upper-frequency data taken in a large anechoic chamber. The curve taken without the grille (which has been smoothed) fits a



fairly tight, 4.5-dB, window from 60 Hz to 20 kHz. The window is even tighter (2 dB) below 2 kHz. But above that point, the curve is less smooth, with broad peaks near 4 and 12 kHz and a slight dip at 7.6 kHz. The grille causes minimal response deviations, slight dips at 7.3 and 17 kHz that will likely be inaudible on most recordings. Averaged from 250 Hz to 4 kHz, sensitivity was 87.5 dB. The right and left speakers matched closely, within ±1 dB of each other.

Figure 2 shows the MFM-5's phase and group-delay responses, referenced to the tweeter's arrival time. The phase curve's continual downward slope, typical of direct-radiator speakers, levels out above 6 kHz. The direction of the curve's slope indicates that the upper woofer's acoustic output lags the tweeter's. One reason for the delay is that the upper woofer's acoustic center is behind the tweeter's, but the crossover's delay characteristic is also a factor. The group-delay curve reveals that the lag averages approximately 0.2 millisecond between 600 Hz and 2.5 kHz.

The MFM-5's horizontal off-axis response (Fig. 3) is very uniform all the way to 20 kHz within the main listening window, 15° to either side of the axis. Farther off axis, it narrows above 12 or 13 kHz.

In the vertical plane, off-axis response (Fig. 4) is quite uniform except in the crossover region, between 2 and 5 kHz, where significant dips appear below the axis and more than 5° above it. Although you can't see it clearly, the responses above and below axis are asymmetrical, a sign of lobing.

I had not expected that lobing, because my usual test of crossover phasing (which consists of measuring on-axis response with normal and reversed tweeter connections) revealed a fairly sharp dip in the crossover region. That dip was 20 dB at 2.7 kHz, the apparent crossover frequency, and spanned the range from 1.25 to 7 kHz. The depth of this dip indicated that the MFM-5's tweeter and upper woofer, when connected normally, should be essentially in phase through the crossover region; this phase match should have minimized lobing. The phasing test did suggest that there would be lobing in the narrow range from 7 to 9 kHz, where output increased about 2 dB when the tweeter correction was reversed, but the effect is too minor to be seen in Fig. 4.

The MFM-5's vented enclosure gives its curve for impedance magnitude (Fig. 5A) the usual twin peaks straddling a dip at the approximate tuning frequency. For this Wharfedale speaker, that frequency is 33 Hz and the impedance is at its minimum, 4 ohms, there. The maximum impedance of 22.6 ohms is reached near crossover, at 2 kHz. From 20 Hz to 20 kHz, the ratio of the maximum to the minimum impedance is a moderate 5.65 to 1 (22.6 divided by 4). Therefore, if cable series resistance is less than about 0.05 ohm, response peaks and dips from cable-drop effects should not exceed 0.1 dB. For a typical run of about 10 feet, that would correspond to 14-gauge (or heavier), low-inductance cable. Overall, the MFM-5's impedance is closer to 4 ohms than to its rated 8 ohms; I would not suggest paralleling two MFM-5s on one amplifier output. But a single MFM-5 should be relatively easy for any amplifier to drive, because its impedance phase (Fig. 5B) varies only from about +45° to about –35° within the audio range.

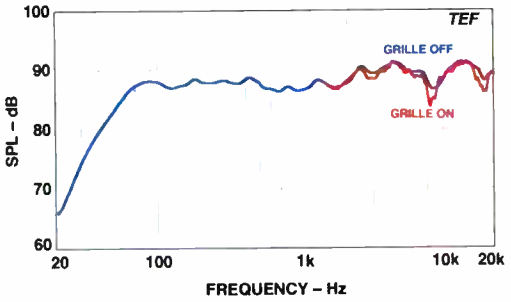


Fig. 1—One-meter, on-axis frequency response.

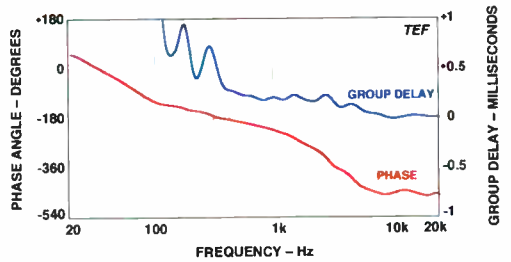


Fig. 2—On-axis phase response and group delay.

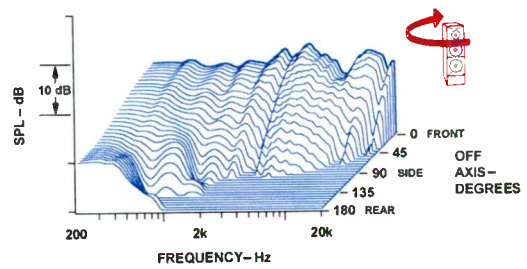


Fig. 3—Horizontal off-axis frequency response.

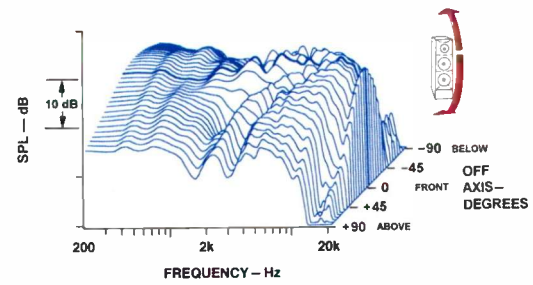
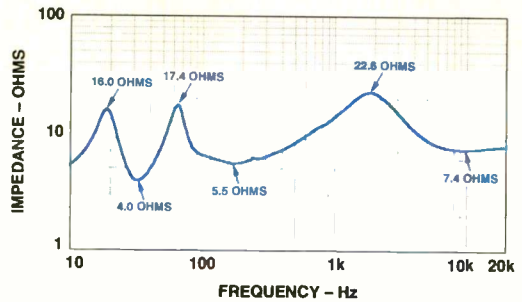
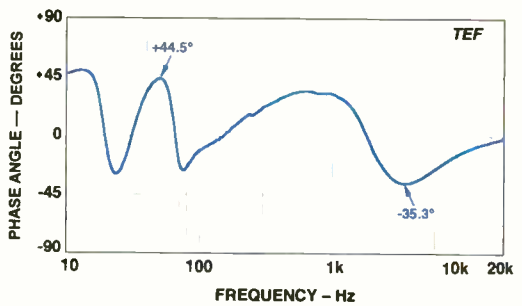


Fig. 4—Vertical off-axis frequency response.



A



B

Fig. 5—Impedance magnitude (A) and phase (B).

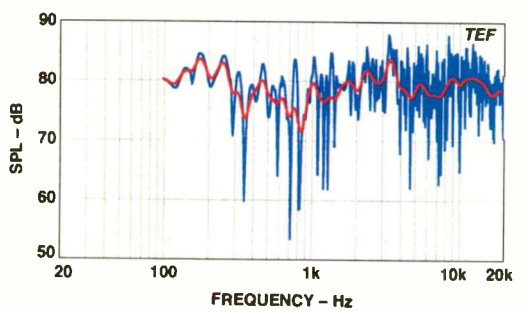


Fig. 6—Three-meter room response.

A high-level sine-wave sweep revealed that the MFM-5's cabinet was fairly rigid, although its back, front, and side panels did vibrate a bit at 230 Hz. (The plastic bezel around the upper woofer buzzed at this frequency, too, until I seated it properly by pushing it with my palm.) The woofers had a fairly generous travel capability of about 0.5 inch, peak to peak, and made no harsh sounds when overdriven by the test signal.

The excursions of the woofers differed significantly. When two woofers share an enclosure, as they do here, their excursion and distortion usually reach a minimum at the speaker's tuning frequency. But when I swept the MFM-5 with a high-level (15-volt) sine wave, the lower woofer reached a sharp null (about 0.4 inch) at about 41 Hz, while the top woofer's excursion had a shallower null (about 0.05 inch) at a lower frequency, 36 Hz. This is probably because the lower woofer is next to the vent, whereas the upper woofer is some distance from it.

For the raw and smoothed 3-meter room response curves (Fig. 6), I placed my test microphone at seated ear height (36 inches) at the listening position. The smoothed curve fits a relatively tight, 12-dB, window and a tighter, 7.5-dB, window above 1 kHz. Above 4 kHz, it tightens still further, to 3.5 dB.

The MFM-5's E_1 (41.2-Hz) harmonic distortion is shown in Fig. 7 for a 50-watt signal (20 volts rms into the rated 8-ohm load). Despite fairly high second- and third-harmonic levels, the speaker sounded reasonably clean because of its low levels of fourth and higher harmonics. Output at this level and frequency was a fairly healthy 97 dB SPL at 1 meter in a free field.

The A_2 (110-Hz) harmonic distortion (Fig. 8) was moderate; the fifth and higher harmonics were almost completely below the floor of the plot. At 110 Hz, a 50-watt input generated a fairly loud 104 dB SPL at 1 meter in a free field. The sharp rise in the second, third, and fourth harmonics was caused by significant dynamic offset, which begins occurring between 12.5 and 16 watts. This was more pronounced in the upper woofer above 90 Hz; interestingly, this woofer moved in and the other moved out. (Dynamic offset is a form of self-rectification in which a cone's average position shifts inward or outward when the speaker is fed a high-level, narrow-bandwidth signal.)

The MFM-5's intermodulation distortion, for 440-Hz (A_4) and 41.2-Hz (E_1) tones of equal power, rises gradually as power increases (Fig. 9). At 50 watts, the IM distortion reaches a moderate, but quite audible, 12%.

The MFM-5's short-term maximum peak power input and output can be seen in Fig. 10. Maximum input is 6 watts at 20 Hz and then rises very rapidly to 200 watts at 41 Hz. After falling somewhat, to 130 watts at 60 Hz, the maximum input gradually rises again, to 5 kilowatts above 3 kHz. Even with room gain, maximum peak acoustic output also starts low (81 dB at 20 Hz) and rises very quickly, passing through 100 dB at 30 Hz, 110 dB at 52 Hz, and 120 dB at a relatively high 370 Hz. At 1 kHz, maximum output is 122 dB, reaching 125 to 130 dB above 2 kHz.

Use and Listening Tests

The equipment I used when evaluating the Wharfedale MFM-5 speakers included an Onkyo Integra DX-7711 CD player, a Krell KRC preamp, a Crown Macro Reference power amplifier, B&W 801 Matrix Series 3 speakers, and Straight Wire Maestro cabling.

WITHIN THE MAIN LISTENING WINDOW, THE WHARFEDALE MFM-5 HAS VERY UNIFORM RESPONSE TO 20 kHz.

Although the MFM-5 supports bi-wiring, I used normal, single-wire, connections. Hookup was easy, as the binding posts are spaced to accept double-banana plugs. European safety regulations mandate that binding post terminals not accept the standard European AC power plug, whose prongs, like this speaker's binding posts, are on ¾-inch centers. Wharfedale got around that by blocking the terminals' holes with plastic plugs and providing instructions on how customers outside Europe can remove them.

The MFM-5's six-page owner's manual is in seven languages, which makes the instructions in each language quite brief. Just three sentences are devoted to the subject of speaker positioning.

The Wharfedale MFM-5s are significantly better-looking, in my opinion, than many other tower speakers. Their molded front panels are so handsome that you may prefer to leave the grilles off all the time. At 30 pounds apiece, these speakers are quite light for their size, but they pack a big bass wallop. Few speakers I've tested could so closely match my B&W 801s' bass authority and extension at low to moderately loud levels. Even at higher levels, the Wharfedales kept up with the B&Ws except when

the music contained high levels of frequencies below 30 Hz.

The Wharfedales proved to be good all-around performers on most recordings. They were somewhat brighter than the B&Ws, but this wasn't necessarily unwelcome: It made the MFM-5s sound more lively and energetic than the 801s, though perhaps a bit too much so on vocals.

For my initial listening, I used several CDs I'd brought back from the Winter Consumer Electronics Show in January. On vocalist and guitarist Livingston Taylor's *Ink* (Chesky JD162), "Isn't She Lovely," the first track, begins with Taylor whistling and playing the guitar. Through the Wharfedales, the whistling sounded extremely realistic; the image appeared to float in space, midway between the speakers and slightly above them. The solo acoustic bass guitar at the beginning of track 3 was reproduced very accurately, and Taylor's fingering on the strings was most realistic.

THE IMAGE APPEARED TO FLOAT IN SPACE, MIDWAY BETWEEN AND SLIGHTLY ABOVE THE MFM-5s.

I found that the MFM-5s sounded somewhat better when I was seated than when I stood up; on the pink-noise stand-up/sit-down test, the sound of the upper midrange significantly changed when I changed position. From my seat, the Wharfedales sounded marginally better when I tilted them back approximately 4° to 5°. To do this, I used the supplied spikes to raise the front of each speaker about ¾ of an inch, which aimed the tweeters more directly toward my ears. I could have gotten the same result by placing the speakers on short stands, 8 to 9 inches high.

On the third-octave band-limited pink-noise test, the Wharfedale MFM-5s had no usable output at 20 Hz, some usable output in the 25-Hz band, and strong output from 32 Hz up. From 40 Hz up, the MFM-5's maximum output equaled the 801's. Port wind noise was audible but not objectionable.

A recording of African music with drums, *Love Drum Talk* by Babatunde Olatunji (Chesky WO160), uncovered a problem. When I played track 3 (the title track) at high levels, one of the MFM-5s produced a cracking sound on the bass drum. I discovered that the upper woofer was bottoming out, its voice coil hitting the driver's backplate. This problem did not occur during earlier tests because they did not overload the speaker with low bass, which this track apparently did. One cause of the problem was that this track has a particularly high crest factor (the ratio between peak and continuous power). Over the track's first 2 minutes, its average crest factor is 21.2 dB (a power ratio of 132 to 1), compared with 12 to 18 dB for most other recordings. As a result, even though the music didn't sound particularly loud, its bass transients were driving the MFM-5's woofers nuts.

On the same CD, a solo acoustic bass guitar in the first 30 seconds of track 7 is accompanied by clapping, and it has an even higher crest factor, 25.5 dB (a power ratio of 355 to 1). However, because the hand-clap transients are higher in frequency than the drum transients in track 3, the MFM-5s reproduced them quite loudly and realistically—though my Crown amplifier's clipping indicators showed that this took essentially all the peak power the amp could provide. On recordings having lower crest factors, the Wharfedales did not demand so much power; they were, in fact, about 2 dB more sensitive than the B&Ws.

On orchestral music, the MFM-5s were good all-around performers. They exhibited excellent soundstage capability, produced stable center images for solo instruments, and had ample and robust bass. On music having quite high levels of bass, however, I heard some intermodulation distortion at loud levels. The Wharfedale speakers had no trouble reproducing cleanly recorded female and male vocals. They also sounded clean on well-recorded rock and country music, even when played at loud levels.

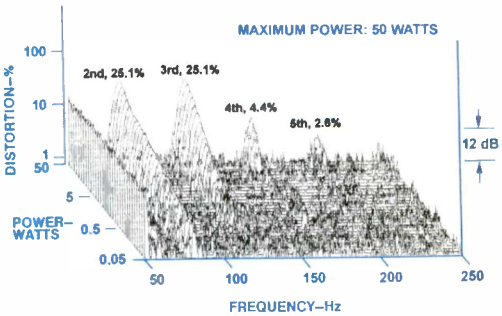


Fig. 7—Harmonic distortion for E_1 (41.2 Hz).

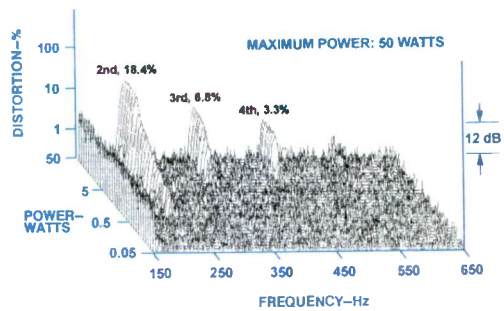


Fig. 8—Harmonic distortion for A_2 (110 Hz).

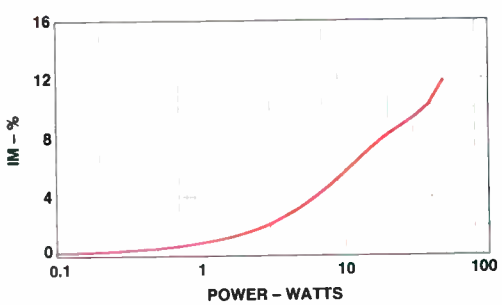


Fig. 9—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

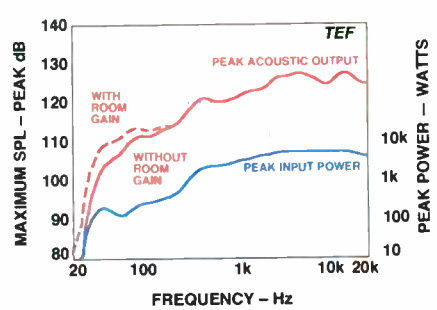


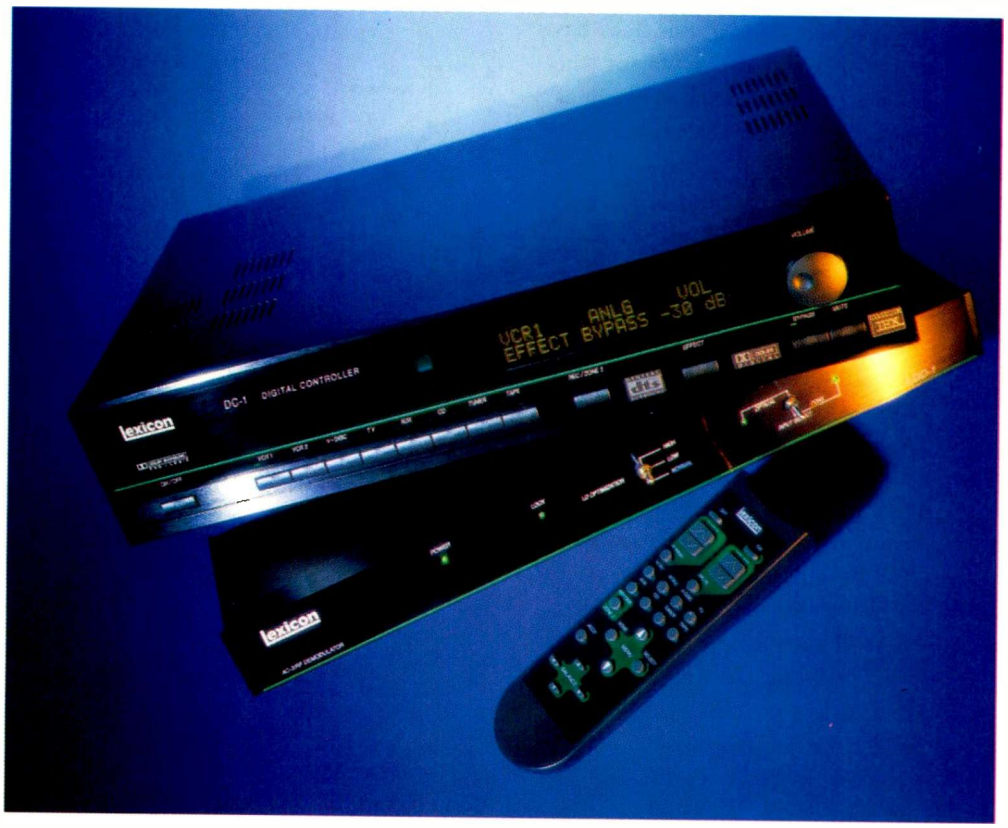
Fig. 10—Maximum peak input power and sound output.

Wharfedale's MFM-5s deserve serious consideration as an addition to any system. Their excellent looks, extended bass, and good overall performance on a wide range of program material make them well worth their relatively modest price. A

AURICLE

ANTHONY H. CORDESMAN

LEXICON DC-1 5.1-CHANNEL A/V PREAMP/PROCESSOR



If you don't bother adjusting its default settings, the Lexicon DC-1 surround controller is merely one of the best-sounding A/V preamps around. But if you prefer adventures in surround sound, you can alter virtually every effect, surround, and setup parameter in ways no other unit can match. It has serious rivals in terms of sound quality, but nothing else comes close to its ability to let you experiment with surround.

The DC-1 is currently available in four configurations. The base model, at $1,995, has A/D and D/A converters, numerous music-enhancement modes, and its own digital Dolby Pro Logic surround decoding. The Pro Logic decoder incorporates several advanced processes, such as Auto-Azimuth, which Lexicon says is unique in providing automatic correction of interchannel phase as well as balance. (Like all Lexicon processors, by the way, the DC-1 does everything digitally, which is why it contains A/D converters.) The $2,995 DC-1/THX, reviewed by Edward J. Foster in the May 1996 issue, adds enhanced Home THX processing, tone controls, and such features as Lexicon's proprietary Logic 7 mode (about which more later). The version under consideration here is the full-blown discrete 5.1-channel model that provides, in addition to everything else described so far, Dolby Digital (AC-3) and DTS surround decoding. It is priced at $4,995, or $4,500 without the DTS option. Any version of the DC-1 can be upgraded to any higher version simply by changing a card inside the chassis. Lexicon also makes a companion RF demodulator for Dolby Digital laserdiscs, the LDD-1, which will run you another $699.

Company Address: 3 Oak Park Dr., Bedford, Mass. 01730; 781/280-0300; www.lexicon.com.

The DC-1's sound quality easily compares with that of the most expensive surround processors (even the $12,000 Krell Audio+Video Standard), and its excellent ergonomics make it easier to set up and tailor to a given installation than most of its competitors. Where the DC-1 really excels, however, is in its versatility: It's virtually a home laboratory for experimenting with surround sound. I know of no other processor that gives you this much flexibility to create the precise sound characteristics you want for your particular system in your listening room.

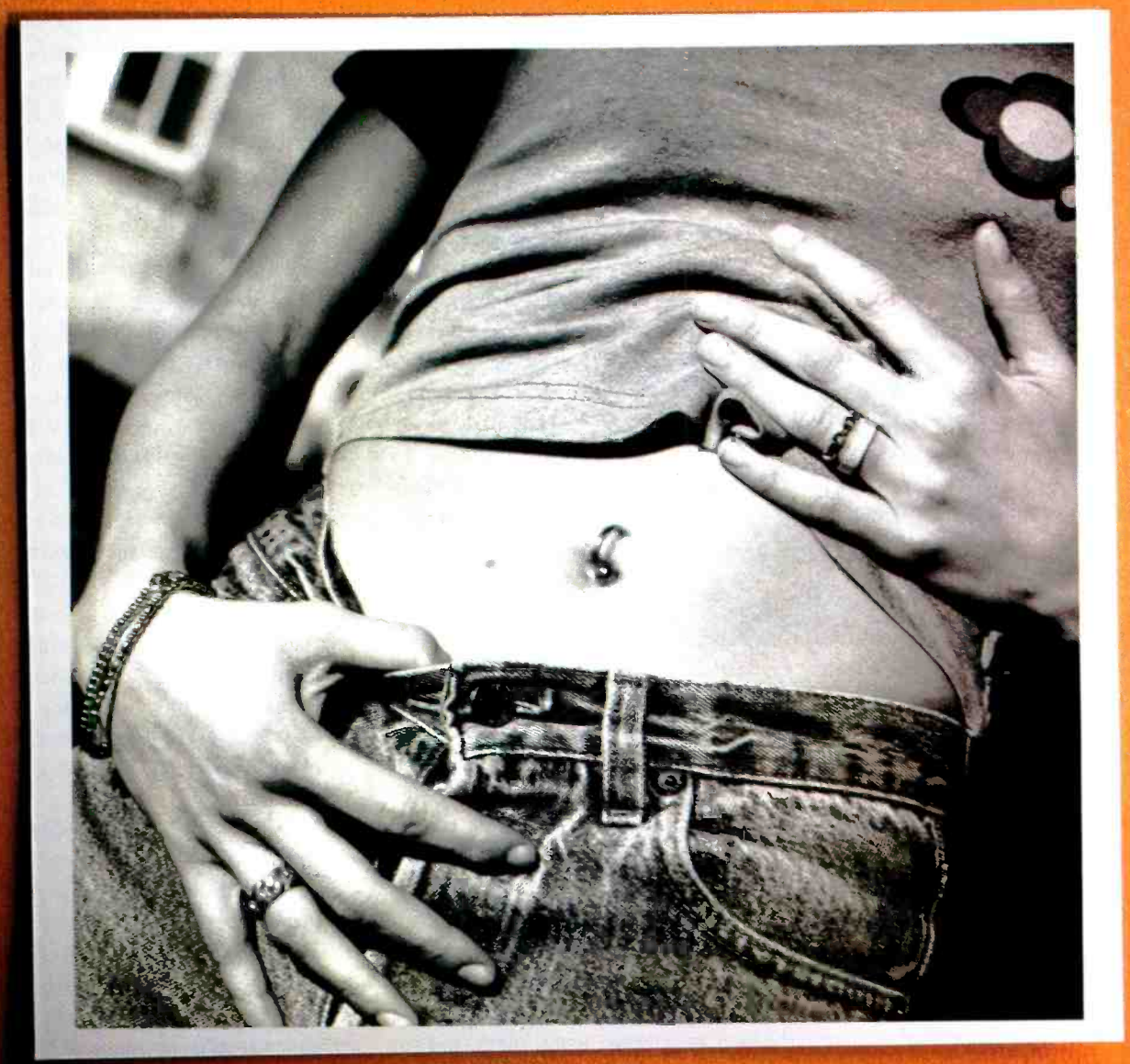
THE LEXICON DC-1 IS VIRTUALLY A HOME LABORATORY FOR EXPERIMENTING WITH SURROUND SOUND.

Yet all of these adjustments are user-friendly, aided by a remote control that ordinary families can use and understand and by the best instruction manual I have ever seen for an A/V preamp/processor. Also supplied are manuals that describe the theory and design of the DC-1 and its various processing modes.

The Lexicon DC-1 works fine right out of the box; you really don't need to read the manuals to use it. But you'll appreciate them if you do want to experiment, even though

Photo: Michael Groen

"I'VE MADE A CD AS UNIQUE AS I AM."



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y adjustment you make shows up clear-
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tly what setting you've chosen and can log it and repeat it at will. (You also can lock your setup adjustments to prevent accidental changes to them.)

The DC-1 uses high-quality components and is very well built. Its A/D and D/A converters are 20-bit delta-sigma types, and its distortion, noise, frequency response, and dynamic range specifications are very good—as you'd expect from a product in this price range, built by a company with Lexicon's track record in both professional and consumer digital audio.

As a preamp, the DC-1 has five A/V inputs (three with S-video jacks) plus three audio-only analog inputs and four digital audio inputs. On the output side, it has composite- and S-video jacks for a TV monitor and VCR, tape-recorder and second-zone audio outputs, the standard 5.1-channel surround outputs (of which the front left and right can be used for stereo-only playback), and an extra pair of surround outputs that enable two additional effects channels (which also require an extra pair of speakers) for numerous enhanced ambience-extraction and surround modes.

THE LEXICON'S SOUND QUALITY EASILY COMPARES WITH THAT OF THE COSTLIEST HIGH-END PROCESSORS.

This assortment of inputs and outputs, while enough for the vast majority of A/V systems, does not quite match the flexibility of the connections on the Krell, Meridian 565, and Theta Digital processors. The Lexicon has no balanced inputs or outputs, only one center-channel output, and just one subwoofer output. And only two of its four digital inputs are coaxial, which could force you to use Toslink connections if more than two of your system's source components have digital outputs.

All the signal input and output jacks, as well as a mini-jack for an infrared control receiver and a DIN connector for 12-volt triggering of projection screens or other devices, are intelligently laid out on the back panel. However, you have to cram a lot of cables into a very small space (a complaint I'd also make about most A/V preamps other than the Krell and Theta Digital). This can present problems if your interconnects have very large RCA plugs; it also makes it hard to read the names of the inputs and outputs. On the other hand, you do not have to go through a setup menu to assign an audio input to a specific video input or to get the right name on the display, although you can change the default settings for these assignments if you like.

The Lexicon DC-1's adjustments and processing features are more difficult to summarize. In fact, to fully understand its operation, you just about have to read all three manuals and then hear a demonstration by a dealer who really knows how to show you what the DC-1 can do.

Let's start with its surround facilities. Even the base, Dolby Pro Logic version of the DC-1 has 10 surround and ambience modes, which include "Mono Logic" (for expanding mono film soundtracks), "TV Matrix" (which enhances ordinary TV sound), and "Panorama" (which realistically expands the soundstage of a good stereo recording by combining ambience extraction with interaural crosstalk cancellation). The THX version adds Home THX processing and Lexicon's "Logic 7" mode. The latter goes beyond Pro Logic to deliver seven-channel surround from Dolby Surround-encoded material, with stereo surround-channel steering both left to right and between side and rear surround speakers. It can also be used to convert standard two-channel stereo into five- or seven-channel surround sound, adding spaciousness and an enhanced listening area while preserving the basic soundstage depth, width, and vocal balance. (Normally, however, you would use the related "Music Logic" or "Music Surround" mode for this purpose, since, as their names imply, they are specifically configured for music reproduction. The former is available in all versions of the processor, the latter in the THX and higher versions.) In the DC-1's top versions, Logic 7 may also be applied to expand 5.1-channel Dolby Digital and DTS soundtracks into an enhanced 7.1-channel presentation.

Although some of the DC-1's ambience simulations carry familiar names ("Concert Hall," "Nightclub," "Church," and "Cathedral"), they should not be confused with the musically abusive settings found on some competing processors and many A/V receivers.

The quality and sophistication of the DC-1's effects settings are reinforced by its digital equalization capabilities. Unlike most of its competition, the THX and higher versions of the Lexicon have shelving bass and treble controls, with a ±6-dB range; the Dolby Digital and DTS versions also have a spectral tilt control, hinged at 1 kHz, which gently adds bass while reducing treble (or vice versa). Like the equalization controls on the Theta Casablanca, the Lexicon's can do wonders to correct the timbral anomalies in a system and the tendency of many soundtracks to be a bit too bright. I never found this to be necessary with THX-certified soundtracks, but I cannot say the same of many others.

As in all good, recent A/V preamp/processors, the speakers used with the Lexicon can be identified as "Small" or "Large," and the digital crossover filters for the subwoofer and various main speakers can be set individually at 80, 100, or 120 Hz. The subwoofer level can be set individually for each surround setting (a feature more high-end units should include). The unusual ability to adjust the level of the low-frequency-effects (LFE) channel separately for each Dolby Digital and DTS mode also has real value.

Though not really needed in day-to-day use, the DC-1's front panel is nevertheless well laid out; in fact, the LCD display is large enough to be legible from a typical listening position. Normally, adjustment of the DC-1 will be done using the remote control in conjunction with easily readable on-screen menus whose content and sequence actually make sense.

With the setup menus, you can make simple and precise time-alignment adjustments (relative to the primary listening position) for each speaker and the subwoofer. You can also select the test signals for speaker level setting and setup of the "Panorama" mode and a host of sophisticated luxury adjustments, such as synchronizing the voice and image on a TV when a line doubler is in use. There are also adjustable muting levels, overload warnings, bypass options, controls for sending signals to other

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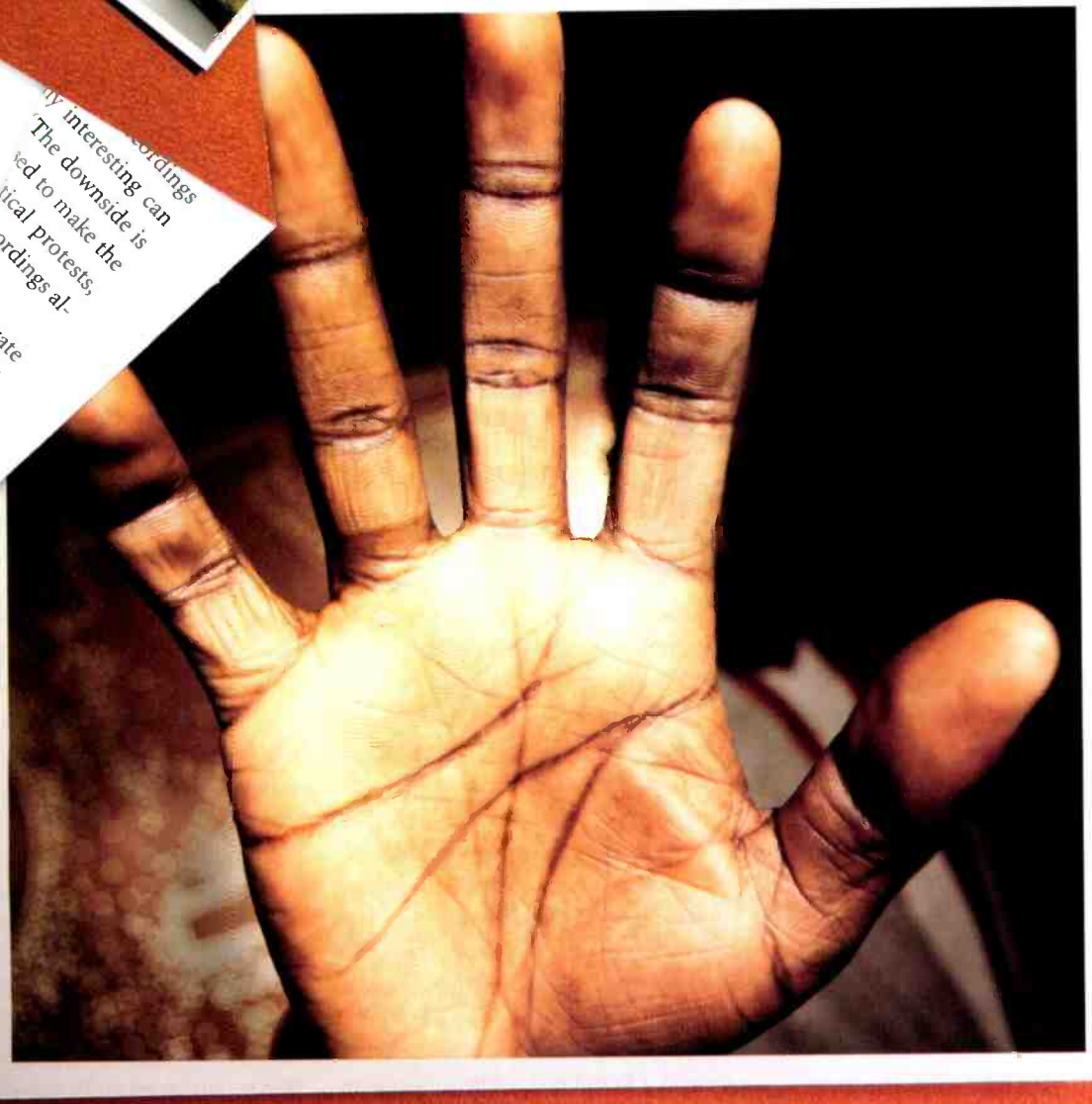

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rooms and for setting hidden functions on the remote, on-screen display adjustments, and separate adjustment menus for each input. Further, in the DC-1's memory you can store default processing modes for each signal type—e.g., PCM (and analog), Dolby Digital, and DTS—for each input. The correct mode will then be selected automatically when you choose the input, based on the type of signal the DC-1 detects at that input.

The Lexicon DC-1 has an intelligently designed remote that is easy and practical to use. (Too often, high-end remotes are marvels of so-called clever engineering, which in real-world operation proves to be illogical and non-intuitive.) A good remote is not a minor issue with an A/V preamp/processor, as you will spend a lot of time using it, and ease of use is a real blessing. In the case of the Lexicon, after setup is complete, a few moments of instruction are all you need in order to enjoy the system. The labels are clear, and you can tailor the effects and channel balance to an individual recording in seconds.

THE DC-1 DOES A TRULY SUPERB JOB PROCESSING DOLBY PRO LOGIC IN ITS THX CINEMA AND LOGIC 7 MODES.

The accessory LDD-1 RF demodulator worked very well, switching efficiently and automatically between Dolby Digital-encoded laserdisc soundtracks, when present, and the standard PCM digital tracks. It has an unusual control setting to minimize the error rate from different types of laserdisc players, particularly those that have been upgraded with an aftermarket Dolby Digital RF output jack.

The overall performance of the DC-1 is anything but easy to characterize. As I have noted, an almost infinite range of adjustments is possible for any A/V system into which the Lexicon is installed. But first I'll describe its performance reproducing stereo music.

In broad terms, I found the DC-1's sound quality to be very good. The Lexicon's bass was excellent—deep and well defined, with excellent dynamics. Its midrange and treble were very clean and had very good dynamics and transparency. At the same time, the DC-1 was not quite as sweet or as transparent as the Krell Audio+Video Standard and it had just a touch of upper midrange hardness. This was also true relative to the Theta Casablanca, though to a lesser degree. (The Lexicon is, incidentally, far less expensive than either of these other processors.)

The low-level resolution of the Krell and the Theta seemed just a bit better than that of the Lexicon. As for dynamics and transients, all three processors sounded different: The Krell had a more tube-like character, with a greater feeling of space, whereas the Theta had more sheer life. Nevertheless, the Lexicon's dynamics were very lifelike, rather like those of a very good stereo preamp that uses bipolar devices. The choice is a matter of taste.

In pure stereo mode, the Lexicon had a slightly less well-defined and subtle soundstage than the Krell or the Theta, but the difference was scarcely one to die for. Furthermore, the Lexicon does the best job of any processor I have yet auditioned in letting you add realistic surround sound and hall effects to enhance ordinary stereo. The people at Lexicon have musical taste as well as formidable technical skills, and the effect modes for stereo listening worked well even with comparatively simple A/V speaker systems.

I spent most of my time listening to the Lexicon through my reference Polk SRT system, which has separate subwoofers for the front and surround channels, full-range surround-channel speakers, and two center-channel speakers. I also experimented with stereo playback using friends' audio systems equiped with high-quality electronics and B&W and VMPS speakers. In the process, I found that *subtle* adjustments of the DC-1's effects and other settings can be even more valuable in a demanding high-end system than in a less costly one. This is particularly true if that system has a demanding full-range center-channel speaker with full-range, high-resolution surround speakers that precisely match the fronts.

In CD listening, you can partially compensate for timbre problems, close miking, and a lack of soundstage air and ambience. The right combination of effects and digital equalization can also do a lot to improve old analog recordings that have been re-

mastered to CD. It may seem heresy to suggest using surround ... good idea ... most LPs ar... from the DC-...

The younger ... form me that the... round and ambien... "salvage" a wide r... and pop recordings. ... are right. Many pop a... that are fun and musica... be made to sound better. ... that the DC-1 can also be u... clueless whining, anger, pol... and self-pity on some grunge ... most intelligible!)

I am not going to give up my ... stereo systems for the DC-1 and s... sound: I still prefer listening to n... CDs and LPs in plain stereo, withou... processing. But I'd be careful about ... dulging in audio snobbery and dismissi... the benefits the DC-1 can bring. Ther... were many individual classical and jazz recordings that the Lexicon processed in ways that I felt made them sound much more realistic.

Processing TV sound, the Lexicon DC-1 delivered the best combination of logic and matrix effects I have heard to date. Far too few A/V equipment manufacturers take the sound of broadcast television seriously. Lexicon does not make this mistake, and the result is a mix of processing modes that is remarkably effective in coping with the sometimes widely variable sound quality from local TV stations, cable-TV services, and satellite systems. The "TV Matrix," "Logic 7," and "Mono Logic" modes are all useful with different types of programs. (Do no engineers at the transmitter or relay stations ever check to see if Dolby Surround-encoded audio is properly balanced when it is broadcast or to ensure that commercials and other feeds do not produce weird imbalances and phasiness in the soundstage when they are injected into the middle of a Dolby Surround program?)

With respect to Dolby Pro Logic processing, I have heard great results from the Krell, Meridian, and Theta processors, but the Lexicon does do a truly superb job, particularly in its "THX Cinema" and "Logic 7" modes. Incidentally, Lexicon has pub-

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lished a detailed AES paper on its unique Auto-Azimuth interchannel balance and phase-correction technique, which the company says rectifies the two most common sources of errors in current Dolby Surround video soundtracks. I can't claim to have validated these claims, but they certainly help explain why the DC-1's Dolby Pro Logic performance is so good. Bear in mind, too, that there are decades' worth of video soundtracks and TV programs for which the ability to decode matrix Dolby Surround will continue to determine sound quality.

Is the Lexicon DC-1 the world-beater in this respect? The answer is a firm maybe. Dolby Pro Logic performance varies so much by soundtrack, system setup, the method of decoding, and the synergy between the various speakers used in a given system that it's impossible to say. I can attest that the Lexicon delivered exceptionally clean and logical front left and right, center-channel, and surround-channel sound with the best Dolby Surround soundtracks as well as with Dolby Surround CDs. While it's hard for me to define "truth," the DC-1 provides a superb illusion.

Evaluating Dolby Digital and DTS presents the same problem in terms of "truth" and absolutes. Production values and the sound mix vary sharply by soundtrack or performance. You can guess at what a video of a musical performance should sound like, but with movies nothing is natural or real; only the illusion counts. Consequently, any ranking of A/V preamp/processors can change from disc to disc. A lot also depends on speaker placement and listening room configuration, which increases the difficulty of making valid comparisons of A/V preamps for A/V enthusiasts who have different rooms and systems.

In broad terms, however, the Lexicon DC-1's performance in reproducing the bass of Dolby Digital and DTS is as good as that of any processor I have heard. The deep bass is realistic, with sometimes explosively lifelike dynamics, yet it still has good definition and control.

The DC-1's overall dynamic and transient performance is very good to excellent. It has a bit less low-level resolution and fine ambient detail than the Krell or Theta but excellent mid-theater realism. As to replicating super-loud dramatic effects, the Lexicon did very well, reproducing even the most demanding peaks of DTS-encoded programs.

I found the upper midrange of the Krell, Meridian, and Theta slightly better defined, with a touch more air, but each processor yields a slightly different mix of timbre, detail, and resolution. (By the way, I detected such differences only on the most demanding passages of the best film soundtracks and on DTS and Dolby Digital music tracks.) It is a very hard call; you really have to listen for yourself and weigh subtleties of reproduction versus price.

Furthermore, the DC-1's superior processing modes often let you tailor Dolby Digital and DTS performance in ways that are subjectively more important than ultimate resolving capability and subtle differences in upper-midrange sweetness and air. (The Logic 7 effects modes are particularly good in this respect.) Likewise, the Lexicon's spectral tilt control and other equalization settings enable you to fine-tune the timbre of individual recordings in ways that may be more important to overall enjoyment than any differences in resolution of the upper midrange.

In terms of passthrough of the video signal, any differences between the Krell, Theta, Meridian, and Lexicon were minor and usually less apparent than the equally marginal differences caused by switching video cables or changing cable lengths. Evaluated with the laserdisc and DVD versions of *Video Essentials*, the Lexicon's performance with my 40-inch TV monitor was very impressive indeed.

In conclusion, the Lexicon DC-1 clearly competes with the finest and most costly processors available, despite its comparatively moderate price. And it has the best ergonomics and real-world features of any A/V preamp/processor I have encountered. If you do nothing but use the default settings, you'll find the DC-1 easy and fun to live with, and its processing features for TV sound have no equal.

If you are willing to venture further into the DC-1's capabilities and spend the time necessary to tailor its effects and other adjustments to your needs and taste, the Lexicon can take you where no other processor can go. You'll begin a journey into personal sound engineering that will transport you to an endless land of the imagination. A

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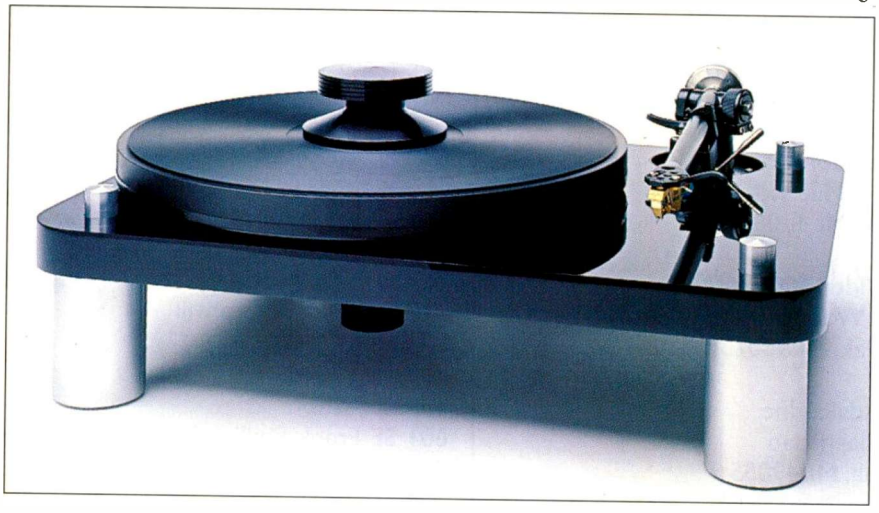
AURICLE

KEN KESSLER

BASIS AUDIO 2000 TURNTABLE

Despite exhortations from vinyl junkies and used record dealers, interest in playing LPs has been reduced forever to cult level. Yet, curiously, the median price for turntables has gone up, not down. This suggests that most remaining record lovers are audiophiles, and audiophiles expect to be fiscally molested, if not quite raped.



The amount the impoverished but fastidious hi-fi hound considers the minimum to spend for a proper platter spinner is probably far in excess of what the non-audiophile would invest. And given that there are gems like the Rega Planar 2 available for as little as $500, I'm loath to call the Basis Audio 2000 a budget turntable. With an arm but minus a cartridge, it costs $2,500.

Nonetheless, 2½ grand *is* a bargain for a Basis. My first experience with the brand involved an early version of the flagship Debut Gold, which sells for $8,200 to $10,600, depending on options; as the 2000 reflects much of its dearer sibling's glory, I suppose its price is almost sensible.

Not that the 2000 is particularly stark in its minimalism. If anything, it's almost embarrassingly understated: gloss black and uncluttered. If the 2000 were an article of clothing, it would be Italian and fit perfectly on Kate Moss. The visual effect of a black acrylic main chassis, adjustable brushed-aluminum legs, a matte-black platter, and bare metal for the leg caps, pulley, and on/off switch will someday be thought of as '80s retro; for the time being, it's merely elegant.

The arm with which the 2000 is fitted at the factory is the British-made Rega Research RB300. The Rega is easily the best tonearm value on the market, but the Basis designers have further enhanced it with a custom mounting arrangement that enables you to adjust vertical tracking angle. The RB300's color scheme even matches the 2000's.

By making the 2000 17 inches wide and 12 inches deep, Basis has ignored the recent trend toward unnecessarily enormous turntables that can't fit most equipment racks. (I placed it on a Target rack made of square steel tubing, weighed down with some 150 pounds' worth of tube amplifiers on its lower shelves.) Yes, you can buy a smaller turntable (such as Wilson Benesch's Circle) if space is at a premium, but the 2000 seems to be proportioned just right for avoiding excess while still oozing gravitas. The only other allowance you have to make is for the motor assembly, whose footprint is a mere 3 x 3 inches and whose 4-inch height makes its pulley level with the platter. Only the drive belt and your shelf connect the motor assembly to the turntable, to ensure isolation from motor-borne vibration. For this you will be grateful, as the Basis 2000 system is eerily quiet.

You may place the motor assembly behind the turntable or to the left. As the on/off button is on the motor assembly, it's easier to reach with the motor positioned to one side. (On the other hand, placing the motor in the rear makes the Basis 2000 look a lot nicer.) At the top of the motor assembly is a two-step pulley; you raise or lower the belt manually to select 45 or 33⅓ rpm. In my system, once the motor was in place and spaced exactly ⅜ inch from the chassis, the flat belt never drifted at all.

Setup was straightforward enough, the detailed instructions outlining how to fit the bearing housing, insert the bearing assembly and platter, and mount the arm. Because the 2000 lacks a suspension, you can forget all about the irritating, headache-inducing setup procedures that have hardened generations of audiophiles. Leveling the 2000 involves nothing more than screwing the feet—"support pods," as the manual calls them—up or down, as required.

If the absence of a suspension strikes a sour note with those who swear by the isolating properties of a suspended subchassis, note that the support pods' spongy feet provide some decoupling from the outside world. However, the 2000 can be upgraded to 2001 status by exchanging the standard feet for Basis Audio's more sophisticated Resonance Annihilator suspension system. And you can trade up from the 2000 or 2001 to the 2500 ($5,500) or 2800 ($7,900) by paying the difference in retail prices.

Company Address: 26 Clinton Dr., Unit 116, Hollis, N.H. 03049; phone, 603/889-4776; fax, 603/889-5402.

Factory mods apart, a Basis 2000 in the raw responds vividly to aftermarket tweaking. It comes with neither separate mat nor record clamp, although Basis sells a $75 weight and a $219 clamp [seen in our photo—*Ed.*] for those who feel more solid contact with the platter is needed. And audiophiles who prefer a mat beneath their LPs are free to experiment. I tried thin foam, felt, and Sorbothane mats, and their effects were consistent with my earlier experiences—you *will* hear the differences in materials. But in the end, I reverted to the bare platter, which seemed to deaden the sound less.

I chose not to let the matter of cartridges complicate things. My current favorite among the near-affordables is Grado's wooden-bodied Platinum, at $300 the least expensive in the company's Reference Products line. I'd been using the Platinum to test moving-magnet-only phono stages and quite simply fell in love with it. This spared me the inconvenience of moving-coil cartridge-matching as well.

My choice of the Grado also made it possible for me to use what will likely emerge as the biggest bargain in analog this year (or the next): NAD's deliriously inexpensive Model PP-1 moving-magnet phono preamp, perfect for those who have line-level systems and want to add a turntable without going broke. This little black box sells for $129—$129!!!—and yet it's clean and quiet enough to treat a cartridge as subtle as the Grado with due respect. It's also good enough to feed a Sonus Faber Musica integrated amp or a Sutherland C-2000 preamp.

Because the PP-1 comes with captive leads, you don't even have to think about cables. Thus, the entire phono system used for this review (Basis 2000 with Rega arm, Grado cartridge, and NAD preamp) comes to less than $3,000. To keep this in context, I used the just-introduced Sonus Faber Musica (price to be announced but likely to be around $3,000) and a pair of Quad 77-10L speakers at $1,500 per pair. (Okay, okay, a $7,500 system ain't exactly entry level, but I know of a pair of speaker cables that costs more than the whole setup, so indulge me for a few more paragraphs.)

Not surprisingly, the Basis exploited analog's virtues in such a way that any CDs I played immediately after sounded cold and harsh. Transparency was great enough to confuse digital diehards who vaguely recall analog sound as being clouded, while the 2000's midband and treble clarity ensured that vocals stayed uncolored and free of unwanted chestiness or sibilance. Details were of such precision and fineness, and the noise floor so low, that teensy sonic clues did not have to struggle to be heard above stylus tracing or vinyl "whoosh."

Where the Basis might disappoint listeners under a certain age is in its lack of aggression, its refusal to hammer you with bass of the mechanoid variety. The 45-rpm 12-inchers I used had as much impact as I wanted—but then, I'm not partial to rave sonics. On the other hand, you can, if you so desire, "Beavis up" the bass with a record clamp, a glass mat, and a modest subwoofer.

But the Basis isn't aimed at the MTV audience. Without trying to read the designers' minds, I'd posit that the 2000 was conceived for the vinylphile who wants but cannot afford a Debut Gold or one of the other $8,000+ heavyweights. What's so admirable about the 2000 is that you'll soon forget all about them—and probably about CD, too. A

CLASSICAL RECORDINGS

Schubert

Schubert: Sonata in A Minor for Arpeggione, D. 821; Beethoven: Sonata No. 3 in A Major for Violoncello, Op. 69
Hidemi Suzuki, violoncello and violoncello piccolo; Yoshiko Kojima, pianoforte
DEUTSCHE HARMONIA MUNDI
05472 77396; 52:45
Sound: A, Performance: A+

This disc's two works from the solo cellist's repertoire are performed with skill and sensitivity, but the unusual choice of instruments on the Schubert sonata stands out. Using an authentic pianoforte for this type of music is, of course, not as unusual today as it was a few decades ago; however, giving a very beautiful and impressive performance of the difficult "Arpeggione" Sonata on a violoncello piccolo is extraordinary.

Schubert's Sonata in A Minor is the only known work composed for the arpeggione, an obscure instrument invented in 1823 and popular for only a few years. And it was a hybrid: It was played like a cello with a bow, yet it had frets and six strings like a guitar. Today this lovely sonata is typically played on the cello (though occasionally on the viola and even the flute).

The Japanese cellist Hidemi Suzuki is well known for his scholarship and expertise in early music composed for the cello. To present this Schubert sonata in an historical context, Suzuki first attempted to perform it on an actual arpeggione. But its limited sound and poor intonation made it completely ineffectual. Therefore, he chose to record the work on a violoncello piccolo (literally, "small cello"), which is usually associated with Bach and other 18th-century composers. Its sound—piercing and trenchant, more like a low woodwind's than a string instrument's—is quite unlike a cello's, and it is well captured on this disc. The performance is strikingly convincing: Instead of creating a curious novelty, Suzuki presents the sonata with both grace and power. His intonation is impeccable, and he is in control of every Schubertian nuance.

The Beethoven sonata provides a different timbre and feeling; the cello is less a solo part and more on equal footing with the keyboard. (Here, Suzuki plays a standard cello.) Yoshiko Kojima is quite adept at the fortepiano, and it's remarkable how much dynamic contrast she coaxes from her instrument—a modern copy of an 1815 model. Together, she and Suzuki have created an excellent blend of historical accuracy and musical exhilaration. *Patrick Kavanaugh*

Schumann

Sonata for Piano No. 1 in F-Sharp Minor, Op. 11, and Kreisleriana Fantasies for Piano, Op. 16
Murray Perahia, piano
SONY CLASSICAL SK 62786
DDD; 58:13
Sound: A, Performance: A

The young Robert Schumann considered himself as much a pianist as a composer. Unfortunately, in his zeal to perfect his piano technique, he tried strengthening his fourth finger with a harness contraption, causing permanent damage to his hand and ruining his concert career. Nevertheless, he would go on to compose many masterpieces for the keyboard. This recording contains two of the most original works of Schumann's youth, his first sonata and the fanciful "Kreisleriana" Fantasies. Murray Perahia, known for his adeptness in performing Romantic compositions, interprets this music splendidly. His absolute mastery of contrasting dynamics, especially notable in the sonata's first movement, is well recorded and vividly conveys the young Schumann's imagination. *Patrick Kavanaugh*

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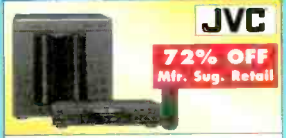

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ROCK~POP RECORDINGS

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The Complete Wailers, 1967-1972: Part 1
Bob Marley and The Wailers
JAD 1002, three CDs, 2:11:22
Sound: B, Performance: A+

Before signing with Island Records in 1972, The Wailers—Bob Marley, Bunny Wailer, Peter Tosh, and Rita Marley—recorded hundreds of sides for the Jamaican market. Most were issued on 7-inch vinyl and available in extremely limited quantities. So I was happy to learn that the recently revived JAD label intends to release a four-part, 10-disc series called *The Complete Wailers, 1967-1972*. Each of the three discs in Part 1 is separately titled (and has its own booklet): *Rock to the Rock* is from 1968, *Selassie Is the Chapel* is from 1968-70, and *Best of The Wailers* is from 1969-70.

Before settling into the role of the world's preeminent ganja-stoked reggae prophet in the mid-'70s, the young Bob Marley fancied himself a traditional soul singer (albeit one with obvious rock-steady underpinnings). Those aspirations are often apparent here, in the Otis Redding-like beseeching of "Touch Me," the Muscle Shoals balladry of "Chances Are," the hypnotic gospel skeleton of "Selassie Is the Chapel," the cycling funk groove of "What Goes Around Comes Around," and the Junior Walker and The All Stars cover "Hold on to That Feeling." Tosh and Wailer turn in a few gems of their own, including the former's majestic

semisonic

Feeling Strangely Fine
MCA MCAD/11733, 50:51
Sound: A, Performance: A

When it's done poorly, pop is conventional, accessible, and maddeningly soporific. When it's done right, pop is conventional, accessible, and positively exhilarating. No album in recent memory more perfectly embodies the latter maxim than Semisonic's *Feeling Strangely Fine*. This sophomore effort by the Minneapolis-based threesome (singer/guitarist Dan Wilson, bassist John Munson, and drummer Jacob Slichter) is a remarkable example of what happens when smarts, verve, and imagination are used as structural imperatives at every step of the creative process.

Those imperatives—those crucial aesthetic values—are nowhere more apparent than in the runaway exuberance of "Singing in My Sleep," the Ben Folds-like tinkle-and-bash of "Never You Mind," the rubber-band funk of "Completely Pleased," and the Westerbergian stomp of "This Will Be My Year." Likewise, Wilson and company apply just the right touch to the album's quieter, more contemplative moments. With its balmy Rhodes piano and aching melody, "Secret Smile" evokes all the illicit intimacy implied by the title, while "California" finds Wilson telegraphing the chorus ("Caaaaliforni!") as though he were John Denver marooned on some L.A. mountaintop, calling out to someone on the far side of the continent.

Unlike Semisonic's debut, 1996's *Great Divide*, whose snappy songs were sometimes vitiated by Paul Fox's layered production, the new album benefits from Nick Naunay's penchant for texture and economy. But, of course, that's just the icing on the cake: *Feeling Strangely Fine* is an absolutely exhilarating pop experience. *Greg Siegel*

kiss-off "Stop the Train" and the latter's double-entendre-laden "Tread Oh."

That this collection of 47 tracks (some are alternate versions, and some were never released or not released outside of Jamaica) makes The Wailers' early work widely and legitimately available for the first time is no mean accomplishment. That it does so with admirable sound is even better, especially since most of the original source tapes were destroyed or lost decades ago, which necessitated painstaking transfer from the few remaining vinyl copies. Of course, all the disinterred 45s and digital remastering in the world do not a masterpiece make. Fortunately, *The Complete Wailers: Part 1* proves triumphant on this front as well. *Greg Siegel*

Deconstructed

Bush
INTERSCOPE INTD-90161, 66:59
Sound: A–, Performance: B+

The main problem with Bush's remix album, *Deconstructed*, is its title. The songs aren't merely taken apart or stripped down: They're sliced, puréed, shuffled, and then *reconstructed* into striking electronic soundscapes that would barely be recognizable as Bush, were it not for the snippets of original vocal tracks.

Of course, frontman Gavin Rossdale has never been mistaken for an English scholar, so

no one should be surprised by this contextual error. What *is* more than a bit surprising, however, is just how good *Deconstructed* really is. Even if Bush were to be accused of leapfrogging from trend to trend (alt-grunge to techno), nobody could call this disc derivative or uninspiring.

Granted, the majority of *Deconstructed*'s sonic brilliance has nothing to do with Bush, since the band was on tour during the album's creation. Moreover, many of the group's original guitar rhythms, bass lines, and drum beats have been obliterated from the mix. But Bush does deserve credit for hiring a choice group of cybersurgeons (including Tricky, Goldie, and Meat Beat Manifesto) to transmogrify its material.

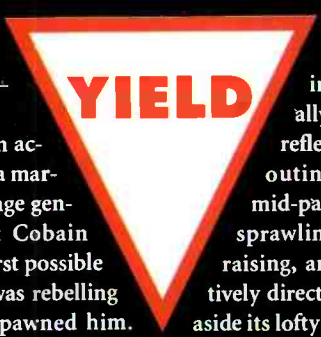
The band's gravy-train anthem, "Everything Zen," is recast twice, first as a breakbeat-charged stormer (a Lhasa Fever mix) and then as a tribal-trance track. Elsewhere, "Synapse" is mutated into a haunting ambient number by Consolidated's Philip Steir, and "Swallowed" is transformed by Goldie into a brain-frazzling blend of siren guitar samples, galactic sound effects, and skittering drum and bass beats.

In their original forms, many Bush songs don't contain hooks strong enough to effectively propel the melodies, but in Silicon City, the band's material holds up better than that of many purely electronic groups. Now, if only its label could find some way to keep Bush out of the control room for the next album, too. *Jon Wiederhorn*

PEARL JAM

Yield

EPIC EK 68164, 48:37
Sound: A–, Performance: A–



In the early '90s, Pearl Jam accidentally volunteered to be a martyr for the angst-ridden grunge generation. Even before Kurt Cobain eschewed stardom in the worst possible way, vocalist Eddie Vedder was rebelling against the industry that spawned him. Not long after Pearl Jam's second album, *Vs.*, topped the charts (in 1993), Vedder and his bandmates skirted convention and sensibility by refusing to shoot any more videos, going out of their way not to promote themselves. Their behavior led many to write the band off as a relic from a bygone era.

And like the very cross-bearing figure Vedder evokes, Pearl Jam has been reborn—though its return has nothing to do with metaphysical abstraction or religious symbolism. The group has always created its own destiny, and now it has chosen to throw away the soapbox and shelve its anti-industry sentiments, to *Yield* to the forces of oppression and focus on creating great rock songs. Like *Ten* was in 1991, this album is a blast of creative energy in a lackluster musical period.

Yield does have full-throttle riffs and soul-searing howls, but things are actually quite a bit tamer and more reflective than in past Pearl Jam outings. Still, the power in the mid-paced anthems and even in the sprawling ballads is palpably hair-raising, and the songwriting is effectively direct. In short, Pearl Jam has cast aside its lofty musical and political pretensions. The Middle Eastern atmosphere, punk-rock elitism, and blatant Neil Young cronyism have vanished.

The band has returned to its freewheeling, rock-loving roots. Several tracks here, including "Faithful" and "Given To Fly," billow with atmospheric guitars and a pulsing groove that recalls Led Zeppelin. Other numbers are more experimental. "Do the Evolution" interrupts a surging rhythm with a church choir, and the untitled eighth track comprises steel percussion, maracas, and the repeated chant "We're all crazy." "Push Me, Pull Me" features whizzing samples, backwards guitars, and a spoken-word vocal reminiscent of Jim Morrison. It sounds like Pearl Jam is having fun while purging its poisons. In Vedder's own joyous words, "It's evolution, baby!" *Jon Weiderhorn*

Blue Cinderella

Kami Lyle
MCA MCAD-11641, 44:16
Sound: A–, Performance: B+

Blue Cinderella is a glorious pop confection from Kami Lyle, the only singer/songwriter I know of whose instrument is trumpet. This debut album was sequenced so that the six songs featuring her trumpet as a solo voice are the odd-numbered selections. Thus, no two are consecutive, which emphasizes the variety in the set.

You'll find nothing ordinary about Lyle's songs. They can be jazzy (the breezy 6/8 title track), brooding ("Midnight Club"), sex-charged ("Boys"), or have a classic torch song feel ("September"). "Polka Dots" is pure pop stuff, a song almost giddy with joy and longing whose melody is based on a piano part very similar to that of R.E.M.'s "Nightswimming." "Mr. Trouble" has a light swing feel coupled with dense wordplay similar to Lyle Lovett's. The most intimate and impressionistic tracks, "Love Me" and "The Grocery Song," are backed solely by Matt Rollings' piano.

A core band of drummer Manu Katché, bassist David Jacques, keyboardist Robbie Kondor, and guitarist David Steele—augmented by percussionist Bashiri Johnson—illuminates Lyle's songs with graceful, dignified, and restrained performances. And her

voice itself is a gentle instrument reminiscent of Rickie Lee Jones. Lyle frequently doubles complementary vocal parts to attractive effect, a technique used compellingly of late by Shawn Colvin. Hugh Padgham (past producer of Genesis, XTC, Peter Gabriel, and Sting, to name a few) oversees a clear-headed, mostly straightforward rendering of Lyle's songs.

Whether *Blue Cinderella* announces Kami Lyle as a major talent remains to be seen. What is certain is that she is already an artist with vision and a clear notion of herself. This is a distinctive debut. *Michael Tearson*

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DVD REVIEWS

SHORT cinema journal

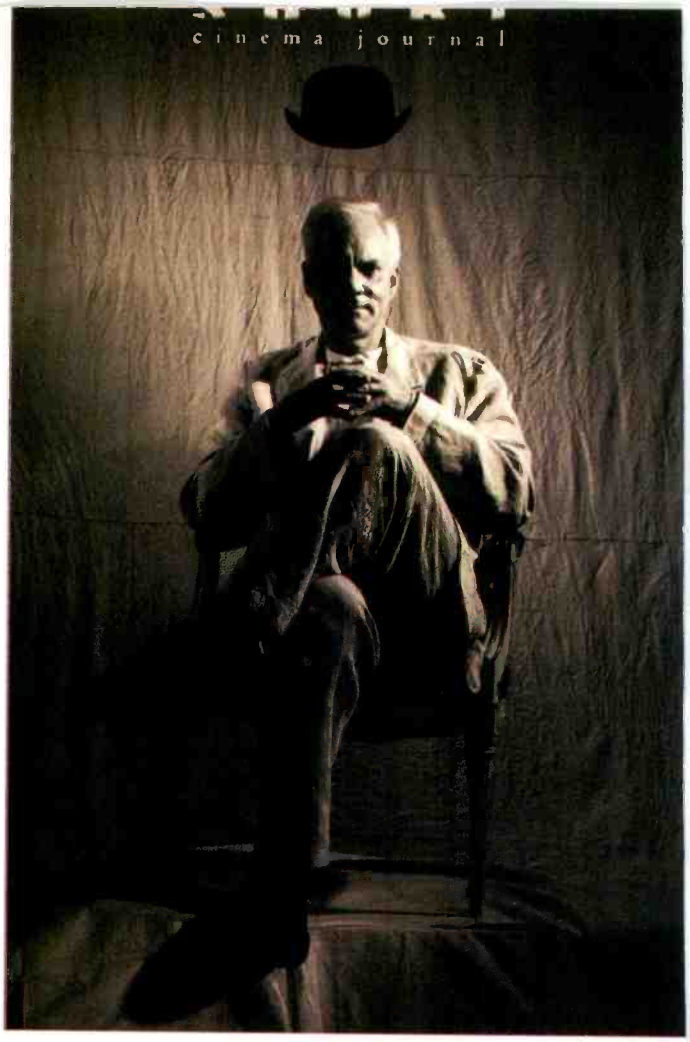


Photo: ©1998, Jeff Fry

Short Cinema Journal, Volume 1:2 *1997; see text for rating; black-and-white and color; two-sided (letterboxed and full screen); mostly English Dolby Digital two-channel matrix surround; includes alternative audio and video tracks and commercials.* SHORT CINEMA/POLYGRAM 440 055-2, 3:33:00, $29.95
Picture: A, Sound: A–, Content: A–

The producers of *Short Cinema Journal* view their DVDs as video magazines that incorporate short films, animated shorts, interviews, and personality profiles. It's a concept that seems made to order for DVD, which offers high-quality video and audio, alternative audio and video track capability, and instant access to the material on the disc. Indeed, the concept probably could not exist successfully in any other format.

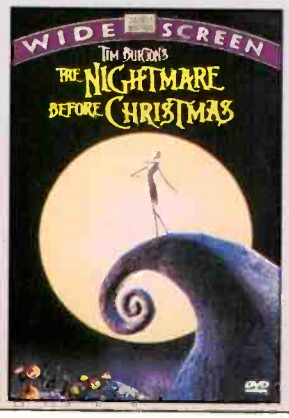
As with looking through a print magazine, some viewers will prefer various video "articles" that others may find insignificant. Nevertheless, outside of big-city art houses, it is unlikely that the average moviegoer would encounter these features. Thanks to *Short Cinema*, more people will get an opportunity to see them.

This second issue of *Short Cinema Journal* contains almost as good a mix as the first. (The material's ratings range from G to R, so parents should preview this disc before turning it over to unsupervised children.) Easily likable are Carmen Elly's *A Guy Walks into a Bar*, a riotous satire on Westerns and coming of age (starring Fred Savage of TV's *The Wonder Years*); Chris Marker's heralded cult short, *La Jetée* (the haunting inspiration for Terry Gilliam's *12 Monkeys*); and the brush stroke-animated "daydream" short *Cafe Bar*. On the other hand, Michael Failla's brutal portrait of a heroin addict, *Vincent: The Junkie Chronicles*, and the austere documentary of Jane Campion filming the equally dour feature, *Portrait of a Lady*, are likely to have far less appeal.

The disc has a long running time (side one is 155 minutes, the longest of any DVD I've seen so far) yet suffers from no apparent loss in quality, making it unlikely anyone will feel cheated. The menu contains a full-motion background shot, as do the video footnotes that accompany most of the dozen or so programs. (*Short Cinema* titles are available in general distribution at stores or from PolyGram, or, at a lower subscription rate, by calling 888/383-6247.) *Rad Bennett*

THE NIGHTMARE BEFORE CHRISTMAS

The Nightmare Before Christmas *1993; PG rating; one-sided (1.66:1 letterboxed); English/French Dolby Digital 5.1; Spanish subtitles; closed-captioned; includes trailer.* TOUCHSTONE 13080, 1:16:00, $29.99
Picture: A, Sound: A–, Content: B+



Here's Tim Burton's brilliant, if often disturbing, stop-motion animation film that tells the story of Jack Skellington, the Pumpkin King of Halloween Town, who tries to branch out and take over the Christmas holiday. The Academy Award-nominated, eye-popping visuals are captured beautifully on DVD. But sound is of equal importance to this short film, which is really a musical that blends disparate elements of English music hall and Berlin musical theater into its personal, macabre style. And somehow, it all works quite well. The Dolby Digital 5.1 mix is exceptionally transparent, with every word, sound effect, and musical note heard to great effect. Only a very slight bass shyness relative to the laserdisc version brings my sound grade for this DVD down a half notch. *R.B.*

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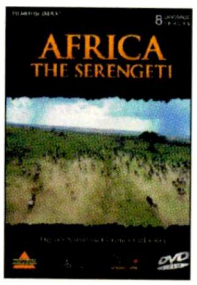
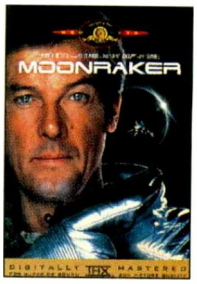
Africa: The Serengeti *1994; no rating; one-sided; Dolby Digital 5.1 (English, Bavarian, Castilian, Catalan, French, Japanese, Korean, and Mandarin); English closed-captioned.* LUMIVISION DVD2097, 40 minutes (transferred from IMAX master), $29.95
Picture: A–, Sound: A, Content: B+



By providing Dolby Digital 5.1 soundtracks in eight different languages on this release, Lumivision has taken full advantage of DVD's remarkable audio storage capability. Perhaps it's something of a circus stunt, but it does demonstrate the potential of the medium (and also means the disc can be sold worldwide). Though the picture quality is superior to the original version of this title (released about a year ago as one of the first-ever DVDs), image clarity does vary somewhat. Of course, that's to be expected of an on-site documentary made over a period of time. Its best images are the close-ups of the Serengeti's wildlife; you can sense an animal's personality along with its color and stripe. A migration of wildebeest, which is the heart of the film, is graphically conveyed. The score includes some pounding, dynamic music by Hans Zimmer, and, on the English soundtrack, the sonorous narration by James Earl Jones is state of the art. Live-action menus are cool. On the debit side, this disc is a little pricey; I hope Lumivision's multi-language marketing plan will bring lower prices on future releases. *R.B.*

Moonraker *1979; PG rating; one-sided (2.35:1 letterboxed and pan-and-scan); dual-layer; English Dolby Digital 5.1, French Dolby Digital two-channel matrix surround; English, French, and Spanish subtitles; closed-captioned; includes featurette and trailer.* MGM/UA 906996, 2:06:00, $24.95
Picture: A, Sound: A–, Content: B

Made to cash in on all the excitement generated by *Star Wars* and real-life NASA missions, this 007 James Bond outing was more notable for its special effects than anything the actors might have inadvertently contributed. But those Academy Award-nominated effects *are* pretty neat, and the THX-certified DVD transfer is one of the sharpest around: The scenes shot in Venice, for example, often resemble Canoletto's architectural paintings. The final battle in space is particularly clean, and the remixed soundtrack comes across clearly, serving John Barry's excellent score and the various sound effects equally well.

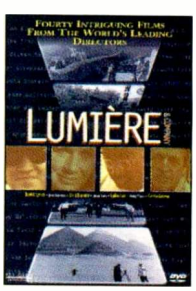


There are extensive menus, including a "hidden page." I had trouble finding it, but it's there. (I don't want to spoil your fun; just keep clicking on highlighted items!) With this release, MGM has apparently abandoned the familiar Warner cardboard-and-plastic box and adopted the plastic Amaray DVD-Safe Case used by TriStar and MCA Universal (sometimes called a keep case). *R.B.*

Lumière & Company *1995; no rating; black-and-white and color; one-sided (full frame and 1.2:1 windowboxed); French Dolby Digital two-channel mono; English subtitles; includes trailer.* FOX LORBER FLV5013, 1:28:00, $29.95
Picture: A, Sound: B+, Content: A–

In 1894, Louis and Auguste Lumière incorporated the ideas of Edison, Marey, and Muybridge to invent the Cinématographe, a combination camera and projector. The French brothers were granted a patent in 1895 and, after a series of demonstrations, showed their films to a paying audience on December 28, 1895, a date many scholars consider the birth of the motion picture.

The Lumières, unlike their contemporary Georges Mèliés, shot mostly realistic vignettes of people's normal daily activities. In a tribute to the brothers, a French production company restored an original camera and secured the services of 40 top directors to create their own brand-new Lumière films. The impressive list of directors includes David Lynch, John Boorman, Claude Lelouch, Costa Gavras, and Spike Lee. (A menu makes it easy to locate each contemporary director's contribution.) The documentary's producers requested that each film be a 52-second sequence, without synchronous sound, and that each be completed in only three takes. Most of the directors complied, but a few, such as Lynch, created fantasies and fictions more in the style of Mèliés than the Lumières (there's even an outrageous color-tinted sequence). The documentary is tied together by several original Lumière shots as well as interviews and question-and-answer sessions with the new directors, each of whom is asked three questions: Why did you agree to shoot with



the Lumière camera, why do you do film, and is cinema mortal?

All of the sequences filmed with the Cinématographe, new and old, are presented so the entire 1.2:1 frame will be seen on video monitors with correctly adjusted overscan. The interview footage is shot full-frame. Regardless of shooting method, the images are all crystal clear; the old Lumière films have been well preserved and are often as sharp and clean as the new ones.

Every film buff will want to own *Lumière & Company*, but it will also entertain and amaze the average viewer. *R.B.*

Crimson Tide *1995; R rating; one-sided (2.35:1 letterboxed); English Dolby Digital 5.1, French Dolby Digital two-channel matrix surround; Spanish subtitles; closed-captioned.*
HOLLYWOOD 13679, 1:56:00, $29.99
Picture: A, Sound: A, Content: B+

This manipulative, flag-waving, machismo action/adventure suspense movie is nonetheless extraordinarily enjoyable. On a nuclear submarine whose mission is to strike Russia if a coup in that country succeeds, the captain and executive officer are pitted against each other. The old-school captain, played by Gene Hackman, wants to fire, based on an initial order; Denzel Washington's more cautious executive officer wishes to wait for a completed second message. It arrives, fragmented, when the sub's communications are disabled by an enemy craft.

There are lots of close-ups of Hackman and Washington confronting each other, and this sharp and clear DVD transfer conveys every muscle-twitching nuance these fine actors bring to their roles. Underwater action scenes are equally compelling, thanks to the extra bit of detail in this carefully mastered disc.

The Dolby Digital 5.1-channel English soundtrack is impressive, too. As the sub's hull adjusts to various depths, subtle creaks and groans move from channel to channel, successfully evoking the edgy claustrophobia that the crew must endure in the close quarters of a submarine. It's interesting that Hollywood, a division of Disney, offers French-speaking viewers more than most companies. Switching the soundtrack to French not only gives you dubbed dialog but also changes the opening and closing credits: The red title near the beginning of the movie becomes *Marée Rouge*! But in any language, *Crimson Tide* is grand entertainment. *R.B.*

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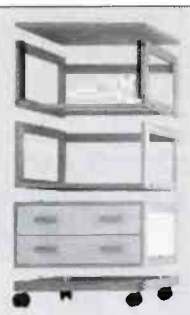

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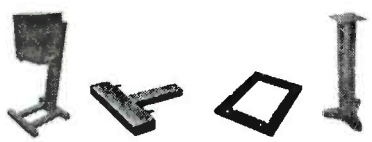

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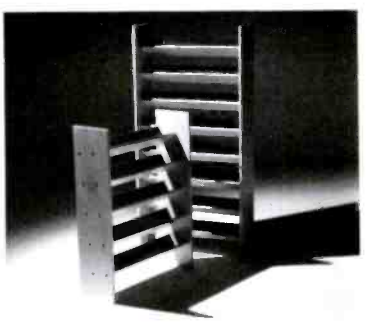

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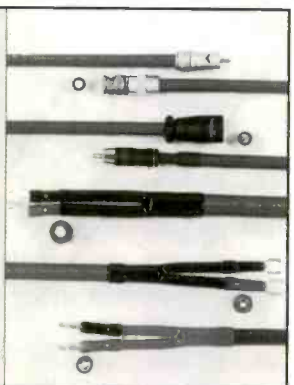

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PlayBack

BELL'OGGETTI SSP-12A SURROUND SPEAKER STANDS

Speaker stands tall enough to properly position surround-channel speakers are rare, but the SSP-12A adjusts in height from 32 to 58 inches, enough for virtually any surround setup; the platform where the speaker sits is 5⅛ inches square. You can run fairly thick cables up through the 12A's shaft, making the stand more stable and the cables less conspicuous and harder to trip over. Bell'Oggetti supplies rubber strips to protect your speakers and L-brackets with attachment bolts. (The bolts, a common metric size I've seen on microphones and old German cameras, will probably be a direct fit for some European speakers.) The crossbars of each stand's H-shaped base can be swiveled to form an "A," for corner placement. These stands come in black or white, cost $125 per pair, and should support a speaker weighing up to 8 pounds.

With NHT's 3-pound New Wave speakers, the SSP-12As were moderately stable at maximum height on a wood floor but a bit precarious on a thick carpet, perhaps because each base is only 10 x 10 inches. A bigger, and perhaps heavier, base would have helped in either situation, and detachable spikes would have been a tremendous help on the carpet. If your floors are carpeted or your speakers are heavy and do not need to be as high, Bell'Oggetti's SP-100 stands ($180 per pair), which have 15-inch bases and adjust from 31 to 43 inches, might be a better bet. (Bell'Oggetti International: 711 Ginesi Dr., Morganville, N.J. 07751; 732/972-1333; www.belloggetti.com.) Ivan Berger

GRADE: B–

JBL HARMONY RADIO/CD PLAYER

Manufacturers have long believed there is a considerable market for audio systems that take up little room in kitchens, bedrooms, and offices, so mini-systems of various stripes have been with us for more than 20 years. Some have been excellent, whereas others have delivered less than high fidelity. Moreover, the only way to achieve stereo with some of these systems is to detach the loudspeakers and set them apart from the main unit, more or less negating the size advantage.

Then there's the striking-looking JBL Harmony ($429.95), which is a bit difficult to classify. With its AM/FM tuner and alarm functions (including a snooze button), it might be considered a clock radio. Yet because it has a built-in CD player, it could be described as a mini-system. It certainly is small: a foot wide, 8 inches deep, and 10 inches high. Behind its grille are a pair of 3-inch tweeters flanking a 4-inch long-throw woofer. Each upper-frequency speaker is driven by its own 10-watt amplifier; the woofer gets 20 watts.

You can set two alarm times and be awakened by radio, a CD, or tones. Both sources were excellent: The CD player was as stable as I've encountered, and in my country location, the tuner, with just a single-wire antenna, pulled in stations that are usually lost in noise. There's also a set of line inputs, and the remote control is nicely laid out and very intuitive (as are the front-panel controls, incidentally).

GRADE: B+

In spite of the fact that the Harmony is in a single box, its sound was definitely stereo, thanks to the sort of phase-manipulation circuit that widens the image. This was very effective up close, though it tended to disappear beyond about 5 feet. I found the sound quality admirably neutral, and bass output in my tests extended to 50 Hz. For a device of this class, the Harmony could play very loud without noticeable distress. My only criticism is that there is no output connection of any kind, which makes it impossible to fill out the bass with a subwoofer. Still, the JBL Harmony's virtues far outweigh that small complaint. (JBL Consumer Products: 250 Crossways Park Dr., Woodbury, N.Y. 11797; 800/336-4525.) Ian G. Masters

Grado SR325 Headphones

I have long been a fan of Grado's SR series of open-back headphones. Having heaped praise on the $39 SR40 last summer [August 1997 issue], I recently tried the Prestige Series SR325 ($295), Grado's top of the line.

The SR325's earpiece housing is high-quality aluminum instead of plastic, and heavier wire is used in the line cord and connections to each driver. The drivers are said to be slightly larger and built to tighter tolerances than in the other members of the SR family. As with the SR40, the SR325 is comfortable. Adjustments to accommodate head size are accomplished by pulling or pushing each of the earpieces, which are mounted on sliding metal tubes. The gold-plated, stereo phone connector can be plugged into an included stereo mini-adaptor for use with portable components.

GRADE: A+

The SR325's higher price does not get you a giant leap in sound quality over the other SR headphones. I'd say that its sound can be characterized as 100% Grado: open and natural, with a detailed stereo image. What the SR325 does give you is deeper bass and more resolution in the upper midrange and lower treble. Using a Class-A headphone amp, I found the deluxe Grado equally adept at bringing out the detailed sounds of DAT-recorded acoustic guitar and for monitoring audiophile jazz recordings. Of all the Grado headphones I've heard, the SR325 is my favorite. (Grado Laboratories: 4614 7th Ave., Brooklyn, N.Y. 11220; 718/435-5340.) John Gatski

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