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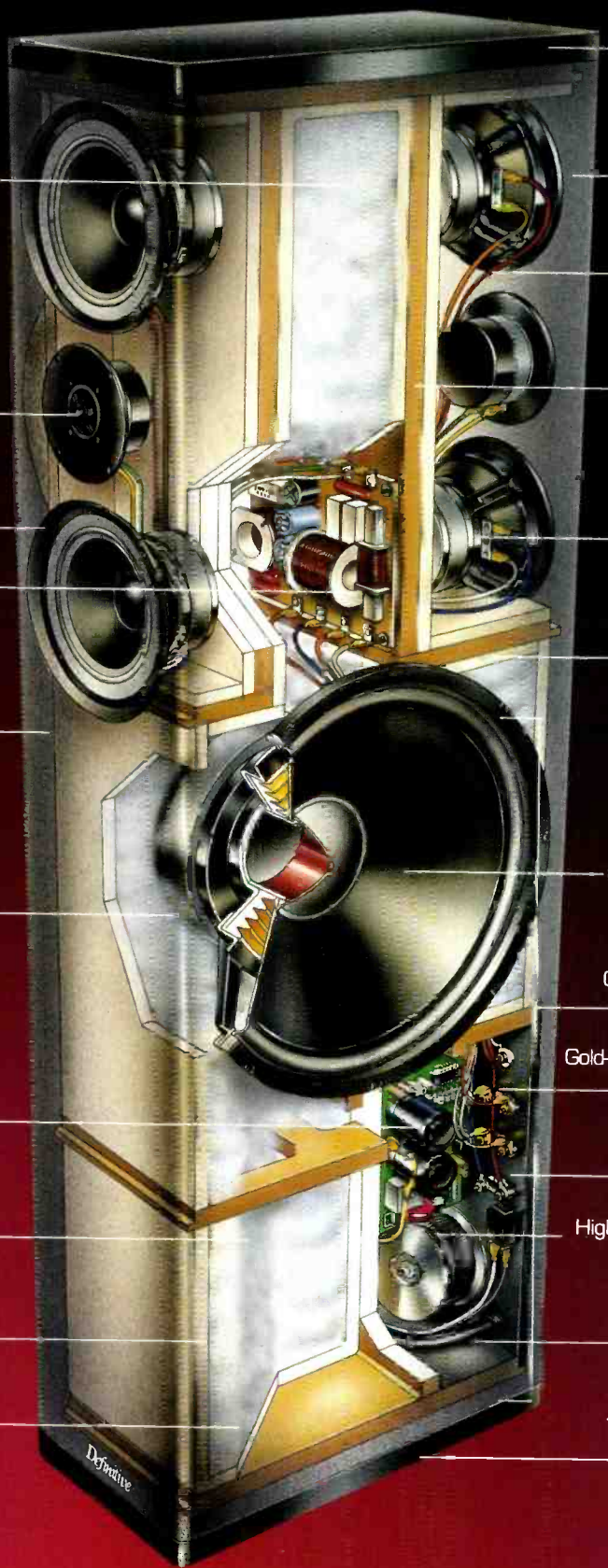

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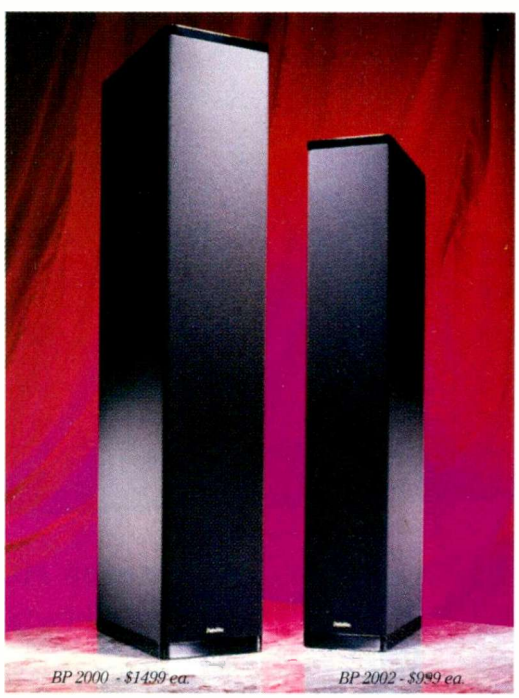

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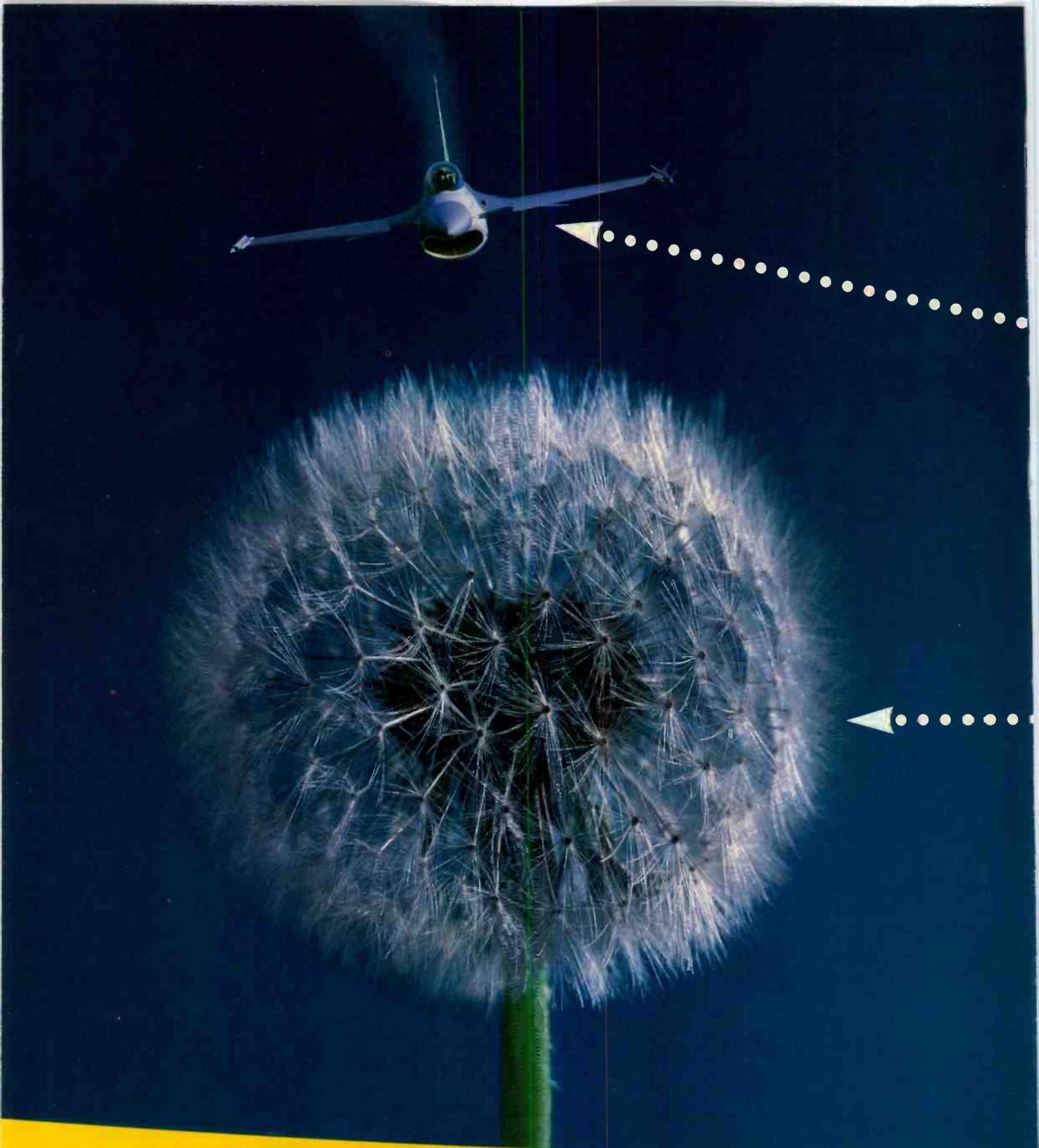

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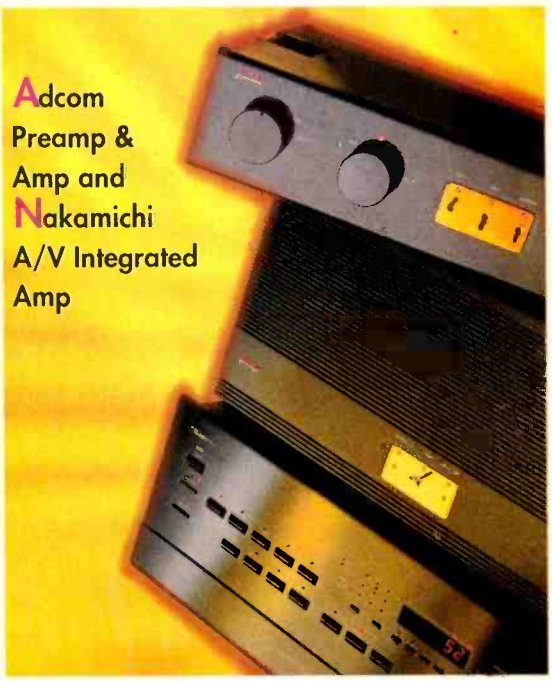
Science of Listening, *page 40*



Adcom Preamp & Amp and Nakamichi A/V Integrated Amp

FEATURES

EQUIPMENT PROFILES

AURICLES

DEPARTMENTS

PLAYBACK

Parasound Room Equalizer, *page 128*

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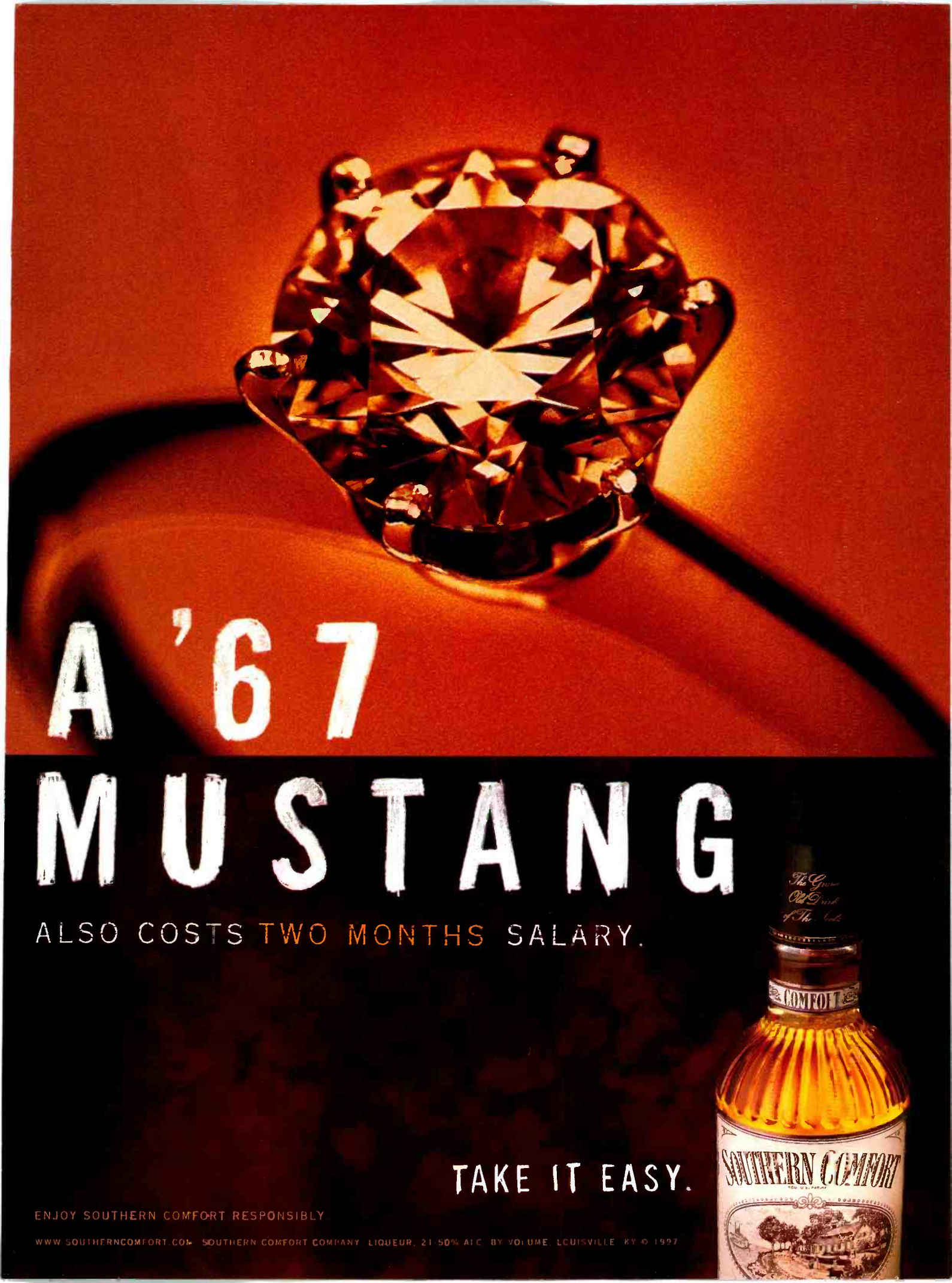
The Audit Bureau

Motown Man Mike McLean, *page 50*

Mission Speaker, *page 16*



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CIRCLE NO. 2 ON READER SERVICE CARD

FAST FORE-WORD

By the time this issue hits the newsstands, the DVD Forum's Working Group 4 (WG-4) is supposed to have completed a draft DVD-Audio specification. And though there is considerable reason to doubt they will meet that deadline, there is no question that the topic of DVD-Audio and multichannel music recording in general has been heating up lately. John Eargle discusses some aspects of the subject this month in "Currents" (page 28), but I would like here to touch on some other significant ideas and developments presented at and around September's Audio Engineering Convention.

Most interesting was a paper presented by Bob Stuart of Meridian. Titled "Coding Methods for High Resolution Recording Systems," it mainly concerns what is required to assure complete transparency of a digital audio channel and how to make best use of such coding in the storage capacity available on DVD. He concludes that 58-kHz linear PCM using a word length of either 20 bits (without noise shaping) or 14 bits with optimal pre-emphasis and noise shaping would be completely adequate for any combination of signals and listeners. From there, he goes on to show how lossless compression can be used even at a 96-kHz sampling rate to reduce data rate substantially without degrading signal quality and thus fit five or six channels onto a single side and layer of a DVD.

There is a great deal more to what Stuart had to say than I can go into here. However, I do want to emphasize what I consider a key point, which is that there is a point beyond which no further improvement is possible. Stuart allows that it probably makes more sense to go to a sampling rate of 88.2 or 96 kHz rather than 58 kHz, because those are multiples of rates currently used for CD and DVD and thus easier to downconvert when necessary. But higher sampling rates, such as the 192 kHz some have suggested, and 24-bit coding are, at best, simply wasteful.

Meanwhile, Sony and Philips held demonstrations of their proposed DVD-Audio system, based on Sony's Direct Stream Digital (DSD) recording process. This proposal is attractive in its completeness, as it meets all of the requirements set for DVD-Audio by the International Steering Committee (the recording industry's counterpart to WG-4). Most important, it suggests a dual-layer method for providing a CD version on the same disc as the DVD-Audio, thereby eliminating the need for the dreaded dual inventory both in stores and in our homes. Unfortunately, DSD requires entirely new editing and signal processing equipment in studios and is not very efficient. Even with the 2:1 lossless compression Sony and Philips say they have developed, the data rate per channel is twice that of CD.

The ideal, I think, would be something like Stuart's coding scheme on a dual-layer disc like that of the Sony/Philips system (plus, perhaps, a Dolby Digital version tucked somewhere as well, as an intermediate option). Unfortunately, the paper presented by a representative of WG-4 seemed to suggest that the committee is thinking in terms of a single-layer disc based on high-data-rate PCM (88.2 or 96 kHz with 16- to 24-bit samples) without compression—a sort of worst-of-all-possible-worlds scenario.

So is there an alternative if DVD-Audio turns out to be a system only a mother could love or (more likely) the process of arriving at a final specification drags on for years? There are several obvious existing ones. DTS has been releasing multichannel CDs for a while now, using its data-reduction system to shoehorn six channels into the space normally occupied by just two. The quality is variable, but that's a function of the mix, as the system itself is quite good. Unfortunately, DTS on CD also forces dual inventory. DVD-Video? Pretty much the same situation. High quality is possible, but you do need a DVD player. It's not going to work in your car or your portable CD player. And though this problem can be circumvented by Dolby Surround encoding ordinary CDs, the performance is obviously inferior to what can be achieved with a discrete-channel system.

But what if there were a matrix encoding scheme that could approximate the performance of a discrete-channel system while maintaining full compatibility with ordinary two-channel stereo? That could give us now on CD something close to what DVD-Audio promises, when and if it arrives. The kicker is that such a system exists. At AES, Lexicon was demonstrating an encode/decode version of its Logic 7 system. In direct comparison, discrete and Logic 7 versions of the same five-channel recordings were difficult or impossible to tell apart. As a bonus, Logic 7 decodes Dolby Surround better than Pro Logic does. Logic 7 can be so much better than those systems because they were developed 20 years ago, long before DSP became cheap and plentiful. So maybe matrix encoding, born in the analog era, isn't dead after all, thanks, ironically, to the progress of digital.

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Kessler Cant, Toole Tribute

Dear Editor:

I don't usually read hi-fi magazines, although at one time, many years ago, I used to be an audio enthusiast. Recently, however, I found your 50th anniversary issue (May) lying on a table and leafed through it, hence my letter.

Ken Kessler and his articles are not new to me, as it was he and others of his ilk who drove me away from the purchase of audio magazines in particular and the hobby of hi-fi in general. It is hardly surprising that the public takes no interest in high fidelity when sneered at and insulted by such self-serving, elitist drivel. Kessler has spent years perfecting the dubious art of rambling on at length about equipment that very few can afford and considerably fewer would even want, wondering why only others of his own scant technical knowledge and intellect are foolish enough to listen to him. You do your magazine a serious disservice by including his particular brand of nonsense.

In sharp contrast, the article by Floyd E. Toole ("The Future of Stereo, Part I") in the same issue was of high caliber and interest and has encouraged me to seek out the second part of this article (June) on the illusion that continues to elude us. It is well-written pieces such as these that will attract (to quote Kessler) "civilians" and encourage those of us who have fallen by the wayside to once again become audio enthusiasts.

David J. Millea-Hunt
Denton, Tex.

Comin' Back at Ya

Dear Editor:

I find your reviews of surround sound decoders mostly excellent except for the failure of the reviewers to comment on a performance characteristic that every enthusiast should be on the lookout for when evaluating any Dolby Pro Logic or Pro Logic-compatible surround sound decoder: its ability to convincingly portray *back-to-front* movement. I do not mean the fast jet flyovers but, rather, the slow, gradual transition of sound from the rear to the front, as found in some of the submarine scenes in *The Hunt for Red October* or the movement of the probes in the opening scenes of *The Empire Strikes Back*. I believe there are other movies that have this type of panning.

About 10 to 11 minutes into *The Hunt for Red October*, the U.S.S. Dallas gradually fills the picture frame and then slowly disappears into the distance. Most decoders portray this with a diffuse, enveloping rumble followed by a hard frontal sound. Front-to-back pans can be executed by all the logic-steered surround sound decoders that I know of, and even by passive decoders. However, many Pro Logic and Pro Logic-compatible decoders, including some high-priced ones, fall flat when called upon to execute convincing back-to-front panning of the type of sound described.

However, a properly designed decoder (analog or digital) would initially present a distinct surround image that would grow in intensity and then make a gradual, seamless transition to the front, thus helping the viewer imagine that the submarine had passed overhead. And similarly in *The Empire Strikes Back*, the rear-to-front movement of the probes.

Among the budget models, the Pro Logic decoders manufactured by SSI Products and those marketed by Paramount Pictures are very adept at executing such pans. Even my fast-steering and generally superior decoder is outperformed by my budget-priced Paramount Pictures FX 3300.

I would request and hope that in future issues this aspect of a decoder's performance be investigated and commented upon. I hope this will also get the attention of manufacturers of surround sound decoders.

Leopold Tamakloe
New York, N.Y.

Indirectly Direct

Dear Editor:

Time to put Anthony Cordesman out to pasture: He seems to be semantically challenged. On the first page of his July "Auricle" review of the Pass Aleph 1.2 amplifier,

Cordesman says, "The 1.2's input signal goes through a resistor to the input MOS-FET, through another resistor to a bank of paralleled output MOS-FETs, and finally through a power resistor to the load." On the next page he says, "the unbalanced input feeds the input stage directly." Well, which is it? Direct or through a resistor? And since when did a path through three resistors and two MOS-FETS qualify as minimalism?

And I take definite exception to his comment that the Aleph is rated at a maximum of 1% distortion but is "said to be well under 0.01% at most power outputs." If the manufacturer says 1%, then 1% it is. Trying to get credit for much better performance than you are willing to specify is a trick that's beneath contempt. I've grown to expect that from manufacturers but not from reviewers!

Norm Strong
Seattle, Wash.

Editor's Reply: The resistor is part of the input stage. In this context, "direct" normally means that there is no coupling or blocking capacitor in the signal path. The characterization of the design as minimalist is based on its use of only two gain stages, as opposed to the more typical three or four. Regarding the distortion specification, I think you are unduly harsh. Many amplifiers produce very low distortion until they approach clipping, which means that if only the distortion at clipping is given, you will get a misleading picture of the amplifier's performance under more normal conditions. This problem can be dealt with either by specifying distortion at more than one output level (as Pass has done) or by pegging the rated power somewhat below the actual clipping level.—*M.R.*

Hit or Myths

Dear Editor:

I am writing with the hope that my comments will have some impact on the audio industry, and because this is *Audio*'s 50th anniversary. *Audio* began more as an engineering journal than as a consumer-oriented magazine. For at least the first 30 years, it remained engineering-oriented, even though it leaned more and more toward the consumer. During the last 10 years, *Audio* has become mostly consumer-oriented. Why is this important? Because consumer audio is currently riddled with misinformation and *Audio* has become a major contributor to this misinformation.

Audio is an odd mixture of rigorous testing, well-documented articles written by knowledgeable people, and a lot of silly speculation by a variety of people, many of whom should know better. Because of this, it is difficult to know what to believe when reading *Audio*. Some other publications engage in a much higher degree of silly speculation than *Audio*, and some even have an obvious anti-science bias.

It is difficult for a consumer to get good information about audio equipment these days, especially about high-end audio equipment. I have compiled a list of what I consider to be 21 high-end audio myths (see below). These myths are commonly stated in the pages of many high-end publications, and many salespeople in high-end audio salons throw them around as conventional wisdom. It's amazing the number of consumers who believe these ideas! I would challenge anyone to provide good empirical

evidence that these are not myths, using good scientific methodology. I stress the use of good scientific methodology because it is painfully absent from most of the material presented to audio consumers.

For those who would like to get a better understanding of just how bad things are in audio, I suggest the following books: *Fads & Fallacies in the Name of Science*, by Martin Gardner, and *False Prophets: Fraud and Error in Science and Medicine*, by Alexander Kohn. These books discuss pseudoscience, various types of legitimate scientific error, and forging, trimming, and cooking of data (cheating). All of these problems, except maybe cheating, are currently appearing regularly in the pages of most audio publications. For those who feel that science is not an appropriate method of evaluating audio equipment, I recommend another book, *The Common Sense of Science* by Jacob Bronowski.

It is interesting that *Audio* has published articles such as *Flying Blind: The Case Against Long-Term Listening* by Tom Nousaine (March) while it continues to run the "Auricle"-style reviews that were debunked in Mr. Nousaine's article. This is typical of the mishmash we consumers are constantly subjected to in the audio press and retail establishments.

I have targeted *Audio* for this letter because it is the only publication that has a large circulation yet still retains some of the engineering philosophy that is necessary for a publication to be able to present information that has any sense of accuracy or integrity.

The following claims have never been proven with any controlled experiments, and in fact, experiments have been done that disprove most of them. Some do not even make sense from a logical perspective.

1. More expensive equipment necessarily sounds better than cheaper equipment.

2. The sound of equipment is determined by design philosophy and not measurable distortion. In fact, the better the sound, the worse the measurements.

3. Controlled listening tests do not work with audio equipment. They stress the listener so that he cannot hear differences that really exist. Only uncontrolled tests are valid.

4. All else being equal, high levels of negative feedback will make a component sound worse than lower feedback levels.

5. Simple circuits (e.g., single-ended tubes) will sound better (i.e., purer) than more complex circuits because there is less in the pathway to change the sound.

6. Class-A amplifiers generally sound better than Class-AB amplifiers.

7. One of the biggest problems with the sound of digital equipment is jitter.

8. With digital recordings, 16 bits and a 44.1-kHz sampling rate are inadequate for good reproduction. Recordings made with 20-bit A/D conversion and 96-kHz sampling rates sound far superior.

9. Cables and other electronics need time to break in and will sound much better after the break-in period. This effect is more obvious with better-sounding (i.e., more expensive) equipment.

10. If a product sounds better, it *is* better.

11. Tube equipment is generally superior in sound quality (smoother, more liquid) to transistor equipment.

12. Transistors often sound hard, etched, and glaring, compared to tubes.

13. Analog audio (especially the vinyl LP) sounds better than digital.

14. Any audiophile with good hearing and enough experience can tell the difference in sound between any two components, no matter how good they are.

15. There are some reasons why a piece of audio equipment might sound good that have nothing to do with the laws of physics.

16. Some aspects of electronic audio components can affect the "pace and rhythm" of reproduced music.

17. A faster woofer will generate better bass than a slower one.

18. MOS-FETs sound more tube-like than bipolar transistors.

19. Components must be thoroughly warmed up to sound best.

20. Components should be matched in quality (read that as price) for the best sound. In other words, if your amp, preamp, and speakers are at the high end of the price spectrum, your cables, CD player, and other components should be also.

21. A whole range of theories, none of which are based on resistance, capacitance, or inductance, are the basis for audio cable design. Each designer claims that *his* cable design, based on *his* theory, is superior in sound quality to *all* others.

Charles Butler, Ph.D.
Miami, Fla.

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Pure silver wiring and proprietary INPOL circuitry are used throughout the Twin Towers integrated amp. A Class-A hybrid design with a tube input stage and transistor output stage, it is rated at 30 watts per channel into 8 ohms, with less than 0.5% harmonic distortion. All components, including the 23-step volume potentiometer, are said to have been chosen after lengthy listening evaluation by musicians and audiophiles. The striking Italian design incorporates vertical, fan-assisted radiators to dissipate heat. Price: $4,900. *(Pathos, c/o Hi-Fi Forum, 800/771-8279)* For literature, circle No. 101

UNIVERSAL REMOTE CONTROL

There are 25 macro buttons, each capable of sending up to 10 commands (including on/off power sequences), on the Home Theater Master SL-8000 preprogrammed universal remote. The SL-8000 can draw upon a database of more than 1,000 audio/video components, including high-end units, for its operation and will control as many as eight separate A/V components. Easy use in the dark is enabled by back-lit buttons and a liquid-crystal display. Price: $99.95. *(Universal Remote Control, 914/235-2610)* For literature, circle No. 102

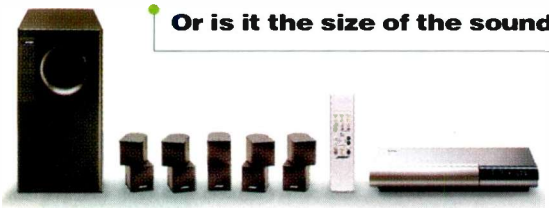
SONY DVD PLAYER

Separate lasers, optimized for CD and DVD playback, are used in the DVP-S3000 DVD player, which also incorporates a 10-bit video D/A converter to minimize digital artifacts. A 32-bit microprocessor is said to yield superior slow motion, frame-by-frame advance, and high-speed scanning. Horizontal video resolution is specified at greater than 500 lines. The player includes composite and S-video outputs as well as coaxial and optical digital outputs for connection to 5.1-channel Dolby Digital (AC-3) decoders. Price: $599. *(Sony, Sony Dr., Park Ridge, N.J. 07656)* For literature, circle No. 103

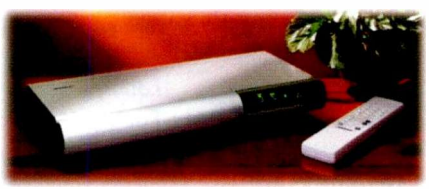
As you begin your search for the ideal home theater audio system, ask yourself what's important:

Is it the size of the equipment?

Or is it the size of the sound?



It has long been assumed that bigger equipment means better sound. Not anymore. Bose® Lifestyle® systems allow you to enjoy better sound with less clutter, less equipment and less complication.



• A single, 2⅝" high music center replaces an entire rack of electronics and includes a built-in CD player and AM/FM tuner. • Tiny Jewel Cube® speakers are about the size of a computer mouse. And hidden away out of view is the Acoustimass® module for purer, more natural bass. Your favorite music, movies and sports programs will come to life in a way you simply cannot imagine. • *Home Theater Technology* summed it up by saying, "Everything is included and carefully thought out.... The performance is awesome."* • Please call for your complimentary guide to our Lifestyle® music and home theater systems, and for Bose dealers near you. Then compare the size of Bose sound to the sound of the biggest equipment you can find.

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Better sound through research®

1-800-444-BOSE Ext.599 www.bose.com

CIRCLE NO. 6 ON READER SERVICE CARD

WHAT'S NEW

ENERGY SPEAKER

Using two 5-inch polypropylene cone woofers and a 1-inch multi-laminate dome tweeter, the AC-300 center-channel speaker is said to be a high-performance design providing a suitable timbral match to Energy's front-radiating Connoisseur and bipolar Audissey models.

A vented system, the AC-300 has gold-plated terminals for biamping and is rated for amplifiers as powerful as 175 watts per channel. The 3-dB-down low frequency is specified at 47 Hz. Price: $400 each. *(Energy, c/o Audio Products International, 416/321-1800)*
For literature, circle No. 105

B&W SPEAKER

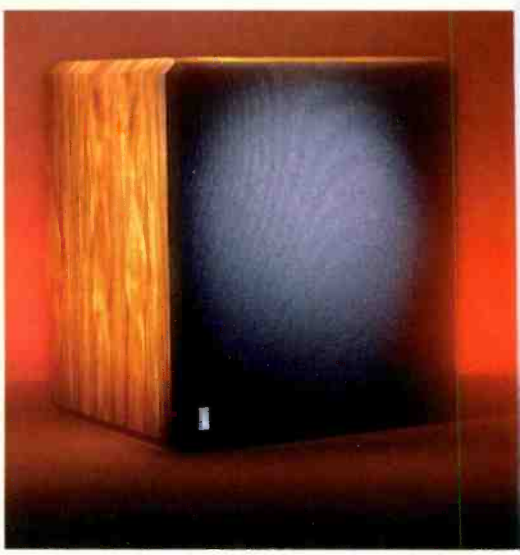
Like its stand-mounted sibling (the CDM 1), the floor-standing CDM 7 has a canted upper baffle that is said to eliminate high-frequency reflections and promote fine imaging. A vented system with a footprint the size of a magazine, the CDM 7 uses a 6½-inch Cobex-cone woofer and a second 6½-inch bass/midrange driver, the latter with a long-throw, woven-Kevlar cone. A 1-inch metal-alloy dome handles frequencies above 3 kHz. Frequency response is specified as 40 Hz to 20 kHz, ±3 dB, with 6-dB-down points at 30 Hz and 30 kHz. Price: $1,800 per pair. *(B&W, 508/664-2870)*
For literature, circle No. 106

MISSION SPEAKER

To celebrate Mission's 20th anniversary, worldwide production of the 750LE (Limited Edition), a mini-monitor with a 5¼-inch woofer and 1-inch fabric-dome tweeter, will be limited to 7,000 pairs. The woofer's cone material, Aerogel, is said to provide exceptional midrange clarity, and the inverted arrangement of the tweeter below the woofer was selected to yield optimum vertical dispersion and time coherence. The enclosure, made of 1¼-inch-thick medium-density fiberboard, is finished in burnished rosewood. Price: $500 per pair. *(Mission Electronics, c/o Denon, 973/575-7810)*
For literature, circle No. 107

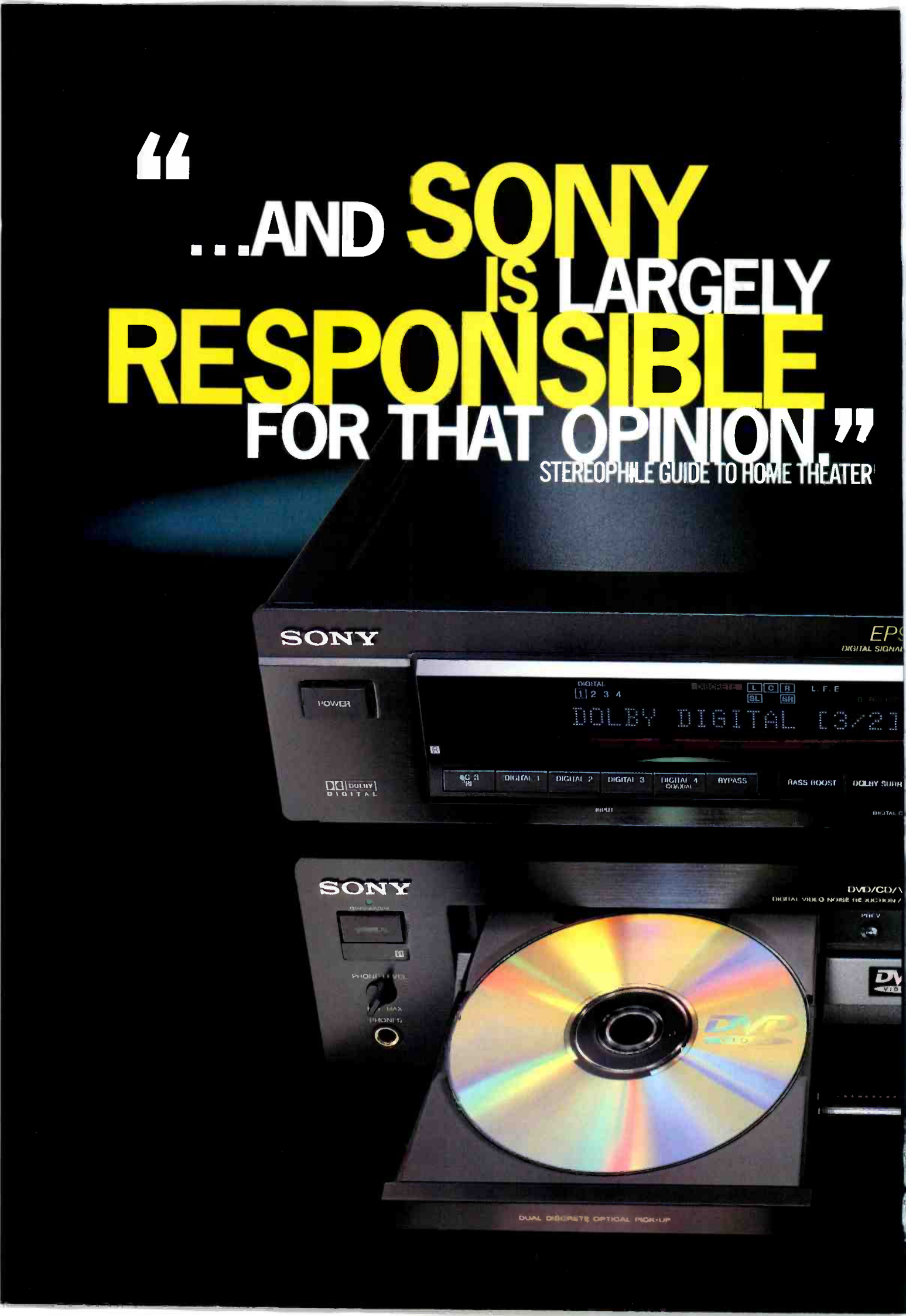
Bag End Subwoofer

Intended for home theater or stereo systems, the Infrasub-18 uses an 18-inch cone driver in a sealed enclosure powered by a built-in, 400-watt amplifier. The amp's Extended Low Frequency (ELF) dual integrator circuit electronically boosts the driver's response below resonance to yield a flat acoustical response that Bag End says extends to 8 Hz, a full octave below the lowest audible musical note (16 Hz). Though 8 Hz is inaudible, the company says this design improves phase response. Price: $3,295 in rosewood (shown) or $1,895 in black vinyl. *(Bag End Loudspeakers, 847/382-4550)*
For literature, circle No. 108



SONY

“YOU ALREADY KNOW MY HIGH OPINION OF DVD...”


"...AND SONY IS LARGELY RESPONSIBLE FOR THAT OPINION."
STEREOPHILE GUIDE TO HOME THEATER
SONY
POWER
DIGITAL
DOLBY DIGITAL [3/2]
DIGITAL 1
DIGITAL 2
DIGITAL 3
DIGITAL 4 COAXIAL
BYPASS
BASS BOOST
SONY
DUAL DISCRETE OPTICAL PICK-UP

Presenting the "REFERENCE STANDARD" in DVD Performance.

Studio-quality digital video. Multichannel digital audio. Superb convenience. Unprecedented versatility. DVD is an amazing entertainment medium — and one that imposes incredible new demands on home entertainment components.

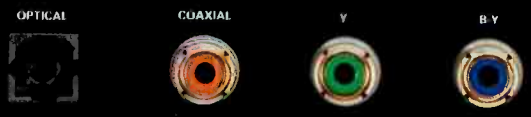
To meet these demands, Sony has created a "**reference standard**" DVD playback system featuring our **DVP-S7000 DVD Player** and **SDP-EP9ES Dolby® Digital Processor**. Taken individually, each component has won universal acclaim from the world's most demanding audio/video critics. But taken as a whole, they achieve a new level of sight and sound performance.

It was not mere coincidence that both of these components came from Sony. For years, Sony has accumulated expertise from co-inventing the Compact Disc, as well as from being one of the principal developers of the new DVD format. And Sony in-house expertise covers every aspect of DVD hardware and software, including everything from proprietary digital signal processing and laser optics to motion picture and concert video production, MPEG-2 encoding, disc authoring, mastering and replication.

Now you can benefit directly from this expertise and experience the full potential of DVD performance. Go with the only company that fully understands digital video and audio technology. **Sony – Defining the Digital Future™.**

SDP-EP9ES Dolby Digital Processor
and DVP-S7000 DVD/CD Player

DVP-S3000 DVD/CD Player



The DVP-S7000 incorporates a full complement of Audio/Video outputs.

Critics who rarely agree on anything are unanimous in praising the Sony **DVP-S7000** DVD Player. *Video Magazine* stated it "...**sets the Reference Standard**"[3] and *Widescreen Review*[4] declared it "...**our reference DVD player...**"[4] *Audio* magazine hailed the S7000 for its "**dead-on accuracy**" and found it "**the most nearly perfect video product I've had on my bench.**"[5]

Audio/Video Interiors called the DVP-S7000 "...**the hot piece,**"[6] while *FI* proclaimed that it "...**has gained a reputation with videophiles as the best of the current batch of players...**"[7] And *Stereophile Guide to Home Theater* simply concluded "...**using the Sony, I never felt the urge to change to another player. Its smooth-yet-sharp video performance results in truly film-like images and never disappoints.**"[1]

The **DVP-S7000** achieves these unparalleled results by using unprecedented technologies. There's Sony's proprietary **MPEG-2 decoder IC** for superlative picture detail, plus **10-bit video D/A conversion** to extract every ounce of tonal gradation. **Component video** outputs preserve every last drop of color resolution, while our **Dual Discrete™ optical pick-up** provides uncompromised performance for both DVD and CD. And audio circuitry straight from Sony's most advanced CD players results in sonic clarity and detail far beyond the ordinary.

Now the **DVP-S7000** has been joined by the more affordable **DVP-S3000**. It retains much of the performance and technology of its top-of-the-line sibling, including both coaxial and optical digital outputs, while adding a new feature: **Audio Priority**. This Sony exclusive automatically selects the **5.1-channel mode,** regardless of where it's embedded on the disc. Best of all, there's no need to search through menus, making it the most convenient way to play.

Whether you choose the Reference Standard **DVP-S7000** or the more accessible **DVP-S3000**, you'll enjoy DVD Video performance that's pure Sony. And you'll have the ideal companion to one of our **Dolby Digital** processors or receivers.

"...A CUT ABOVE OF FEATURES, ERGONOMICS

THE REST IN TERMS AND PERFORMANCE."

HOME THEATER MAGAZINE[2]

"THE BEST AUDIO SYSTEM WAY I'VE FOUND OF FOR THE NEW

SDP-EP9ES Dolby Digital Processor

ES

READYING AN EXISTING DIGITAL SURROUND AGE."

AUDIO MAGAZINE®

The Sony **SDP-EP9ES** Dolby Digital Processor has the critics applauding. *Stereophile Guide to Home Theater* declared that it "**offers performance that approaches the state-of-the-art in digital surround processing...**"[9] while *HiFi News & Record Review* called it "**a truly magnificent example of digital engineering...**"[10]

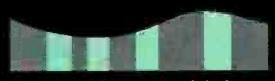
Furthermore, *Hi-Fi Choice* says that the **SDP-EP9ES** "**seamlessly blends the digital sources of hi-fi and home cinema...**"[11] And *Home Entertainment* states it "**could be the one product that finally bridges the gap between high end digital hifi and the best home cinema has to offer.**"[12]

This remarkable component brings home all the excitement, impact and control options that Dolby Digital (AC-3®) surround provides. Unlike Dolby Pro Logic® decoding, Dolby Digital reproduces full bandwidth, with **more than 90 dB** of separation between all six channels. So you hear movie soundtracks and concert videos that are more dynamic, more dimensional and more convincing. In short, it's a crucial part of the total DVD Video experience.

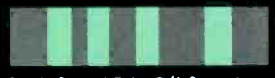
STR-DA90ESG Dolby Digital Receiver

And only Sony provides Dolby Digital decoding with a difference. For added realism, our exclusive **Digital Cinema Sound**™ modes allow you to enhance DVD playback using soundfields that are exact acoustic replicas of actual Hollywood sound stages. You'll also hear Dolby Digital as it was meant to be heard, thanks to our higher performance **24-bit digital signal processing**, as well as the same digital filters and D/A converters that are built into our acclaimed CD players.

Digital Cinema Sound



Conventional Voltage Type D/A Converter



Sony's Current Pulse D/A Converter

Plus, unlike many Dolby Digital decoders, Sony products let you customize sound parameters to match your specific room requirements, including everything from digital equalization and dynamic range compression to bass redirection functions.

Finally, no one offers more Dolby Digital solutions than Sony. Both our reference standard **SDP-EP9ES** and our more affordable Dolby Digital Processor can be connected to any Dolby Digital-ready receiver. Or choose from four receivers with built-in Dolby Digital decoding, including our new flagship, the **STR-DA90ESG**. Each boasts the full bandwidth multichannel power and comprehensive control that you expect from Sony.

It all adds up to more ways to maximize your DVD experience.

Dolby Digital Decoding with a difference.

Customize sound to match speaker placement.
- Front: Large/Small
- Center: Large/Small/No
- Rear: Large/Small/No
- Subwoofer: Yes/No

Adjust delay parameters to fit room requirements.
- Front: 3 to 40 feet
- Center: 1 to 6 feet
- Rear: 1 to 6 feet

Set volume for individual channels.
- Front L/R Balance -8 to +8 dB
- Rear L/R Balance -8 to +8 dB
- Center -10 to +20 dB/Mute
- Rear -10 to +20 dB/Mute
- Subwoofer -10 to +20 dB/Mute

Achieve the highest level of Dolby Digital performance.
- 24-bit DSP decoding
- Exclusive Digital Cinema Sound™ modes
- Virtual 3D modes
- Dolby Pro Logic backward compatibility
- Digital EQ or digital bass/treble controls
- Digital dynamic range compression
- Bass redirection function
- Calibration test tone
- Bypass mode (SDP-EP9ES, E800)
- Direct pass mode (STR-DA90ESG, DA80ES, DE1015G, DE915)
- Digital Master Volume (SDP-EP9ES)
- Multiple Dolby Digital inputs

A SUPERIOR PLAYBACK SYSTEM DESERVES SUPERIOR SOFTWARE

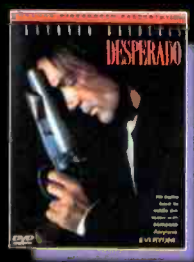
FOUR DVDs FREE!

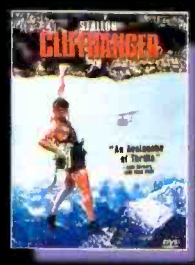
At Sony, we understand that even reference standard components require cutting-edge software to achieve outstanding performance. So if you purchase a **Sony DVD Player** together with a **Sony Processor** or **Receiver** with **Dolby® Digital decoding** between **October 1, 1997** and **January 31, 1998**, you can select **two DVD Movies** and **two DVD Concert Videos** from Columbia TriStar Home Video and Sony Music Entertainment for **Free**, from the titles listed below – **a $100 Value**. *For Coupon and more Information, see your* ***Participating Sony Dealer.***

It's just one more reason why you should demand nothing less than **Sony**, if you want nothing less than **"reference standard" DVD performance.**

CHOOSE TWO MOVIES...

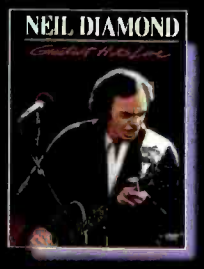
Jerry Maguire • Sleepless in Seattle • Matilda • Legends of the Fall • Desperado • Cliffhanger

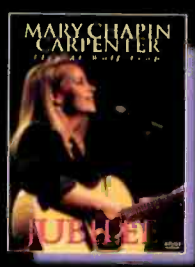




....AND TWO CONCERT VIDEOS

Neil Diamond Greatest Hits Live • Gloria Estefan The Evolution Tour: Live in Miami • Stevie Ray Vaughn Live from Austin, Texas • Mary Chapin Carpenter Jubilee, Live at Wolf Trap • Luther Vandross Always & Forever • Sesame Street Elmo Saves Christmas





SONY

Sony Electronics Inc.
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Park Ridge, NJ 07656
http://www.sony.com

AUDIO CLINIC

JOSEPH GIOVANELLI

Does Swapping CDs Damage Player?

Q *I have a top-loading CD transport and a separate D/A converter. Because I am an erratic listener (playing a couple of songs on one CD, switching to another, and so on), I worry that frequently opening and closing the transport lid might damage it.*—Eric J. Brock, West Chester, Ohio

A I can't imagine any harm will be done by inserting and withdrawing many discs during a listening session. I use a rather inexpensive player and often play short selections from many different CDs. The drawer on my player still works fine. If anything, the lid of your CD transport should be even simpler mechanically than a CD drawer. I believe your transport (which likely cost far more than my entire player) will stand up under your listening conditions.

Wiring Shielded Cables

Q *What is the best way to wire shielded cables and their associated connectors? I always wire XLR connectors so that the shields are attached to pin 1 but also to the shell. This avoids hum if I touch the shell when the equipment is operating. Where the cable has an XLR connector on each end, I connect the shield to pin 1 on both ends of the cable. Some people tell me that it is best to hook up the shield to just one end. I connect the signal return (ground) to both ends, usually pin 2. Sometimes I need to wire a cable with an XLR on one end and a phono plug on the other. I connect the shield only to the phono plug but connect the ground to the phono connector and the XLR. Is this correct?*—Donald Bisbee, Columbus, Ohio

A Let's start with your XLR-to-phono hookup. I approve of your wiring method but only if the phono plug feeds the input of a component. In instances where the shield is to be grounded at just one end, I have always made it a practice to designate that end the input end—i.e., the end of the cable that connects to an input jack of a component.

Where there is a shell ground terminal, use it just as you have. It is there to keep hum from being produced when touching the shell.

The input end of an XLR-to-XLR cable (i.e., the end that plugs into an XLR input) is usually the male connector. This, then, is the end to which the shield is to be soldered. As you said, the signal ground must be soldered to each connector. Usually such cables are used in balanced circuits. In this application, neither of the signal conductors is grounded, so they must be soldered to each end of the cable.

If an XLR cable is to be used as an extension, however, things change. In such a case, ground the shield to pin 1 on both ends of the cable. Failure to do so will mean that the shield won't be carried through.

CD Changer Black-Out

Q *When I turn on my five-disc CD changer via my receiver's AC outlet, sometimes the laser will not read any of the discs. Also, if I open the carousel drawer and press the proper disc number, instead of it closing and the disc playing in the normal way, the drawer stays open. The changer will then indicate it is trying to play the disc with the drawer open. However, if I shut the power off and then turn it back on, the problem is fixed. What is wrong here? Is my powered sub, which is close to the equipment rack, disturbing the player's laser?*—Brad Weintraub, Highland Park, Ill.

A We can be certain that the powered subwoofer is not responsible for the problems with your CD changer. I think the culprit may be insufficient AC power-line voltage. You mention that the CD changer is plugged into a convenience outlet on your receiver and that you turn the equipment on all at once, which includes the player. Have you tried turning off the CD changer and keeping it off until the rest of your hi-fi system is powered up? If so, did the player act normally when it was (separately) turned on? If it did, this means that your equipment draws enough initial current to cause a momentary drop in line voltage at the instant you turn everything on. It may be that the CD changer is reacting negatively to this and failing to "boot up" properly. If the difficulty persists even when you turn the changer on separately, then there is an inherent problem in the machine and it should be serviced by a qualified technician.

Transferring Slides to Video

Q *I want to transfer some slides to videotape and add musical accompaniment to the resulting video. I assume the music will have to be recorded on the VCR's linear track. But how do I connect a CD player to the VCR's microphone input and not overdrive it, as the CD player produces more output than the mike input will tolerate?*—Paul Davis, Torrance, Cal.

A Almost all VCRs have line-level audio inputs that will accept the output of your CD player and work just fine. If all you have is a pair of mike inputs, you can solve your problem by using attenuating cables or adaptors made for this purpose (available at Radio Shack stores or from DB Systems, 603/899-5121). Make sure the cable has appropriate connectors for your equipment.

Most Hi-Fi VCRs are designed so that the incoming audio is recorded on both the Hi-Fi track and the linear edge track, to maintain compatibility with non-Hi-Fi machines. But not all VCRs permit the audio on the linear track to be replaced after it's been recorded. To accomplish this, your VCR must have a function called "audio dubbing," engaged with a switch, in which the linear track is erased and rerecorded without harming the video.

There is no VCR that permits replacing the audio on the Hi-Fi track after the initial recording of video information. This is true even when no audio was recorded during the taping of the video. Attempting to add audio later will erase the video information.

If you wish to use the Hi-Fi tracks to record the music, you will have to time the music and the video information and record both simultaneously. You may have to fade the music as video ends. The process can become involved, and you might want a

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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.

second person to help you cue video and sound. If you use the linear track, you can do the work in short segments and rerecord the music if you make a mistake. But it still requires careful planning and timing to effect a smooth, seamless presentation.

Replacing an Old Power Transformer

Q *I am trying to get my equalizer repaired. Two technicians have told me that the power transformer must be replaced but that it is impossible to find. Is there any way to locate such a transformer?*—Stephen Russell, Sr., Tarrytown, N.Y.

A Try contacting the equalizer manufacturer, if it is still in business. Many companies keep parts in stock for seven years or more, and you may get lucky. If you can't obtain the part, try to get a copy of the service manual (you may be charged for this). The various voltages needed will be listed in the manual, and that should enable you to find a substitute transformer. Of course, the maker may not be able to provide such a manual, but you're not out of luck—yet. There's always Radio Shack, which claims to be able to repair any electronic device. See if they can fix the equalizer. If you'd rather do the job yourself, Radio Shack also sells schematic diagrams on special order. (I have even obtained some non-audio schematics from that source.)

With the schematic in hand and the required voltages shown, you can then look in parts catalogs for a substitute power transformer. It's likely you won't find an exact physical match for the old transformer; you may have to attach the new one to the back panel of the equalizer and run the leads inside. If you really like your equalizer, the extra work is worthwhile.

If the original transformer has several windings and a replacement unit cannot be located, it may be possible to find two separate transformers that, used together, will provide all the voltages you require.

If none of this works out or if you are desperate for the exact part, take out a classified ad in *Audio*.

If that fails, there is one final option: Advertise for an equalizer just like yours, same make and model. Even if it's inoperative, perhaps the transformer is good and you can substitute the good one for the bad one. Of course, if the second equalizer operates and the price is reasonable, buy it and keep the old one for spare parts.

Preamp vs. Amplifier

Q *Can you explain the difference between a preamp and an amplifier? I don't understand why an amplifier can't do the job of a preamp.*—Rob Arrabito, Toronto, Ont., Canada

A The matter of having separate components—a preamp, amp, tuner, and so on—goes back to the early days of high fidelity. Audio buffs wanted to be able to change certain parts of a sound system and keep the remaining pieces.

If you think of a modern receiver, it contains a tuner (to pick up radio stations), a preamplifier, and a power amplifier, all on the same chassis. Similarly, what some people call an amplifier is often an integrated amplifier, because it *integrates* the functions of a preamplifier and a power amplifier on a single chassis. (However, it lacks a tuner; if it had one, it would be a receiver.)

Preamplifiers and power amplifiers can be purchased separately. A preamplifier

contains all of the operating controls—volume, balance, tone, source selector, tape monitor, and (usually) the circuitry needed to boost the tiny output (a few millivolts) of a phono cartridge to a level (about 1 to 3 volts) that will drive an amplifier to its full output. As a low-level device, a preamp's output is not measured in watts but in volts. For this reason, a speaker cannot be connected to it. Because a speaker driver is, essentially, a reciprocating electromagnetic motor, it requires considerable voltage and current to supply the mechanical energy to pump air and fill a room with adequate sound pressure. A power amplifier generates the *power* (expressed in watts) needed to drive a speaker.

The power amplifier may have no controls other than an on/off switch. If it has any, they will likely be limited to one-time use-and-set functions, such as input level or bridged/normal operation.

Background Hiss from Speakers

Q *When my pair of mono amps is on but sitting idle (with my preamp's volume control turned all the way down), I hear excessive hiss from the speakers. I have tried various grounding methods, plugged up all the unused inputs on the preamplifier, and even moved the system to another location in my house to see if the problem was related to the AC wiring. Nothing has helped. What's wrong?*—Jason Levert, Westfield, Ind.

A Probably the sensitivity of your two power amplifiers is too great for the preamp you are using. You are hearing hiss produced by the stages that follow the volume control in the preamplifier circuit. Because they are *after* that control, the hiss cannot be reduced by turning down the volume.

If the power amps have input level controls, turn them down until the hiss disappears. Be sure you maintain channel balance. What you should strive for is a happy combination of little or no hiss and the ability to better control the volume. As it is now, most of the volume control's range you use probably is in the first quarter or third of its rotation. By reducing the power amplifiers' sensitivity, the usable range of the volume control will be expanded.

If the power amplifiers lack level controls, you can add them internally (if there's space) or externally. Or, if you're handy with a soldering iron, you can construct a simple voltage divider, which is all a standard volume control is. Inasmuch as the divider consists of two resistors for each amplifier, it's likely you will find space inside the chassis to install this simple circuit.

I would start with resistor values of 39 and 10 kilohms. (Wattage is not at all critical.) One lead of the 10-kilohm resistor is grounded; the other lead connects to one end of the 39-kilohm resistor. The remaining lead of the 39-kilohm resistor is connected to the hot terminal of the amplifier's input jack. The junction of the two resistors is connected to the wire that was originally soldered to that terminal.

This circuit will supply a 12-dB reduction in sensitivity and, naturally, hiss. If there is still too much hiss, decrease the value of the 12-kilohm resistor experimentally until you find one that's ample but doesn't force you to set the preamp's volume control so high that the preamp is overdriven. If that happens, and you still have obvious hiss, the preamp or the amps are too noisy and should be checked out.

JOHN EARGLE

DVD AUDIO UPDATE

Illustration: Marina Sagona

The first DVD format, DVD-Video, has gotten off to a good start, and I believe it is destined to be as successful as the Compact Disc has been. Just as CD has demonstrated technical advantages over the vinyl LP, DVD has comparable advantages over laserdisc—and it costs less than laserdisc. When second-generation players come on the scene, and when the software catalog reaches critical mass, sales will climb rapidly.

Meanwhile, there is much talk about a future DVD-Audio format, usually in terms of up to eight channels at a resolution of 24 bits and a sampling rate of 96 kHz. This would be a straightforward extension of the PCM audio specifications included in the existing DVD-Video standard. This is not the only possibility, however, as Sony and Philips are proposing Sony's Direct Stream Digital (DSD) bitstream recording process (see "Currents," October 1996) as the basis for DVD-Audio.

For their part, record companies are reluctant to manufacture product for a new format unless it will somehow be backwardly compatible with the existing universe of CD players. This basic requirement calls at least for a double-sided disc or, alternatively, a single-sided, dual-layer disc. In either event, the resulting discs may be more expensive to manufacture than normal CDs.

IT WOULD BE FOOLISH TO INVENT A SYSTEM THAT NOBODY IN THE RECORDING BUSINESS WANTS TO USE.

Given the many techno-musical interests at hand and their multiple agendas, it is easy to see how the definition of a primarily audio-oriented DVD format may be up in the air for some time. Even if there should be formal agreement on a standard, there is no assurance that product will be made for it. As a warning to ourselves, let us state that it would be foolish to invent a system that nobody in the recording business wants to use.

We shouldn't have to wait indefinitely to see what will happen. What we need is a bridge to the future by which certain hypotheses can be tested now. Foremost is the question: Is there really life for surround sound music without a moving picture? I am convinced the answer is a resounding "yes," but we don't know the particulars. Should the approach be one of relating recorded performances to the concert hall experience, via direct-ambient recording techniques? Or will future listeners want to be immersed in a more active sound field, like those to which they may have become accustomed via movie soundtracks?

Another big question is how many channels are really needed for music without picture. Two-channel stereo has been so finely honed over half a century that many serious music lovers believe nothing more is needed. Five-channel represents a starting point; the three channels across the front give absolutely stable imaging in the traditional stereo sense, and the stereo pair of surround channels offers numerous options for creating an ambient backdrop to the overall presentation. No height information is conveyed, however, and no hard side images are possible with the normal speaker configuration.

Fortunately, we do have that bridge to the future I mentioned, by which we can begin to investigate these questions. The discrete multichannel audio systems used for

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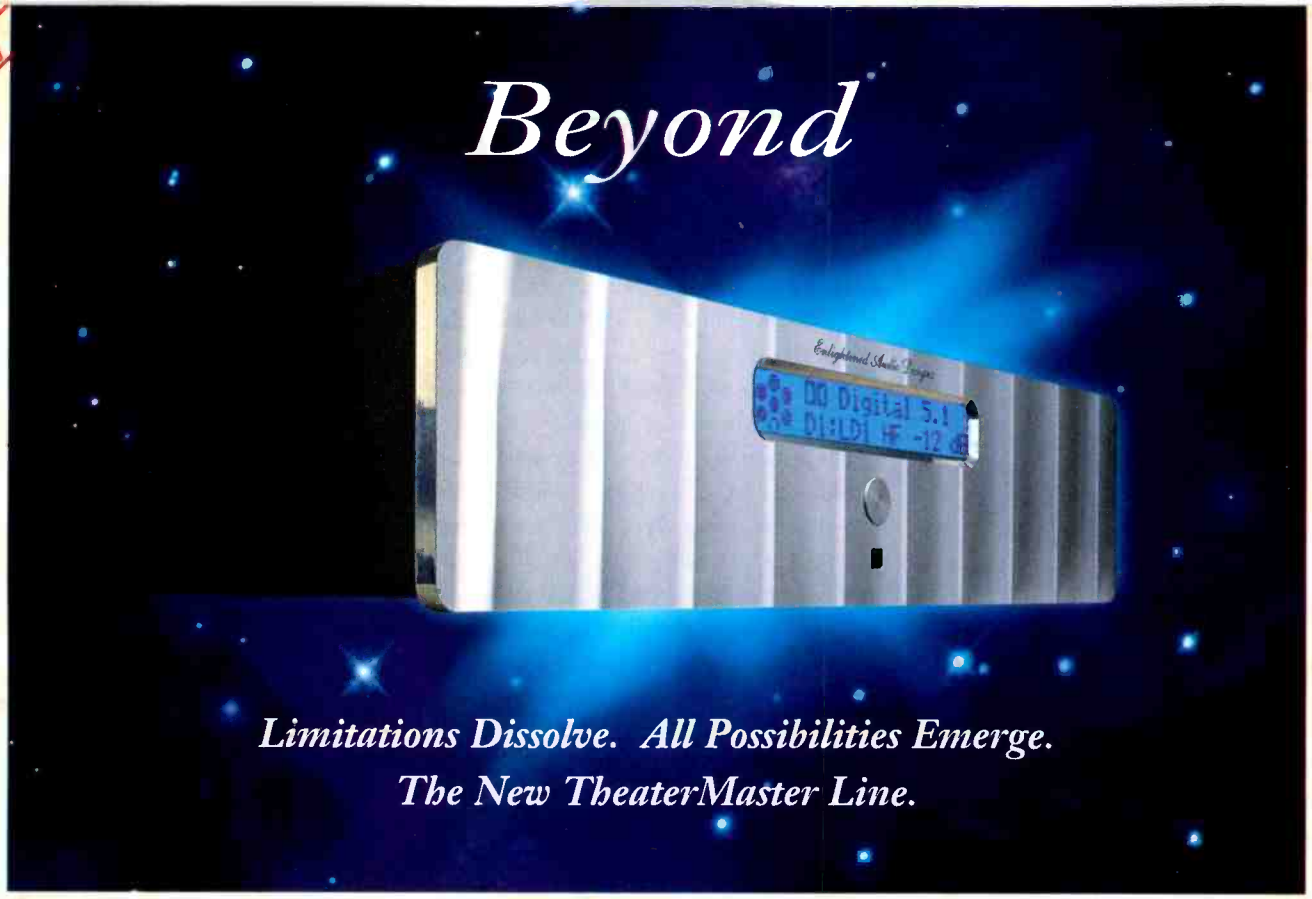

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movie soundtracks on DVD and laserdisc can also be applied to multichannel music recordings. All of these, however, employ some form of perceptual coding for data reduction, to reduce the amount of storage space required on the disc enough for five or six channels of audio to fit alongside all the video information. And that raises the question of just how good those methods of audio data reduction really are.

The answer is, far better than most people think. I have heard my own discrete five-channel mixes reproduced via Dolby Digital (AC-3), DTS, and MPEG-2 and have been aware of no artifacts at all, especially when those systems are operated at their higher data rates. This is not to say that perceptual coding audio systems are necessarily bulletproof, as classical music does not normally stress them greatly. But it is music we are concerned with here.

You can already hear some of this work in progress. For more than a year, Digital Theater Sound has been issuing 5.1-channel music programs on specially encoded CDs that must be played through the digital output of your CD player into a DTS decoder. Now, with DVD, a larger audience opens up. Home theater has given rise to a large population of five-channel loudspeaker setups that have mostly been reproducing Dolby Pro Logic decoded matrix surround. This environment, now being outfitted with DVD players, will extend true, discrete five-channel playback capability rapidly in the general marketplace.

In August of this year, Dolby Laboratories and Delos International issued a multipurpose DVD. The program consists of:

1. Tchaikovsky: "1812" Overture. Andrew Litton conducting the Dallas Symphony Orchestra and Chorus. This is a five-channel direct-ambient recording, presented on the DVD in Dolby Digital operating at a data rate of 448 kilobits per second (the higher of the two multichannel AC-3 data rates officially supported in DVD-Video).

2. Four Dolby film trailers (titled *Train*, *Egypt*, *City*, and *Canyon*) for demonstrating sound in Dolby Digital.

3. Two bonus music tracks: a stereo, 16-bit PCM version of the "1812" Overture (as issued on the Delos CD DE 3196) and a five-channel Dolby Digital version of Richard Rodney Bennett's Barcarolle for piano, played by Carol Rosenberger.

4. Audio test signals, including various reference level and channel checks, polarity checking, and swept frequencies for all channels.

5. Video test signals for determining possible crosstalk of video into the audio signal output and for determining the overall system noise floor.

There is also a "hidden" bonus track of the "1812" Overture accessible only on those DVD players that can accommodate Dolby Digital at its maximum data rate of 640 kilobits per second.

The audio portions of this DVD enable the listener to make some important comparisons. The stereo version of the "1812" is the same as on the Delos CD, but transcoded from the 44.1-kHz CD sampling rate to DVD's 48-kHz rate. Those two channels are identical to the left and right front channels in the five-channel Dolby Digital version, thus permitting a direct comparison between normal PCM (without data reduction) and Dolby Digital. And if you have a player that can handle the 640-kbps AC-3 program, you can make a three-way comparison: linear PCM and Dolby Digital at two different data rates.

As noted above, the surround sound version of the "1812" Overture is most definitely of the direct-ambient type, which I think best fits the needs of the music. The direct-ambient approach can be combined with certain special effects, such as off-stage instruments and ensembles. The works of Hector Berlioz come to mind here. As an example, Delos released earlier in 1997 a CD of the massive Berlioz *Te Deum*, recorded in New York's Cathedral of St. John the Divine. The work was originally performed in the church of St. Eustache in Paris, making use of the organ in the rear gallery, with orchestra, choir, and soloist located at the front of the church. The CD, of course, places the organ in the middle of the rest of the performers, but in the surround sound version we can experiment with putting the organ in the rear, inasmuch as we recorded the rather closely miked instrument with its own dedicated stereo microphone pair.

What I hope we can create during this interim period, before the finalization of DVD-Audio, is a public forum where the end user can participate in the evaluation processes, not only of what works musically, but of what is important technically. A

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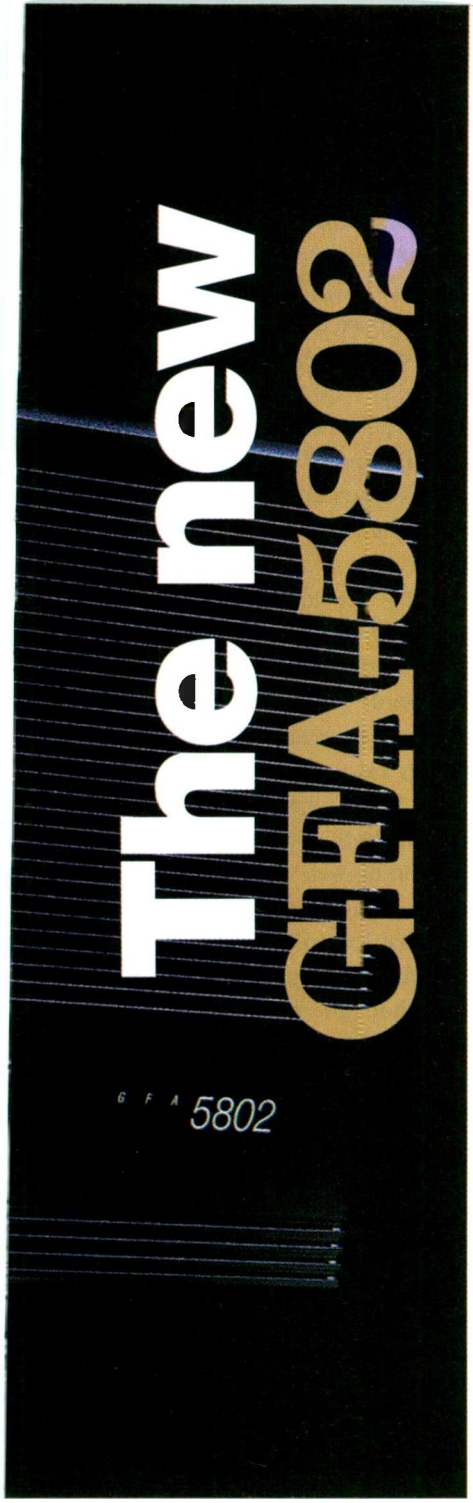

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KEN KESSLER

THROUGH THE GRAPEVINE

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Scratch a journalist and you'll find a yenta. Sorry, but it's in our nature to gossip; we are, after all, news gatherers and disseminators. And the ultimate in gossip-fests are the various hi-fi shows, where it seems that, after hours, we have nothing better to do than wallow in rumor, hearsay, innuendo, and, in some cases, lies. Fortunately, little of this stuff reaches print because libel laws and common sense keep all but the most idiotic and self-destructive of editors from publishing dangerous or hurtful stories. A mere whiff of financial ill health can cause a company to fail, even if the whiff is pure vapor. A glib journalist can wreak more havoc than one would imagine possible.

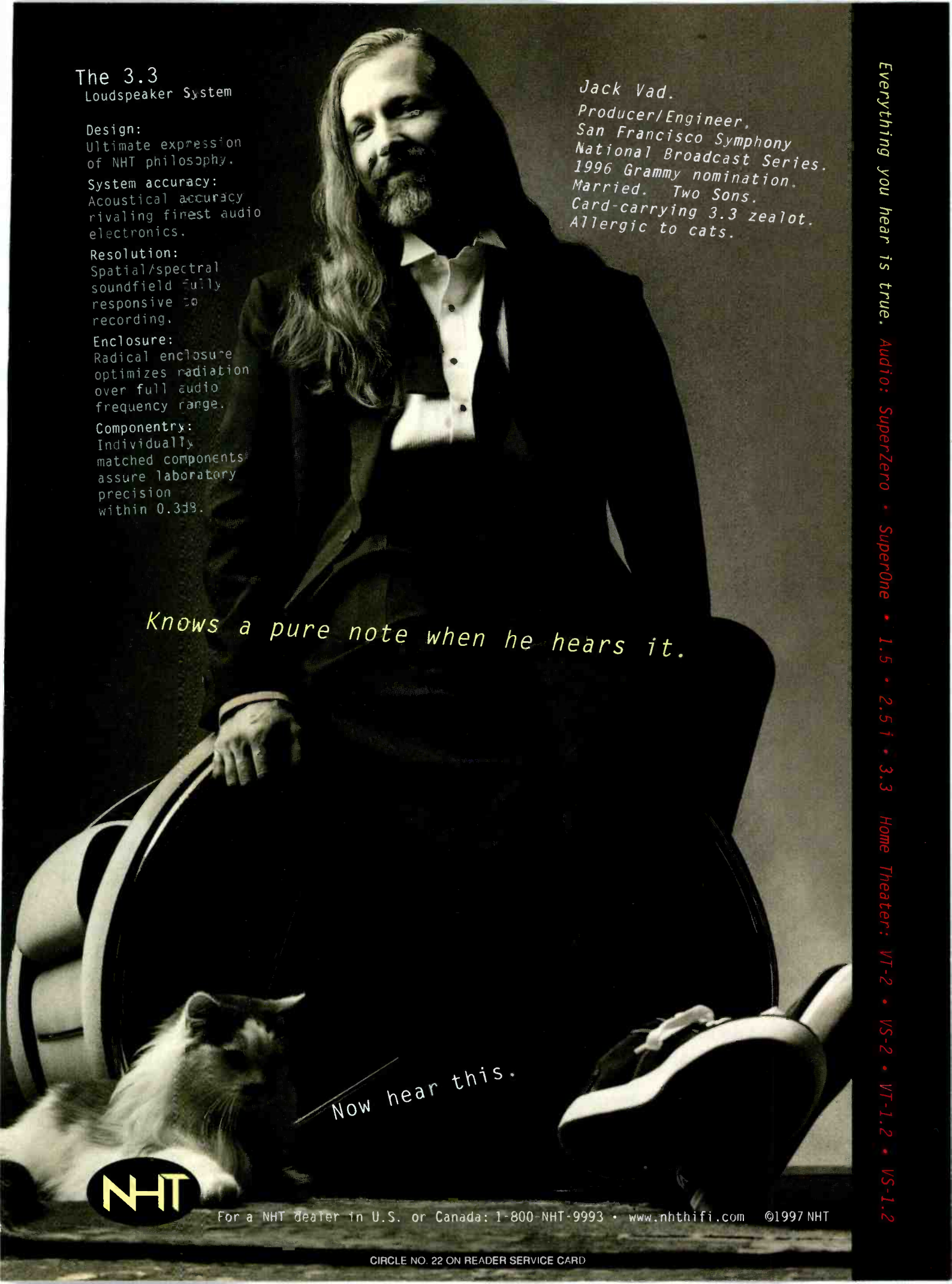
Take the latest sack of scuttlebutt to reach my ears, at the Custom Electronic Design and Installation Association (CEDIA) show in Atlanta and the Hi-Fi Show in London, in early September. Two generally reliable sources told me that word on the street had declared Mobile Fidelity a goner. Given that I had received a couple of review copies from the label just a few weeks earlier and that I had spent an enjoyable lunch with MoFi's Herb Belkin in June (he lives in the wilds of Maine, not far from my parents), when corporate euthanasia was not part of the day's subject matter, I was mildly abashed. It made me feel as no journalist likes to feel: out of the loop.

A WHIFF OF FINANCIAL ILL HEALTH CAN CAUSE A COMPANY TO FAIL, EVEN IF THE WHIFF IS PURE VAPOR.

More to the point, beyond any threat to my ego, was a feeling of loss. . .having assumed that the rumor had merit. (Gimme a break: The sources were, so I thought, impeccable.) I actually like the folks at MoFi and even like the product enough to forgive sad aberrations such as the occasional Rush or Moody Blues release. The concept of no mo' MoFi saddened me, as would the demise of any company that had been around throughout my entire career. No MoFi? Unthinkable. Was this company not the most professional and successful of all the so-called audiophile labels? Had I not just seen a MoFi-only display rack in the (decidedly mainstream) record shop in Atlanta's airport?

So I did what I had to do: I phoned/bothered the semi-retired Herb in his quiet Down East home. After enough small talk to assure him that I wasn't wearing my Total Blockhead Journalist hat, I asked him about the pending demise of MoFi. And I was rewarded with one of his huge belly laughs. I could almost see the tears of laughter welling in the corners of his eyes.

In the course of the conversation, the usual flood of truisms issued forth, reminding me that rumors are what keep the press and all third-rate manufacturers occupied at shows and in-between. For journalists, it's their meat and potatoes. Third-rate manufacturers? They gossip because their businesses are such disasters that they actually have the time to do it. Herb is too much of a gentleman to name whatever rivals he suspected of starting the rumor. Instead, he read to me the list of new releases, extending into autumn 1998. And, to further underscore the conversation, the next day's mail bore MoFi's September releases. Now, to dispel any sense of conspira-



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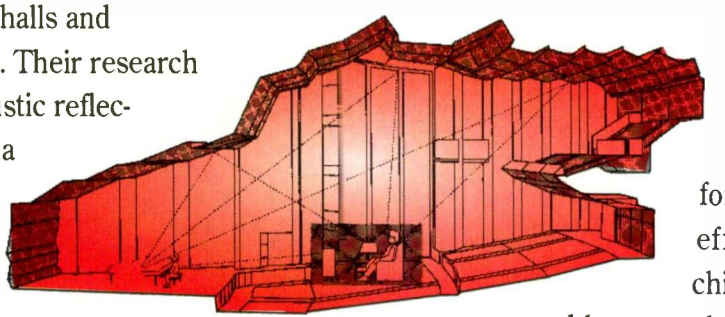

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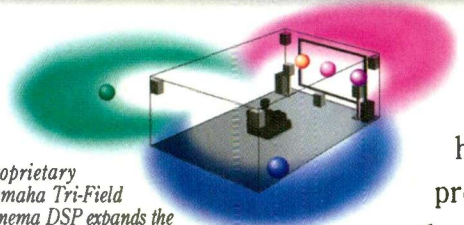

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cy, look at the facts: I live in the United Kingdom, Mobile Fidelity (the company) is in California, Herb is in Maine, and the mail from MoFi's offices was via airborne snail. Therefore, I'm certain that my conversation with Belkin had nothing to do with the sudden appearance of a couple of new releases. They were on their way before our chat; the timing was coincidental.

Of course, there's always the possibility that Herb, a far cannier, wiser, and more experienced individual than I, was pulling my chain, but I don't think so. He has more than a few reasons to think of the press as low-life, scum-sucking vermin, a notion that's enjoying increased popularity and credence following the death of Princess Diana and the complicity of the fourth estate. Although that recent tragedy is as grave as any calamity can be, and hardly comparable with whatever goes on in our industry, it did highlight the contempt in which the press is held.

A GLIB JOURNALIST CAN WREAK MORE HAVOC THAN ONE WOULD IMAGINE POSSIBLE.

Like I said, Belkin is no great lover of journalists. And yet simple trust dictates credence; I hope I'm not too bad a judge of character. Whatever. . .time will be the ultimate arbiter. But if I weren't certain at this moment that Herb was telling the truth, you'd not be reading this. What's infinitely more pleasing, though, is the closure that follows a rumor—an official press release. Herb probably doesn't deem necessary a reports-of-our-death-are-premature missive, which would only dignify the rumors. So MoFi will carry on, business as usual.

But other rumors quickly proved true. In the middle of the CEDIA show in Atlanta, it was whispered that Quad and Wharfedale had just been sold. The latter's U.S. importer seemed as baffled as anyone else. But there it was: The weekend's *Financial Times* ran the news, and you don't get much more official than that. The disclosure more than irritated those who'd heard, and in some cases repeated, the Verity Group's oft-stated intention to restore Quad to its former glory, protecting its legacy, doing the right thing, ad nauseam. (Picture me, 1940s cartoon-style, as a donkey wearing a dunce cap.) Dumping the company ASAP isn't my idea of restoring Quad to its former glory.

DVD? We heard in London that Philips had gone ahead and hamstrung the new format for Europe by insisting on MPEG sound rather than Dolby Digital (AC-3), the NTSC and de facto international standard. Journalists who attended the press conference at Funkaustellung, the massive Berlin consumer electronics fair, reported that spokespersons were seen skulking off stage when the questioning got too rough, their cowardice straight out of a Billy Wilder comedy (with the Philips spokesperson to be played by a young Jack Lemmon). Industry pundits are now expecting a scenario not unlike that of laserdisc—a miserable little cult following in the U.S. and Japan, a catastrophe elsewhere. And let no one tell you that laserdisc ever realized its true potential, even in the U.S.

A related curiosity is that Japanese DVDs have Dolby Digital soundtracks. Yet Japan is part of Zone 2, the same as the U.K. and most of the rest of Europe, which we now know has been MPEG'd. Confused? The writers of the late, lamented *Soap* couldn't have done a better job. The mess begs the question: What *will* emerge from the digital outputs at the back of a Zone 2 player? MPEG sound in Europe and Dolby Digital in Japan? Do we now have Zone 2A and Zone 2B? (*Editor's Note:* Audio coding for DVD was always broken down by television system rather than zone. For NTSC countries, including Japan, the standard for two-channel audio is Dolby Digital or PCM; for PAL and SECAM countries, it is MPEG or PCM. What held up the works in Europe was the question of Dolby Digital versus

MPEG for multichannel soundtracks, since the standard allows either. Officially, this has now been broken down along the same lines as two-channel.—*M.R.*)

More rumors suggest that consumers are importing a flood of Zone 1 (American-spec) DVD players for themselves, a black market that started before the recent pro-MPEG decision became a reality. On a personal level, I know a half-dozen industrious souls in Europe who have Yankee Doodle DVDs, only one of whom has even a peripheral connection to the hi-fi industry; naturally, most manufacturers on the eastern side of the pond have Zone 1 players in order to develop their own hardware for DVD. The rest of my comrades with gray imports are wary civilians with a passion for home cinema and no patience, who are waiting for Philips to get its act together.

More rumor whizzing around the shows had it that Audio Note in the U.K. had gone belly-up. Yet there it was, alive and kicking, with its new CD player and a couple of rooms packed with hardware. I am ill-equipped to delve into the vagaries of British corporate law; let's just say that there *was* an administrative hiccup, but some deft footwork and a forgiving bank manager has ensured that you will be able in the future to buy an Ongaku if you have nothing better to do with a Mercedes-sized budget. It was with a sense of deep relief that single-ended triode worshippers discovered that the news of Audio Note's alleged demise, like that of Mobile Fidelity, was premature.

Alas, one whisper turned out to be all too true, this one concerning a real death. Ross Keim, the 41-year-old head of Meridian's U.S. operation and the man credited with building up the company's American sales in record time, died in a car accident just weeks before the CEDIA show (and only minutes away from his home in Atlanta). It was, then, quietly appropriate that CEDIA took place in the same city where Ross lived and worked. Those who knew him were saddened by the loss, none more so than his colleagues at Meridian. A gentleman who never shed his totally Californian demeanor, even after relocating east, Ross was a class act.

Amidst a constant flow of rumors, that was the one I wish had been nothing more. A

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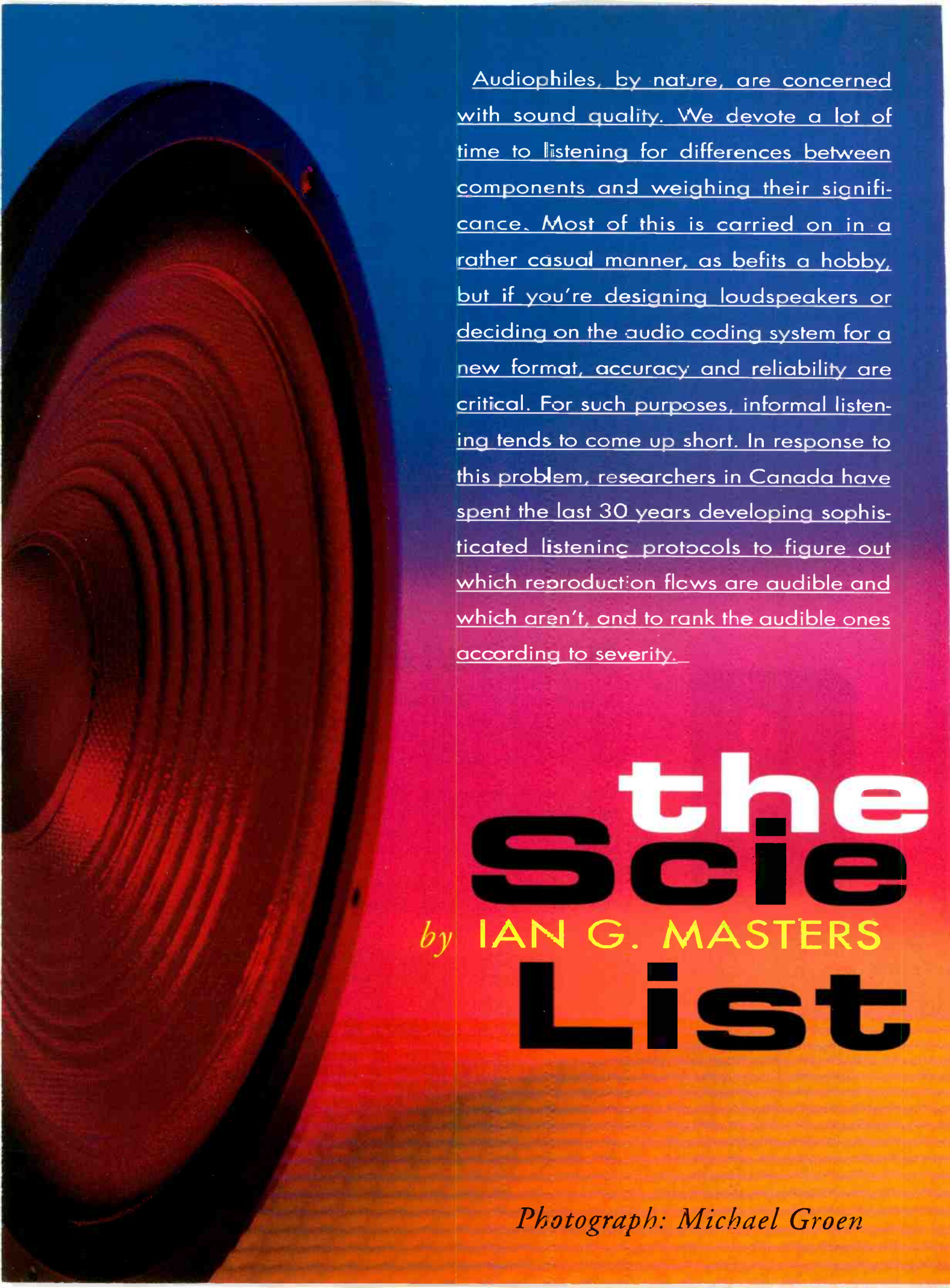

Audiophiles, by nature, are concerned with sound quality. We devote a lot of time to listening for differences between components and weighing their significance. Most of this is carried on in a rather casual manner, as befits a hobby, but if you're designing loudspeakers or deciding on the audio coding system for a new format, accuracy and reliability are critical. For such purposes, informal listening tends to come up short. In response to this problem, researchers in Canada have spent the last 30 years developing sophisticated listening protocols to figure out which reproduction flaws are audible and which aren't, and to rank the audible ones according to severity.

the Scie List

by IAN G. MASTERS

Photograph: Michael Groen

Ottawa is a government town. As Canada's national capital, it is home to numerous federal organizations and agencies, including two that have had far-reaching impact on the world of audio. Like bookends, at the eastern and western edges of the city sit, respectively, the acoustics laboratories of the National Research Council (NRC) and the Communications Research Centre (CRC).

Both agencies were set up by the Canadian government to provide research services to industry, NRC in a broad range of fields, CRC specifically in broadcasting and telecommunications. In carrying out this mandate, both bodies have done groundbreaking work in the evaluation of audio systems and equipment through controlled listening tests. And although they have been involved in very different fields, NRC mainly with consumer loudspeakers and CRC with digital encoding/decoding systems, their techniques are fundamentally similar: Both use repetitive sound samples and instantaneous A/B switching to reveal subtle audible differences.

The NRC program, run for more than a quarter of a century by Dr. Floyd Toole, had its beginnings in 1965, when Toole joined the Council and began looking for high-quality speakers to use in his research. He soon realized that there was little consensus as to what constituted a good speaker, nor were there agreed-upon standards for evaluating speakers. To remedy this, Toole began formulating a series of anechoic measurements and controlled listening procedures designed to establish correlations between the two. The goal was to produce measurements that would enable prediction of how a speaker would sound and to establish listening techniques that would reliably detect

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anomalies revealed by the measurements. Fortunately, NRC was well equipped for this work and had one of the very few large anechoic chambers in the country.

At first, the program borrowed speakers from local hi-fi dealers. That was never fully satisfactory, because the dealers could lend their products only for relatively short periods. Still, Toole was able to develop several testing protocols and to begin accumulating data that would prove useful in developing the program further.

The supply of suitable speakers increased in the 1970s as a result of NRC's association with *Electron*, a Canadian electronics magazine that was in the process of evolving into an audio-only publication. The editor realized that one of the most important features of hi-fi magazines in other countries was the test report, based on objective laboratory measurements, and he set out to find a source of such measurements in Canada. An NRC colleague who had written occasionally for the magazine suggested Toole.

It took some time to develop the test reports, but what did appear almost immediately in *Electron* was the first of dozens of articles and papers Toole would write on various audio subjects, both for that magazine (and its successors) and for scientific journals. The first of the test reports (on the Dynaco A25 speaker) appeared in 1971, and reviews based on NRC data would continue in an unbroken string until the demise of *Sound & Vision* magazine in 1996.

Accurate and consistent equipment reviews offered obvious benefits to audiophiles, but they weren't really NRC's primary mandate, which was to assist in the development of Canadian products. Speakers in those days were often haphazardly designed, in Canada and elsewhere, and it was many years before Canadian audio companies began to take advantage of Toole's expertise and facilities.

The first company to do so was PSB Speakers, in 1974. One magazine editor (me) had heard PSB's speaker and had been

Photo: Tracy Lamonica Photography

Dr. Floyd Toole, Vice President of Engineering for Harman International, in the anechoic chamber at Harman's acoustical lab in Los Angeles.

impressed enough to demonstrate it for Toole. He agreed that it had potential and suggested that designer Paul Barton come to NRC to have the speaker evaluated.

"It was a real revelation," says Barton. "I had only a crude notion of what I was doing and had no way at all of measuring what I had built. Even in the design books, the authors described crossover circuits and so forth but didn't touch on room acoustics; my first few visits to NRC were occupied mainly with learning something about psychoacoustics."

The reworked speaker that emerged from that encounter was considered by most participants in NRC's listening tests to be the sonic equivalent of some of the best imports of the day. It wasn't until the 1980s, however, that other manufacturers made the trek to Ottawa. Ultimately such brands as Energy, Mirage, Paradigm, Axiom, Waveform, and even a few non-Canadian names—Snell, when Kevin Voecks designed its speakers, and Definitive Technology—owed some of their early success to development work done at NRC.

The speaker program at NRC is mostly gone now. A few companies—including PSB, Axiom, and Definitive Technology—still use its facilities, but most have built

Both NRC and CRC use repetitive sound samples and instantaneous A/B switching to reveal subtle audible differences.

their own. And Toole himself left NRC in 1991 to become Vice President of Engineering for Harman International, parent of such brands as Harman Kardon, JBL, and Infinity. But the work goes on; in Los Angeles, Toole and Sean Olive, a former NRC colleague, have set up a testing program within Harman that picks up where they left off in Canada.

TESTING, TESTING

At the National Research Council, although procedural details might vary depending on the uses to which the data would be put, the testing methods generally conformed to those used for the magazine reviews. The usual protocol was to take frequency response measurements of speakers in the anechoic chamber, then perform controlled listening tests. These were followed by a final all-is-revealed comparison of the two.

In addition to frequency response, anechoic measurements were made of the speaker's impedance and its total harmonic distortion. A "directivity index," which reveals something about a speaker's dispersion characteristics, was also compiled. The main curves were of frequency response, on axis and at many different points off axis, because most of the major differences between speakers are spectral. Originally, a number of separate curves were drawn, but in later years computer-averaged curves (taken at many more points) indicated the direct sound that first reached a listener's ears through a 0°-to-15° listening window, the near-field reflections (taken at 60° to 75° off axis, representing sounds reflected from adjacent surfaces), and the balance of the sound radiated into the listening room's reverberant field (calculated from measurements taken at 30° to 45° off axis). A total radiated power curve was produced as well. The closer all these curves were in shape, it was found, the smoother the overall sound would be.

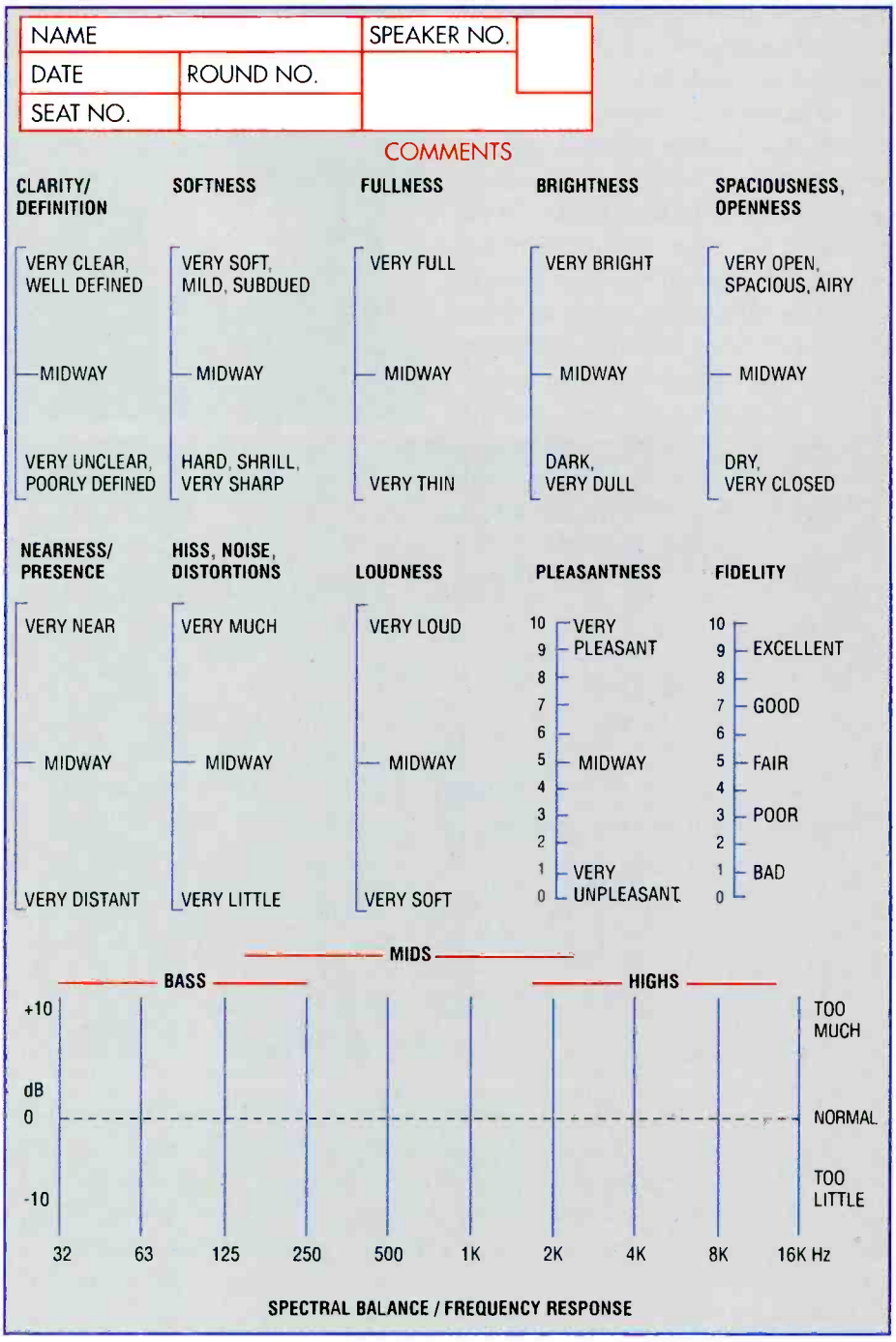
Usually such measurements were taken first and the results withheld until after the listening tests. Listening was done in a specially modified room, which ultimately became the standard for the International Electrotechnical Commission (IEC) and has subsequently been duplicated around the world. Its acoustics are typical of a normal living room.

At the back of the room, the electronics are operated by a technician; in the center are three or four comfortable, numbered chairs, depending on the number of listeners participating; at the front is an acoustically transparent but visually opaque screen, behind which are placed the speakers under test. "At the very least, it's a blind test," says Toole. "The basic principle is to allow the listeners to focus as much as possible on the sound itself and the differences in the sounds they hear, and to be prejudiced as little as possible by other factors.

"We did some blind-versus-sighted tests several years ago," Toole adds, "and the tests showed that when you saw the product you were listening to, that changed the ratings more than the sound. The hard core of us believe that, but there are still a lot of people out there who remain unconvinced."

Listening took place in a number of rounds, each about half an hour long. The

FIG. 1 — *The form used by listeners at NRC to rank speakers in blind listening tests. Experienced listeners could use the area at the bottom to draw a frequency response curve based on their impressions of a speaker's sound.*



number was dictated by the necessity for listeners to hear each speaker in the batch (plus a few extras) against each other. Also, because two speakers couldn't be in the same place when they were compared, they had to be auditioned and then swapped and auditioned again with their positions reversed. Listeners changed chairs as well.

Says Toole: "We try to ensure by repeated tests that speakers are heard in a number of typical locations; the listener positions are known, and loudspeaker locations are known, so that when different listeners offer opinions, we're sure they have heard the same sounds." (One upgrade at the Harman lab in California will be an automated system that will move each speaker into the same spot as it is selected.)

A series of musical selections are used for the test, chosen for their ability to highlight sonic differences. "Some pieces of music are very revealing of these differences, while others are not," says Toole. "Out of our program [at Harman] has come a way to classify the usefulness of music; we've improved the efficiency of our listening tests by identifying really good program material." For the magazine tests, pink noise was added at the end of the music program, which at NRC included jazz, classical, and pop selections.

A maximum of four speakers were included in each round of listening, with levels matched so that the familiar effect of louder speakers seeming better couldn't occur. An illuminated display at the front of the room indicated by number which speaker was playing, as the technician (René St. Denis) switched among them. In the beginning, the listeners did the switching, but, as Toole points out, "With multiple listeners, it's hard enough to focus on the differences in the sound without having to take care of the switching, too. Also, we found that some listeners just didn't know how to switch effectively."

During each round, each listener had to fill out a form (Fig. 1), rating various aspects of performance for each speaker: clarity, spaciousness, brightness, distortion, harshness, and so forth. In addition, the speakers had to be rated on a scale of 1 to 10 for pleasantness and fidelity (10 representing a theoretically perfect reproducer, 1, something worse than a telephone), and on each listener's form was an area for descriptive comments on how each speaker handled the various musical selections. Early on, some of the more experienced listeners also began sketching a rough frequency response curve, so an area was left to do this in the final version of the forms. As the years passed, and the anechoic measure-

FIG. 2—*Evaluation laboratory at CRC, where behavioral scientist Ted Grusec (seated) conducts scientifically controlled listening tests. The speakers are professional monitors made by State of the Art Electronik, in Ottawa.*

Photo: Janice Lang

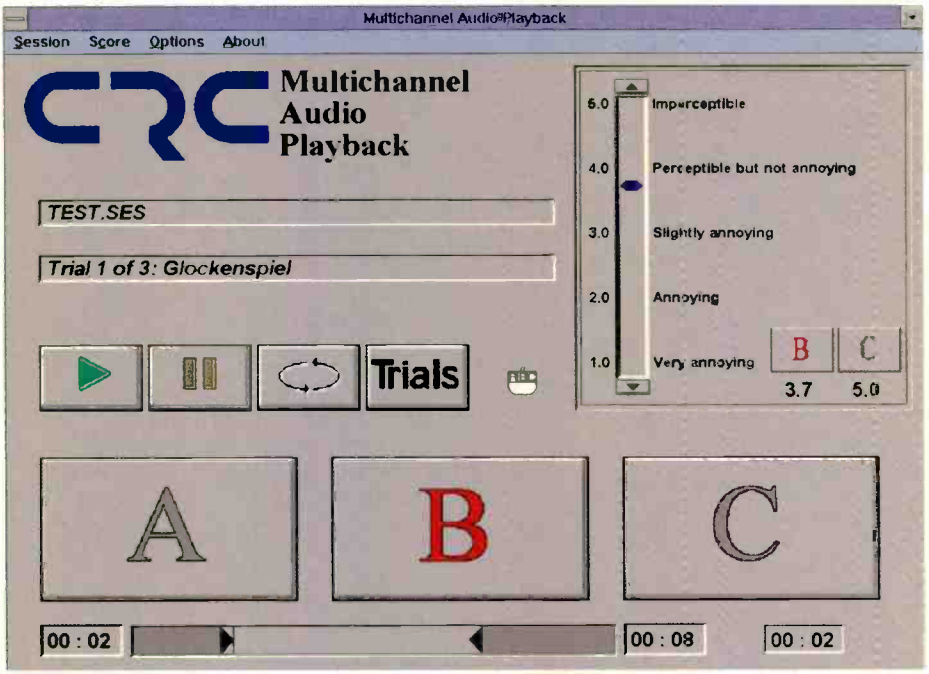


FIG. 3—*The on-screen control panel used in CRC's codec listening tests. Top left: indication of test and selection. Top right: scoring bar. Mid left: function controls (play, pause, loop, and a trial complete button). Mid bottom: the three signal selector buttons. "A" is always the direct reference; "B" or "C" is the encoded signal, with the other a hidden reference (the same as "A" but unknown). Bottom right: a timer for the current sample. To its left is the looping control that lets the subject isolate tiny bits of an audio sample for closer inspection.*

ment techniques and the listening test protocols were increasingly refined, the correlation between anechoic and listening test data grew very close.

At the same time, NRC accumulated a fraternity of listeners who had developed considerable expertise from their experience. Floyd Toole points out, "Inevitably we always have a certain percentage of new listeners, but we always have a hard core of well-practiced listeners because they give us the most rapid and most accurate scores. Their scores do not necessarily differ from those of listeners who are unpracticed, but they get the answers faster."

One innovation that has been introduced by Toole and Olive at Harman International is a method of teaching participants what to listen for. "It's a self-administered, computer-based program that runs at a pace totally determined by the listener. You actually learn to recognize what certain frequency response aberrations sound like." Sometimes these can be very subtle, but the tests do bring them out. Concludes Toole: "What happens when you start doing these tests is that you find that some listeners are much better at it than others. But all listeners improve with practice, dramatically in some cases."

HEARING NEW NOISES

Across town, at the Communications Research Centre, listeners try to evaluate differences that make variations between loudspeakers—even very similar ones—seem gross. There, the Radio Broadcast Systems Group has been doing what might be called "micro" listening tests of digital audio coding/decoding systems (codecs) since 1990.

In that year, a group led by engineer Louis Thibault and behavioral scientist Dr. Ted Grusec began a series of listening tests to compare FM sound quality to that of Musicam (MPEG), the perceptual coding system being considered for digital radio in Europe and other areas. In their report on those tests, Grusec and Thibault concluded that "audio materials processed through Musicam. . .were reliably preferred to FM, although by a very small margin." But they added, "FM signals used in the comparison were generated under ideal conditions, which are not representative of typical FM reception by consumers." Grusec now adds that the test was seriously flawed by the lack of a proper switching facility. "Without an instant, seamless switching system, you miss a lot of [audible] artifacts. Human memory is very limited at this level; if I interpose even a slight delay in the switching, that's enough to really destroy concentration." That was remedied for the next series of tests.

Those took place in 1992, and among the participants were me, *Audio* Editor-in-Chief Michael Riggs, and *Audio* Senior Editor Alan Lofft (although representing different magazines at the time). The tests were part of an international evaluation of codecs, and even the testers didn't know what codecs were included.

Prior to those tests, Thibault commissioned a company in British Columbia, MPR Teltech, to build a computerized record/playback/switching system that enabled listeners to make "the fine-grained discriminations essential in evaluating high-quality codecs." In this system, a series of short audio samples, ranging in length from about 10 to 30 seconds, is recorded on a computer hard disk both "straight" (i.e., uncompressed) and through each of the codecs under examination. Each sample is processed by each codec, and each such combination constitutes a "trial" during the listening tests.

The participant sits in the listening room (Fig. 2), which contains a pair of high-quality studio monitor speakers, tuned to the room by the manufacturer, plus a pair of electrostatic headphones that the listener can use if he prefers. In front of the chair is a computer screen (Fig. 3) that displays three large buttons, labeled "A," "B," and "C"; selection is by means of a three-button mouse. In any trial, "A" is always the uncoded reference, "B" or "C" is processed by the codec, and whichever of those is not processed is a duplicate of the reference. Assignment of the codec is randomized between trials, so if it is, say, "B" in one trial it may be either "B" or "C" in the next.

The first task is to identify which of "B" and "C" is the hidden reference—i.e., identical to "A"—and which is the coded signal. Sometimes this is immediately obvious, but often it's exceedingly difficult or impossible to determine. To help isolate the tiny differences—and there are *always* differences between the coded and uncoded signals, even if the listener can't hear them—a "looping" function is included that permits isolation of very tiny bits of the musical sample, which then repeat over and over until the settings are changed.

The second task is to rate the coded signal, once you have identified it, on an "annoyance" scale from 1.0 to 5.0. In practice, to make sure you really have made a conscious decision as to which is which, the hidden reference must be rated 5.0 and the other 4.9 or less. Scores are automatically stored in the computer.

Listeners take part one at a time, in rounds of 15 trials each. They can take as much or as little time as they like, and, unlike in Toole's speaker tests, do the switching themselves. Says Grusec: "There's nothing more annoying than when you are listening and someone switches at a point where you were suddenly starting to hear something, and it's gone. If you don't control it, you can't focus on things the way you can under these conditions."

The system was introduced for the 1992 tests and was used again in 1995 when CRC was chosen by the Electronic Industries Association (EIA), in Washington, D.C., to conduct listening tests of the various codecs being considered for digital radio in the United States. These subjective evaluations were to complement technical tests per-

Some codecs can be identified only by looping a tiny bit—one note, perhaps, or a bit of reverberation decay.

PSYCHOLOGY & SOUND

Human hearing is an extraordinarily complicated process, which is only beginning when sound impinges on the eardrum and is turned from pressure variations into nerve impulses. From there on, it's a matter of the mind, and psychology becomes a big factor.

Harman International's Dr. Floyd Toole was originally trained as an electrical engineer, but his doctoral work was concerned with sound localization, the mechanism by which our brains use minute variations in the amplitude and arrival time of sounds to create the perception that a sound is coming from a particular direction, even if it isn't (as with a center image between stereo speakers).

Toole is still involved with this form of psychoacoustics and has recently developed a remarkable system (based on technology licensed from Cooper-Bauck Corporation) that creates the absolutely realistic impression of a full surround sound array from two speakers up front. But he is most noted for developing some of the most sophisticated speaker listening tests anywhere.

Part of the challenge is to deal with factors that really do change the sound, such as speaker location and listener position. These can be controlled in repeated tests by moving both around. The effect of program material can be determined by careful selection and listener expertise honed by training and practice. But though all these things do influence the sound we hear, their effects virtually disappear if the tests are not blind. If the listeners can *see* what they're auditioning, their judgments are significantly influenced by such factors as size or visual appeal or brand reputation rather than sonic characteristics.

That psychological reaction has been observed informally for years, and in 1994 Toole and colleague Sean Olive put it to the test. Using the methods described in the accompanying article, they performed a series of blind listening tests and then repeated them exactly but with the speakers visible. In the conclusion of the paper they presented to the Audio Engineering Society, they said: "When listeners knew what they were listening to, the opinions were dictated more by the product identity than by the sound. . . . That an effect of this kind should be observed is not remarkable, nor is it unexpected. What *is* surprising is that the effect is so strong, and that it applies about equally to experienced and inexperienced listeners."

The listening tests carried out at the Communications Research Centre in Canada, on the other hand, are *entirely* about how the mind processes sound. The audio coding and decoding systems (codecs) under test there use what is sometimes called "digital compression" but is more accurately termed "data reduction" or "perceptual coding." Examples include the ATRAC algorithm used for MiniDisc, PASC for Digital Compact Cassette, and AC-3 for Dolby Digital multichannel sound.


Dr. Ted Grusec

Photo: Janice Lang

All take advantage of the fact that our brains respond to only a relatively small part of a complex audio waveform. Certain signal components mask others—for example, loud sounds close in frequency to soft sounds mask the latter. Therefore, if a system can predict what we won't hear in a particular sound, it can discard the undetectable material or encode it with less precision, ideally without changing what we actually hear.

It's the stuff of psychology, and, although engineers are involved at every level, the CRC codec tests are run by a behavioral scientist, Dr. Ted Grusec. "Some would call the work I do 'engineering psychology.' I don't get excited about labels, except to avoid any misidentification with *clinical* psychology, since that's what most people understand as psychology. The psychology of hearing is directly involved both in the design and in appropriate testing of high-quality codecs," he says. "They [the codecs] are based on psychological and physiological research on masking phenomena. So someone with a psychology background can more readily deal with the relevant literature than someone without such background.

"It's very difficult with audio to draw a clean line between technology and psychology, because they're very intimately related," Grusec points out. "The physiology of hearing is very pertinent, so that's part of the contribution that I bring to the mix. Another was my introduction of much better statistical analysis methods than prevailed in the field before Louis Thibault and I started to do research together at the CRC. There are appropriate methods of statistical analysis which experimental psychologists are specially trained in."

Grusec concludes: "If I may be so bold as to suggest it, we have the best lab available anywhere in the world for doing the kind of tests we do, mainly because, uniquely, we have the two primary disciplines well represented: engineering or physical science, and behavioral or experimental-psychology science. Both are needed, but most labs lack the behavioral side." *I.G.M.*

formed in Cleveland and the field trials planned for San Francisco.

The Musicam codec came out on top in those tests (as, it turns out, it had in 1992 as well). But in codecs, bit rate is everything because it translates directly into bandwidth. The lower the data rate you can use and still get acceptable quality, the more you can fit in a particular chunk of the radio spectrum. In the 1995 tests, another codec was audibly almost indistinguishable from the leader but had a bit rate of just 160 kilobits per second (kbps), a substantial reduction from Musicam's 224 kbps.

LOW BIT-RATE LISTENING

For the above tests, CRC had been retained by various organizations to carry out the comparisons. This year, however, it conducted a program on its own initiative, which examined codecs operating at much lower data rates than the earlier ones. The maximum was 192 kbps, the lowest 64 kbps. The codecs came from five sources, but each could be run at several different bit rates, so each codec/data-rate combination was treated as a separate codec. There were 17 in all. Some 24 listeners took part, including me; everybody listened to nine rounds comprising 15 trials each, spread over three days.

Long before the tests commenced, however, there was a great deal of preparatory work to be done. The first task was selecting the sample materials, which were chosen specifically for their ability to "stress" the various codecs—to make them misbehave in some manner. "The [audible] artifacts we're talking about are very tiny things that occur only occasionally," explains Grusec. "I could have you listen for an hour to a given codec, and for 99% of that time you'll not hear anything. Instead, we have to isolate and focus on these little artifacts as they occur."

In the end, eight samples were chosen, including the opening of a Dire Straits cut, some sound effects from a movie, and several short solo-instrument samples. Each was then processed through each codec onto the system's hard disk.

The next job was to select the listeners. Part of CRC's philosophy is to use only expert listeners: "We're looking at strictly worst-case scenarios," says Grusec. "We're trying to detect the worst things these can do, rather than how they will be perceived in actual use. Use of expert listeners is part of the worst-case scenario."

Because of the way the test scoring is structured, it reveals not only what participants consider the audible annoyance level of the codecs but also their reliability in detecting them. Data from those who are unreliable—listeners who guess, basically—is discarded; according to Grusec, three of the 24 testers in the latest series were unsuitable. "We rarely get unacceptable listeners," he adds, "because we preselect. We get the listeners whom you'd expect to have good listening skills: recording engineers, audiophiles, and so forth."

Listeners spend the morning of each day in a training session intended to sensitize them to the sorts of audible artifacts they will encounter. In these rounds, because participants do know which is the reference and which is not, they have a shot at identifying what's going on—especially when led by a knowledgeable trainer (in these tests, research assistant Darcy Boucher). Even so, there were times during the training when there seemed to be no difference at all.

That was also true in the tests themselves, which required a great deal of concentration, especially as the artifacts were often so unfamiliar. Some samples were easy to identify, such as those with no treble or with spatial shifts; others took a long time to reveal their gravelly nature. Still others could be identified only by looping a tiny bit—one note, perhaps, or a bit of reverberation decay. Some seemed totally transparent, at least to my ears. According to Grusec, "We had exactly one listener who could identify every codec. Of the very best listeners, 99% still make errors, and there are times when they can't hear a thing.

"One major thing that has come out in our tests very strongly is that different people really do hear in different ways," Grusec continues. "The sorts of artifacts that coding systems throw up are new, and no one has heard them before. Even when selecting critical material, with three or four superexperts listening, they'd argue with one another about the nature of the artifact."

Such specific differences tend to show up in the learning phase rather than the tests themselves, which rate only an annoyance level, but Grusec points out that so far there hasn't been much opportunity to include descriptive reactions in the test results. "We're restricted in the amount of time we can impose on listeners. It's something that we want to do, and in fact we are going to. But we can't do it in the present context."

The results of this series of tests are keenly awaited by broadcasters in Canada and elsewhere and will be published early in 1998. Grusec hints, however, that readers will be surprised at how very well some of the very low-bit-rate systems do.

Toole's blind-versus-sighted tests showed that seeing the product you were listening to changed the ratings more than the sound.

But if the differences between the good codecs are so tiny, why go to so much trouble to identify and rate them? "These things that are so hard to perceive except under special conditions can accumulate and suddenly become big," says Grusec. "Because all our networks won't be fully digital for some time, signals will have to be decoded and recoded; you do that a few times, and suddenly these artifacts are no longer tiny.

"There is a gracefulness to the kinds of differences that occur among very high-quality loudspeakers," he concludes. "It's not that any of them are unlistenable but, rather, that they have frequency nonlinearities, colorations, and so on—all relatively subtle and pervasive over wide varieties of music. By contrast, when codec distortions become amplified in real broadcasting, they really grate, and listeners would truly object, especially audiophiles." A

"I'd Give It ...If Celestion Hadn't Beaten Me To It."

—D.B. Keele, Jr. on the new Celestion A3, *Audio* August 1997

As more and more sophisticated technologies arrive that are capable of reproducing music with unbelievable detail and nuance, the performance bar is inevitably raised for loudspeaker manufacturers.

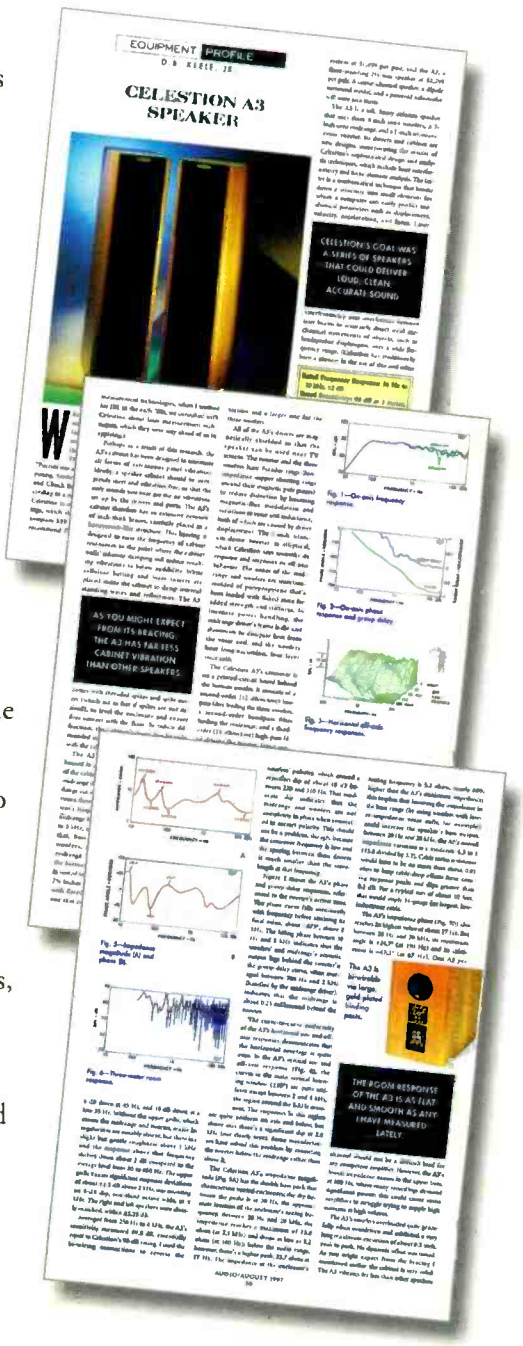
"THE ROOM RESPONSE OF THE A3 IS AS FLAT AND SMOOTH AS ANY I HAVE MEASURED..."

And no company has set the bar higher than Celestion with our new A Series loudspeakers. A fact clearly noticed by D.B. Keele, Jr. in the August issue of *Audio* magazine.

No matter what source materials he selected, from Mozart symphonies to movie soundtracks, Keele was amazed by the A3's performance. He wrote that **"their dynamic range and effortlessness border on the best I have ever heard"** and that **"their imaging and localization could not be faulted."**

Even more impressive was what happened when he compared the Celestion A3s to the reference speakers in his home system, remarking how the Celestion A3 **"exceeded the dynamic range and bass output,"** of his reference speakers while noting that the A3s **"costs less than half as much."**

But our intention with the Celestion A3, and the entire A Series, was not to provoke comparisons but to set standards. All of the drivers are totally new designs. The tweeters, for example, are based on Finite Element Analysis, a Celestion R&D method that ensures greater consistency and superior acoustics.



AN A...

For the drivers, Celestion uses Faraday Rings that optimize dynamics by stabilizing magnetic flux, increasing output and reducing distortion. The injection molded woofer cones are specifically strengthened around the voice coil to achieve greater accuracy across the entire frequency range.

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In fact, there is so much advanced technology in our new A Series loudspeakers it fills a White Paper. Call us and we'll send you a free copy as well as full literature on the speakers and copies of the *Audio* review.

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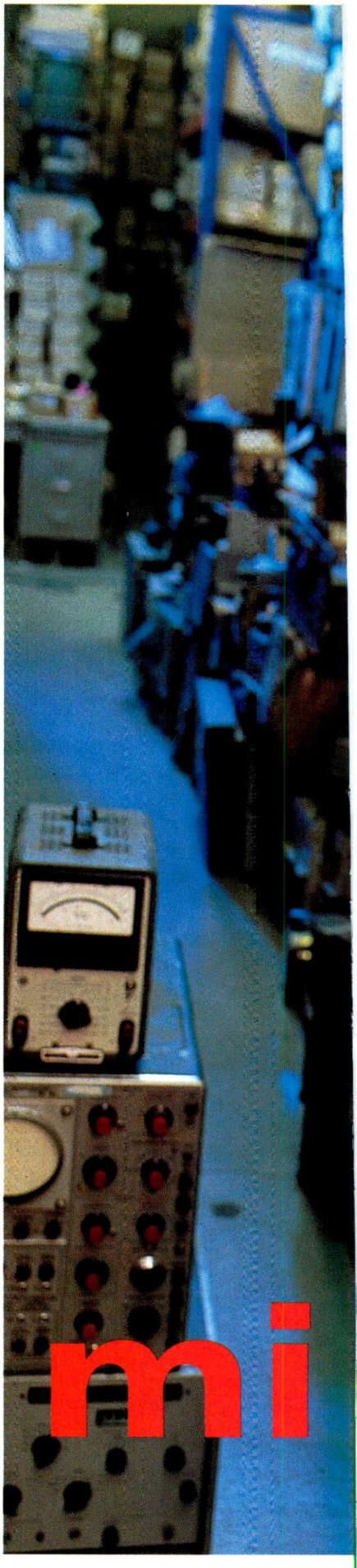
CIRCLE NO. 64 ON READER SERVICE CARD

BY D. W. FOSTLE

MIKE MCLEAN, BERRY GORDY, AND THE QUEST FOR THE "TRUE SOUND"



AS CHIEF TECHNICAL ENGINEER, MIKE MCLEAN DESIGNED, BUILT, OR SPECIFIED NEARLY EVERYTHING IN THE MOTOWN STUDIOS FROM 1961 UNTIL 1972. AT THE END OF LAST MONTH'S INSTALLMENT, MCLEAN HAD GONE TO NEW YORK TO BUY A DISC-CUTTING LATHE, SO BERRY GORDY COULD LISTEN TO NEWLY CUT ACETATES RATHER THAN TAPES.

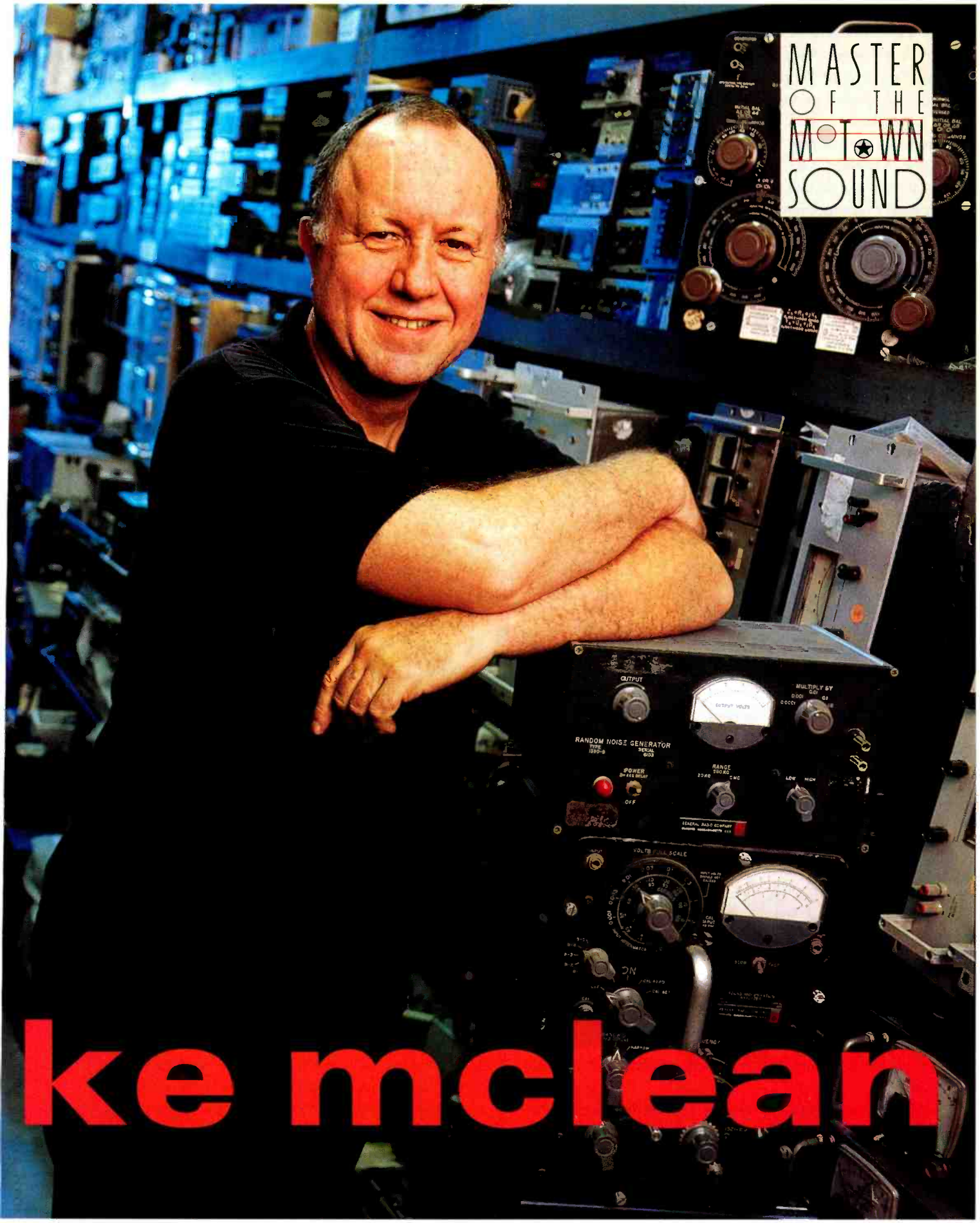
So Berry Gordy wanted to hear what was in the grooves?

You better believe it. He wanted to put a record on the turntable and drop that needle and hear what was there. It was a hell of a problem whether they would track or not. There was an incredibly crummy phonograph, just like a gum-chewing teenager might have. You know, a crappy little thing with a crummy arm and a cheap crystal cartridge. They'd put that acetate on there and see if it skipped. That was in addition to the good hi-fi Empire turntable with a Fairchild SM-2 magnetic cartridge. It was the first quality-control setup.

What was the next big challenge?

Acoustics became a problem all across the board in 1962. Berry wasn't satisfied with the sound he was getting from the studio. The acoustics were not satisfactory, and he wasn't satisfied with the monitoring. He kept saying, "I want you to fix those speakers so we get a true sound." That was what he would say, over and over again. He thought the sound was muddy, mushy, not enough definition, all blurred together. It didn't have clarity in the individual parts, which was a result of many factors: poor sound isolation, poor acoustics, improper monitoring that made recordings sound okay in the control room but not on the reference system. That drove them to use equalization, with the same results. When I say "reference," I'm talking about some system they'd played enough oldies-but-goodies on to get an idea of what it sounded like.

D. W. FOSTLE WORKED FOR MIKE MCLEAN AT MOTOWN FOR TWO YEARS IN THE EARLY '70S. DESPITE THE EXPERIENCE, THEY STILL SPEAK.



Photograph: ©1997, Stephen Harvey

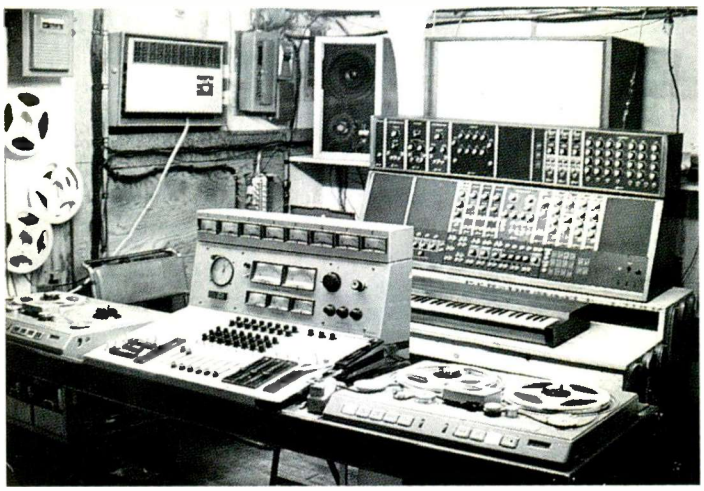
So they'd play their favorite records...

So they had a sense of perspective on that system. They learned the monitor. It went like this: "I know this record; I've heard it in my car, at the beach, heard it here, heard it there. I'm hearing it now. Now I put on this new acetate. Listen to how muddy and boomy that is. It doesn't have enough volume. Why doesn't it have more volume?" I'd say, "Berry, there's so goddamn much bass on it that you can't turn it up any louder without overcutting and skipping." He'd ask, "How come we got that much bass?" I'd tell him, "Well, somebody set the bass too high on the equalizer because there's not enough bass response in the control-room monitor." And Berry would say, "I want a true sound." I bought a General Radio 1554A third-octave analyzer because I naively thought that if I could adjust the speaker response somehow, we could get a true sound. It never occurred to me that I had no plan at all to build the equalization circuits for correction. This was five years before any manufacturer built a commercial third-octave equalizer.

Mike McLean, with the original home-brew eight-track recorder he built for $5,000.

Did Berry Gordy ever get his "true sound"?

After a lot of effort we compromised, tweaked the bass a little and pumped up the treble. When we showed a flat curve on the analyzer, it sounded terribly screechy. The cause was absorption in the room soaking up the reflected energy. Something that sounded right would have a treble rolloff. What shape rolloff is another story in itself; it took me years to figure it out.



The Motown mixing room, Detroit, circa 1967. The gear included a Studer quarter-inch stereo tape recorder (right front), a custom eight-track mixing console (center front), and an Acoustic Research AR-3 speaker (top center).

After learning it was not feasible to apply existing technology to the goal of "true sound," what did you do?

All we could do, which was to try using better speakers. We got on a kick of using Acoustic Research AR-3s. We burned out midranges left and right. Roy Allison was in charge of AR at the time. There was just something about the idea of Motown using ARs that seemed to appeal to him. He told us, "Don't worry about it. Just send us the old drivers and we'll send you new ones, no charge. I don't care how many you burn out." He sent us six of them as revolving stock.

One midrange would last about a week. They didn't last for zip until we built what we called the Super System. It had an AR-3 woofer, a Bozak midrange that was extremely robust (operating between 500 and 1,500 Hz), the AR midrange, and then the AR tweeter. It wasn't as transparent as the AR-3, but it was still reasonable and had many of the AR's merits. The guys doing the mixing used to blast that monitor. We had to triamp it to make it all work. We had a 200-watt McIntosh amp driving the woofer, and I think we had two 60-watt Macs—one for the Bozak mid and another on the AR treble section. It would handle the power—up to a point.

The whole thing caught fire once. The pigtail wires on the woofer got so hot that they ignited the baffle insulation. Somebody shouts, "The speaker's on fire!" We came running up, pulled the woofer out, and, sure enough, there was a fire inside the cabinet. So now we had to go to Roy Allison and ask him to send a few woofers out. It was insane. I would estimate that AR had to rebuild 75 to 100 dome midranges for us over four years. I'd walk into the control room, and I couldn't take it for 30 seconds. "This hurts my ears; this will damage my hearing." You come back two hours later and it's still going on. How those guys can hear anything at all today is beyond me. They ran at threshold-of-pain levels without regard to distortion. Distortion was up in the 20% range. They'd say, "We're gettin' the feel we want." Most of the producers worked like that.

So these were the conditions when a song like "I Hear a Symphony" was cut?

I'd say so.

Was the next big thing your home-brew, 1-inch eight-track recorder?

We worked on that for a couple of years. There were a lot of problems. Ampex eight-track machines were custom and cost like three Cadillacs, about $15,000. I figured what the hell, we could build the thing for $5,000. It would be fun, and why not? That was my attitude. By the time we got it finished, Motown was having all these monster hits. All of a sudden the attitude was, "Why don't we buy an Ampex? We could have it right now." Profits changed the picture.

This time we went and bought a lot of Ampex parts: motors, solenoids, the big banjo casting, and more. We made our own deck plate. The electronics had relay-switched sync. We did that a year before Scully had its Syncmaster.

Another thing we built was a big guitar amp. It had five channels, so we could take the electric instruments direct.

This replaced the Fender amps for the musicians?

Oh, yeah. They didn't have to bring any of those in. Just plug into this beast, with its high-quality flat preamp, and a Mac 30 and Altec 605A for the studio. Each channel came out as a direct feed, transformer-isolated at +4 dB on the control room's jack panel.

How did the musicians respond to that?

They probably thought it was a bit less desirable than having Fender amps there, but they sure as hell dug the fact that they didn't have to bring their amps in. It cleared things up; there wasn't as much clutter, and it made life a lot easier for the musicians. They could just walk in, plug in, and go. I think that countered any purist disadvantages there might have been from the sonic point of view. The attitude was that if there's reverb or anything needed, we'll add it later. You just play the music, and we'll take care of the rest; you're just a musician. Berry believed in specialization. To him, it was like an auto factory. The musicians will play; we'll fix it so we get true sound electronically. Then we've got the real thing right there on the jack panel—no leakage, no extra microphones.

NOTHING WAS MORE IMPORTANT THAN MAXIMUM LOUDNESS AND IMPACT, AS LONG AS THE RECORDS DIDN'T SKIP.

When did the disc-mastering capability first appear?

We spent a lot of time in 1962 on that. We had a Grampian head with a 150-watt Gotham amplifier. The cutting lathe was a Neumann AM-131. Originally this was supposed to be cutting everything, both reference acetates and release master lacquers. The Grampian was a magnetic cutter head, and it had a nice saturation-distortion characteristic combined with a very high resonance frequency. This meant that it would self-limit at high levels but still put out a lot of velocity at the high end. With a feedback cutter like the Neumann, down, down, down goes the [cutting] level capability at high frequencies. But the Grampian had a power capability that was much more uniform across the spectrum.

The Grampian was great for cutting hot 45-rpm singles. It had a nice kind of grunge distortion, just the right amount, to give a commercial zap to the sound. It had a unique, steamy-hot quality on the top end, but the Grampian couldn't reach blisteringly high levels without mushing out into excessive harmonic distortion.

It was fabulous—just the right amount of the mush distortion with that great steamy high end. Sweatless. And here would be your Neumann super-purist cutter head that couldn't keep up with the Grampian unless you went to half-speed mastering. If you want to hear the Grampian, get an original 45-rpm single of Barrett Strong's "Money (That's What I Want)." That's the sound of Grampian. If you want to cut records with that little funk thing, you can't do it more tastefully than a Grampian running about +5 or +6 dB. At the end of the vinyl era, a real hot pop LP would be cut +4 or +5 dB on the same scale. Hot Motown 45s were eventually cut at +9 to +10 dB.

What gear was ultimately used to cut the hot Motown singles?

We used a Westrex 2-B mono head on a Scully lathe at RCA Chicago for all the releases. Later we utilized a Neumann ES-59 head, driven by a Mac 200, for the references cut in Detroit. At the time we used the Grampian, Bell Sound in New York was mastering the releases on a Grampian, so we had a nice match.

Is it your opinion that the sonic qualities of the Grampian are still unexcelled for cutting 45s that cook?

When cutting at levels of about +6 dB, the Grampian added something, a tail end. A sibilant would have a little burst to it that sounded great. "Money" is a magnificent example of this. The Miracles' "Shop Around" was cut that way. It was loud, but not preposterous; it was a rational compromise. Any Motown record cut after 1964 was likely done with the Westrex 2-B if it was mono. "Hitch Hike," "Sugar Pie, Honey Bunch," and "My Girl" were all cut with the Westrex. In theory, the Westrex was garbage, but in practice it was only a little bit worse for linearity and distortion than the ES-59. Both the Westrex and Neumann systems could cut records that no stylus could track. Both could also overcut easily.

And then?

We put in a bandpass filter with ultra-sharp slopes at 70 Hz and 15 kHz. Any extra bass that's not going to add commercial impact is wasted stroke-cutting into the next groove. By 35 Hz, our response was 40 dB down. In case somebody did something stupid with the high-end EQ, we'd stop it in its tracks at 15 kHz. A 5-kHz low-pass is the fundamental characteristic of AM radio, so who cares? The main thing was the low end, where overcutting occurs.

So why didn't you master releases in-house? Why was that done first at Bell Sound and then RCA?

Either our later Neumann half-speed cutter or the Westrex 2-B at RCA could cut a record that was louder than we could possibly release, because of the limitations imposed by skipping and distortion. But if RCA cut it and there was a problem with returns, we had somebody to complain to. We could take it up to the point where Berry would say, "This is just too loud." If they'd been able to, the Motown guys would have reduced the record length to about 10 seconds to get the highest level. If there were a phonograph that could have played it and they could have gotten away with something that short, believe me, they would have cut them at +30 dB.

The only thing that stopped them was the fear that they would get returns from the stores because of skipping. Berry Gordy knew that; he used to own a record store. Distortion didn't bother the decision-makers at all. And that's an understatement.

The big problem was difference-tone intermodulation distortion caused by playback-stylus mistracking. The cutter head could put down a perfect tambourine or a castanet, but on playback the click of the castanet sounded like a crunch. Hack, hack, hack. That caused a ghastly, garbagey sound. The difference-tone IM products

garbled up the midrange with gross-sounding stuff. Basically, what Motown did was write off distortion as the price of doing business. The attitude was that it certainly wasn't worth lowering the recording level. This was not Deutsche Grammophon recording the Berlin Philharmonic. Nothing was more important than maximum loudness and impact, as long as the store didn't send it back because it skipped. The distortion level tolerated was very high by audiophile standards.

Were Motown levels hotter than other record labels'?

I would say so. I think Motown ran levels 2 to 3 dB higher than most. Others had more sophisticated ways of making the loudness in the midrange as effective as possible, and they just didn't bother to put quite so much bass and highs on. Hearing bass, midrange, and highs loud—that's what Berry Gordy wanted, and who am I to say he was wrong with all the success he had?

AS FAR AS BERRY GORDY WAS CONCERNED, STEREO WAS ASSOCIATED WITH COVER ALBUMS. THESE MEETINGS WERE ABOUT GETTING HIT 45S.

So the studio was operating on a pretty heavy schedule by the time your eight-track machine was running?

You better believe it. It was a meat grinder. We maintained a taxi that ran around the clock. We had to go over that equipment every morning. That was all vacuum tube gear. In the eight-channel recorder, each electronics package had six tubes plus all the other stuff. The Fairchild limiters had a whole bunch of tubes. They used four dual triodes in push-pull parallel in the 660 and double that in the 670. We had to keep an eye on a couple of hundred tubes each day. I had built about a dozen preamps with a 12AX7 and a 12AU7 tube in each one. That's 24 more tubes. You could almost watch all this stuff disintegrate before your eyes.

Around the time the eight-track went in, there were three isolation rooms added—on the right, as I recall, as you look out the control-room window in the Hitsville building. . . .

That's right. Once we had the eight-track machine and a greater ability to separate the channels electronically, it was a natural thing to separate them acoustically. One of the problems was that Berry was never really satisfied with the sound we got. He mentions that in his book. It was like some 1949 hi-fi bug trying to improve his phonograph. "Too boomy, too muffled, not enough definition."

I've always maintained that a significant aspect of this problem was the musical arrangement. The music has to be arranged to create sonic clarity, and I feel that the acoustics were only part of the problem. The eight-track and the direct feeds for electric instruments were all a part of the search for clarity and isolation. A fundamental premise that was never questioned was that in a perfect world we would have an infinite number of channels, and every single instrument would sound as though it were in an anechoic chamber. All of this would cause no loss of ensemble playing. If we had that, we could electrically mix for the best result possible.

I would agree that this was a legitimate goal for Motown's stuff, but it did interfere with the ensemble playing. The rooms were made out of concrete blocks, the kind you'd use to put up a gas station. There was no acoustic treatment on the walls. We had a dropped T-bar ceiling and concrete floors. The horns went into one of the rooms. Vibes might be in another, maybe a harp.

What did you do about the ensemble-playing concerns?

We built a binaural headphone system so that everyone would be able to hear a mix of the other three rooms and themselves. Each room had a separate binaural mix. The binaural mikes consisted of two E-V 636s, about 8 inches apart and separated by a 1-foot-square ceiling tile. With the 'phones on, it had all the usual "Oh, wow, it's binaural!" realism. But the musicians usually pushed one 'phone back; the realism didn't seem that important to them. Adjusting to binaural was a much bigger problem for them than adapting to the isolation. They liked to listen with one earphone and hear themselves better. Perhaps the quality of the playing suffered. Maybe a historian will study this for 20 years and be able to show that the grooves weakened. Who knows? They still cut plenty of hits.

Where were all the tracks that were recorded at 2648 West Grand mixed?

By 1964 to '65, there was a total production bottleneck with that one control room. Record, record, dub, dub. So now they couldn't get the work out. Stereo was finally beginning to become a consideration. We were big enough that it wasn't acceptable to just put out a mono LP to cover the single. This would be about the time when "Baby Love" came out.

So we had to take the pressure off the main control room and add stereo at the same time. In the Motown tradition, they decided to stick us in a crummy little room in the basement of a house three doors east of 2648 West Grand. A doctor owned the house next door. He wouldn't sell, so we had to work around him. We had to run wires up and down the alley because he wouldn't let us run them across his property.

Most of that house was filled up with offices. It was a wretched room; you couldn't get more minimal. So to get the true sound, we put in a pair of AR-3s.

We had to have an eight-track reproducer to play back our eight-track tapes. We negotiated with 3M for one of its Isoloop transports. Since 3M didn't make a reproducer, we bought the amplifier cards from them and the deck with a playback head only.

For quarter-inch tape machines, we had Studer C-37s. The very important reason for that was the Studers were available from stock, and we needed quick delivery. It was kind of pricey, $3,700 instead of $2,000. The C-37 had some idiosyncrasies that were pimpier than hell, but overall it was a good machine. There was a warmth to the sound, something about the electronics and the

heads. They were tube electronics, and something funny was going on in that department. I don't know what explains it.

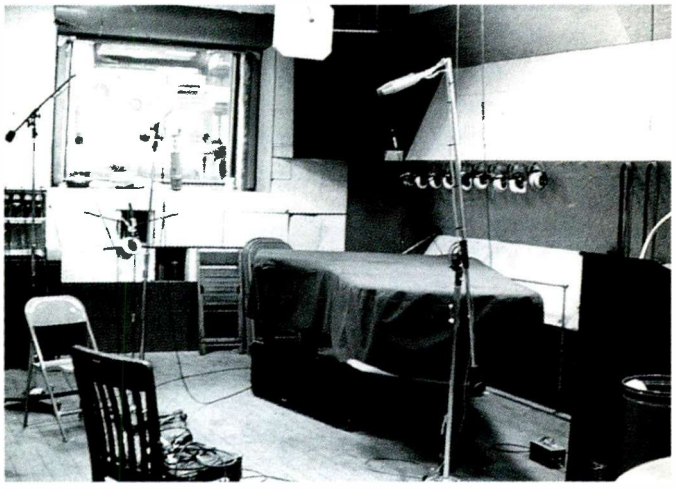
So we built up a console, a home-brew, with a frame that was heliarc-welded by Custom Metal Products, and we dropped the Studers in on either side. This provided eight channels of mixdown to stereo. Each position had three echo pots. We had three acoustic chambers now, an EMT plate, plus Fairchild spring Reverbatrons, and I think we had a Fender tape delay. There was a panpot for each track, and that's about all there was to it.

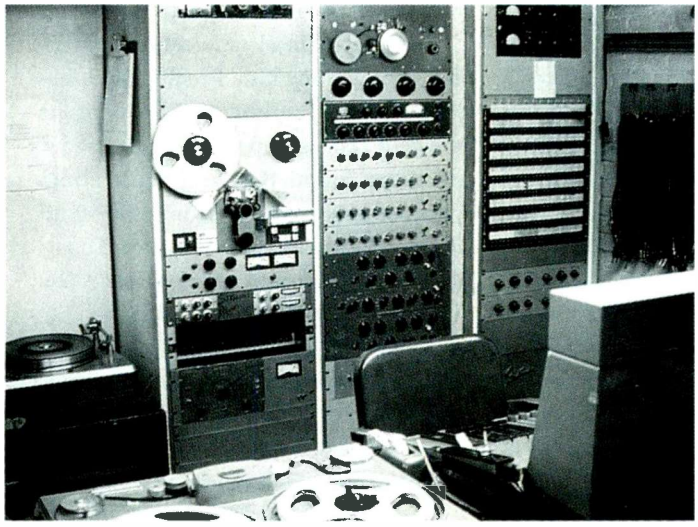
The console had a unique feature. You could turn the eight sliders upside-down. Lawrence Horn wanted that because at Atlantic Records the pots were like that. The volume was raised by pushing up or pulling down on the sliders, depending on which way you put the panel in. Otherwise it was a simple console.

Did that mix room have the first "Motown Graphics"?

We built the "Motown Graphics" for that room. Basically, this was a Langevin graphic equalizer with a gain control added. It was executed with ultra-high-quality, heavy-duty rotary switches instead of sliders—the best military grade money can buy—mounted in an extremely robust, ⅛-inch-thick aluminum chassis. It was 600 ohms, transformer-coupled in and out, with an Op-Amp Labs output amplifier. It was a kind of military-spec, Hummer version of the Langevin graphic EQ. All told, we had about 46 of the equalizers built. We used these beautiful General Radio knobs with strong setscrews and flats on the shaft. You could walk up and twist that knob with all the force your fingers could stand. It would sit there and take it like you were trying to twist the head bolt on an Allison engine. There was a big, telephone-type key that kicked the whole mess in and out. Out, there was only the line amp. This allowed you to A/B the effect of the EQ and gain settings. That was a very important feature for me.

Motown studio at West Grand Blvd., Detroit. Note binaural mike, suspended from ceiling, used by musicians for headphone monitoring.





Rear of Motown mix room, Detroit, circa 1967. The equipment included an Empire turntable (left), a 3M eight-track tape transport, a Fender tape delay (center rack, top), "Motown Graphics" equalizers (center rack, middle), and a Fairchild Reverbatron (behind chair).

What was the story on the Golden World studio?

I can't remember the address; it was on West Davison, not too far from the old garbage plant—that general vicinity. It was an old electric supply house that sold fuse boxes, conduit, and stuff. Ed Wingate bought it, and Wingate had the whole studio set up.

Ed Wingate had Ric-Tic Records, with artists such as The Fantastic Four and Edwin Starr.

Yes. The console was built by Ken Hammond, who later had a lot of credits with Telarc and was a fellow disciple of Steve Temmer, at Gotham Audio. Offhand, I'd say we bought Golden World in 1966 or 1967. Wingate was getting tired of it. He'd been a thorn in Berry's side, and Berry preferred not to have somebody else buy it and turn it into another pain. The third factor was that we could use another studio. We ended up totally rebuilding it. When we were finished, there were 16 inputs on the console, with separate fader sections for the program and monitor mixes. Along about the time of Golden World, we finally gave up on the AR speakers and decided to go back to the Altec Duplex, this time the 604-E. It didn't sound too bad, so we went with the flow. I think perhaps we had some equalizers behind the rack to nerf the Altecs up a little. Out in the studio, we had a 604-E and an Electro-Voice 30-W woofer halfway up the wall. That was a hairy monster.

Had all the idealism evaporated by the time you jettisoned the AR-3s?

No-o-o-o-o! We were still up to our old tricks. That E-V 30-W was obviously an eccentricity of the first magnitude. And then we went to all Neumann KM-86 condenser microphones: "The purpose of the transducer is to pick up the sound! It is not to provide engineers with finger paint! So we will give you identical precision instruments for this purpose. So shut up." That was the attitude.

Are you saying that the only mike available at Motown studios in the late '60s was the Neumann KM-86?

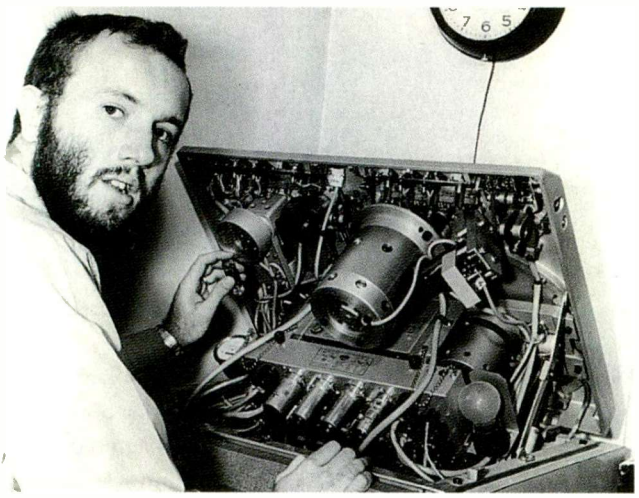
Yes. I was highly susceptible to such a concept. Everybody will have the same set of gauge blocks on Henry Ford's production line, and then the engines will all fit together. We won't have different brands of blocks. We pick the best ones, and all the toolmakers get a set. That was the basic mentality. The U-87 mikes were so beat to hell after years of abuse that they were worthless. I honestly believe the KM-86 was a better mike. It had the linear admittance capsule used in the

KM-84, with a constant directional pattern at all frequencies. That was better in theory than the 87. It had three patterns like an 87. It was smaller, and it had an elegant capsule instead of those old funk 87 capsules. The KM-86 was cheaper and was more resistant to dirt. It was bulletproof.

I was sick and tired of people dropping the mikes on the floor and rippling the membranes. Getting the U-87s repaired was a pain in the ass. When you spray spit into a U-87, it gets noisy. That was a classic problem. So the all-Neumann KM-86 approach made a hell of a lot of sense in the Ford-factory atmosphere at Motown. Berry was saying, "We want a standard system and a true sound. Everybody's gonna do this the same way. We're gonna get out our hits on this production line." Considering the policies of the company, the hit-factory mentality, this wasn't at all out of line. There have been many people who've made fun of this, but now that I'm thinking about it again, I have to say I would defend the KM-86 decision even now. There were people at Motown who didn't know how to set a mike aimed straight. That didn't motivate me to put in all sorts of esoteric instruments in order to equip them with a greater range of choices for subjective, nuance-level things in the process.

The decision to standardize on one microphone had the complete support of management?

Absolutely. I don't think senior management had a ghost of a clue about microphone subtleties. The idea was accepted without even a thought; there was no discussion. It was one of those idiosyncrasies of Motown. The KM-86 decision was made about 1969, and we bought 44 of them.



McLean servicing Studer C-37 tube tape recorder at Motown studios.

When Motown outgrew its six or seven houses on West Grand Boulevard, the building at 2457 Woodward was bought, right by the freeway. What went in there?

The studios were kept running, of course, but now we had to build all these new facilities for the Motown Center. First we built a huge, acoustically treated evaluation room. The new thinking on Berry's part was that he'd call these large meetings. He'd bring everybody into the quality-control meeting so they could get a handle on what it was all about. He was seriously trying to educate his staff. It didn't seem to bother him that he was paying all these people just to sit there, including me.

The first speaker was an Altec 604-E, and an Electro-Voice 30-W like the one at Golden World. This was still mono. As far as Berry was concerned, stereo was associated with cover albums. These meetings were about getting hit 45s. This was in '68 and '69. Then I got a couple of sound columns we had lying around, and I set them side by side, so we had eight JBL D-130 15-inch woofers with a 604-E on top. We used McIntosh 2100s for power amps. We did some incredible tests of the Mac 2100 at 20 kHz, running just at the threshold of clipping into big load resistors. That thing was 150 watts, not 105, both channels running. It ran like that for three days, 24 hours a day. Heat was coming off the amp like a register. We'd walk up to it eight, ten times a day and short the outputs. Zap, spark, zap, spark! "Yeah, it's still taking it." So we bought a bunch; it was our standard amp. Excellent equipment.

This JBL/Altec system had its own unique way of honking, and with those eight 15-inch woofers, when you got down into the region of 100 to 400 Hz, that sucker could really punch out some Fender bass notes. B-o-o-o-o-w-wwww! It put it out there in your face, all across the room. Big time.

Berry Gordy was giving how-to-make-a-hit classes with examples played through eight JBL woofers?

Yeah. He would sit there and say the same things he said in his office to his old cadre of people like Ivy Hunter and Brian Holland, that group of geniuses he had formed. Now he had this peanut gallery of people, which was all that was left. H-D-H [the hugely successful Motown songwriting team of Eddie Holland, Lamont Dozier, and Brian Holland] was long gone; Mickey Stevenson was gone. Ivy Hunter might still have been there. R. Dean Taylor was there, eager and sincere. New people who didn't have a clue were there. The original group that did all that great stuff from 1962 to 1967 became disillusioned and left.

Berry was trying to re-create things on a larger scale with 40 or 50 people. He'd sit there and play the records and make observations. I can remember him playing "You're All I Need To Get By." And he'd say, "We're not sitting here to appreciate this; we're sitting here to criticize it. This is a business, an economic business." I'm quoting him. I remember it because it seemed so bizarre. The monsters were gone. This group was a mere shadow, and Berry found that very frustrating. There were a couple of months of these weekly meetings. He sat up there like it was Sunday school, sincerely trying to educate on quality control, trying to show how a record could be improved. A few weeks later it was announced that Berry was leaving for California.

What did you see as the purpose of the California move?

Berry was starting another production operation to feed the factory that he had established in Detroit. The idea was to make hits, new California hits that would be released through the system.

So Berry Gordy had a new creative geographic center?

Precisely. Because he had all these resources, it probably looked easy. He was making the rounds of all the studios. Eventually, he bought one, and that became MoWest. There was a gigantic amount of money available, and so we designed and had Electrodyne build a pair of mixing consoles for the Motown Center. It wasn't a total vacuum, but when Berry left it was the beginning of the end for most of us in Detroit. A

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NAKAMICHI IA-1z A/V INTEGRATED AMP

The Nakamichi brand was introduced more than a quarter of a century ago with a product everyone knew could not be built, a three-head cassette deck, at a price everyone knew nobody would pay, $1,000. Until then, Nakamichi equipment had been sold only under other brand names, including many leading ones. But Nakamichi's clients were uninterested in the new deck. So the company decided to go it alone, and a new brand was born, a brand with a reputation for unusual products and unique technologies.

In the digital era, it's become hard for small companies like Nakamichi to distinguish themselves from one another, because digital technology forces them to buy much of their circuitry as ICs from the same few sources. Even so, companies can distinguish themselves through the integrity of their products and through innovation in those products' analog sections. In these senses, the Nakamichi IA-1z audio/video integrated amplifier stands apart from the crowd. It has the distinctive Nakamichi look, thanks to its heavy aluminum faceplate, massive size, and subtle (some would say too subtle) gold-on-black lettering. And it's one of those rare components that shuns useless features in favor of basic quality. You won't find "music enhancement" modes that almost never sound realistic, a phono stage that few people would use nowadays, or nondefeatable tone controls (which can really wreak havoc in a multichannel surround system). You will find Dolby Digital (AC-3) surround decoding and dual-zone, dual-source multiroom capability. And you'll find two circuit innovations: Harmonic Time Alignment power amp topology and a Precision Resistor Array Multi-Channel Attenuator.

The Harmonic Time Alignment topology was developed in Nakamichi's California research facility. It is based on the proposition that harmonic distortion is audibly least intrusive if the harmonics that are generated are in perfect synch with the fundamental, which is seldom the case when large amounts of global negative feedback are used. For years, many audiophiles have thought that minimizing global feedback helped components achieve superior sound. However, in Nakamichi's view, the root cause of this has not been appreciated.

THE NAKAMICHI IA-1z'S DOLBY DIGITAL PERFORMANCE IS ABOUT AS FINE AS I'VE SEEN.

When large amounts of feedback are applied to an amplifier, the open-loop gain must be rolled off in a controlled manner to prevent oscillation. The greater the feedback, the lower the frequency at which the rolloff usually must commence. But the stabilization network that causes the rolloff also shifts signal phase (time relationship), misaligning whatever harmonics accompa-

Rated Power, 8-Ohm Loads: Stereo mode, 100 watts per channel, both channels driven; surround modes, 80 watts per channel, five channels driven.
Rated Distortion at Rated Power: THD, 0.1%; IM, 0.1%.
Dimensions: 17 in. W x 6¾ in. H x 15⅝ in. D (43 cm x 17 cm x 39.8 cm).
Weight: 38.6 lbs. (17.5 kg).
Price: $2,900.
Company Address: 955 Francisco St., Torrance, Cal. 90502; 310/538-8150; www.nakamichiusa.com
For literature, circle No. 90

Photos: Michael Groen

MEASURED DATA

AMP SECTION, STEREO MODE

Output Power at Clipping (1% THD at 1 kHz): 8-ohm loads, 135 watts/channel (21.3 dBW); 4-ohm loads, 200 watts/channel (23 dBW).

Dynamic Output Power: 8-ohm loads, 145 watts/channel (21.6 dBW); 4-ohm loads, 225 watts/channel (23.5 dBW); 2-ohm loads, 200 watts/channel (23 dBW).

Dynamic Headroom Referred to 8-Ohm Rating: +1.6 dB.

THD + N, 20 Hz to 20 kHz: 8-ohm loads, less than 0.052% at 100 watts/channel, less than 0.04% at 80 watts/channel, and less than 0.043% at 10 watts/channel; 4-ohm loads, less than 0.418% at 150 watts/channel, less than 0.074% at 100 watts/channel, and less than 0.091% at 10 watts/channel.

Damping Factor Referred to 8-Ohm Loads: 115.

Output Impedance: 75 milliohms at 1 kHz, 90 milliohms at 5 kHz, 125 milliohms at 10 kHz, and 170 milliohms at 20 kHz.

Frequency Response: 20 Hz to 20 kHz, +0, –0.22 dB (–3 dB below 10 Hz and at 91 kHz).

Subwoofer Crossover: High-pass, –3 dB at 79 Hz and –6 dB at 60 Hz, 12 dB/octave; low-pass, –3 dB at 82 Hz and –6 dB at 107 Hz, 12 dB/octave.

Sensitivity for 0 dBW (1 Watt): 28.6 mV.

A-Weighted Noise: –74.1 dBW.

Input Impedance: 21.2 kilohms.

Input Overload (1% THD at 1 kHz): 7.9 V.

Channel Separation, 100 Hz to 10 kHz: Greater than 54.6 dB.

Channel Balance: ±0.0 dB.

Recording Output Level: 480 mV for 500-mV signal at CD input.

Recording Output Impedance: 1.37 kilohms.

AMP SECTION, DOLBY PRO LOGIC MODE

Output Power at Clipping, 8-Ohm Loads: Main channels, 135 watts/channel (21.3 dBW) with phantom center; center channel, "Large" speaker setting, 145 watts (21.6 dBW); surround channels, "Large" speaker setting, 135 watts/channel (21.3 dBW).

THD + N at Rated Output, 8-Ohm Loads: Main, less than 0.05%, 30 Hz to 13 kHz; center, less than 0.05%, 30 Hz to 13 kHz; surround, less than 0.042%, 100 Hz to 10 kHz.

Frequency Response: Main, 20 Hz to 20 kHz, +0.11, –0.3 dB (–3 dB below 10 Hz and at 23.15 kHz); center, "Large" speaker, 20 Hz to 20 kHz, +0.09, –0.48 dB (–3 dB below 10 Hz and at 23.15 kHz); center, "Small" speaker, 79 Hz to 23.15 kHz, +0.08, –3 dB; surround, below 10 Hz to 7.1 kHz, +0.05, –3 dB.

A-Weighted Noise: Main, –71.9 dBW; center, "Large" speaker, –74 dBW; surround, –73.4 dBW.

Channel Separation at 1 kHz: 44.7 dB or greater.

AMP SECTION, DOLBY DIGITAL (AC-3) MODE

Channel Balance: 0.3 dB or better.

Frequency Response: Main channels, 20 Hz to 20 kHz, +0.15, –0.3 dB; center channel, 20 Hz to 20 kHz, +0.14, –0.31 dB; surround channels, 20 Hz to 20 kHz, +0.15, –0.3 dB; LFE channel, 20 to 82 Hz, +0, –3 dB.

THD + N at 1 kHz for 0-dBFS Signal: Main, 0.0192%; center, 0.0112%; surround, 0.276%; LFE, 0.0143% at 30 Hz.

Channel Separation, 100 Hz to 10 kHz: 51.3 dB or greater.

D/A CONVERTER SECTION

Frequency Response: At speaker output, 20 Hz to 20 kHz, +0.13, –0.3 dB; at preamp output, 20 Hz to 20 kHz, +0.15, –0.16 dB.

THD + N at 0 dBFS: 0.198%, 20 Hz to 20 kHz.

THD + N at 1 kHz: At speaker output, below –73 dBFS from 0 to –90 dBFS and below –80.5 dBFS from –30 to –90 dBFS; at preamp output, below –78.5 dBFS from 0 to –90 dBFS and below –81 dBFS from –30 to –90 dBFS.

Maximum Linearity Error: Undithered signal, 1.3 dB to –90 dBFS; dithered signal, 1.9 dB to –100 dBFS.

S/N re 0 dBFS for Infinity Zero Signal: A-weighted, 84.9 dB; CCIR-weighted, 75.7 dB.

Quantization Noise: –75.6 dBFS.

Dynamic Range: Unweighted, 82 dB; A-weighted, 85.2 dB; CCIR-weighted, 75.8 dB.

Channel Separation: Greater than 51.3 dB, 125 Hz to 16 kHz.

ny the fundamental. To get around this, the IA-1z uses local feedback (which is not as prone to stability problems) to reduce open-loop gain while extending the frequency range of that open-loop gain to well beyond the audio band. A minimal amount of overall feedback is then applied, to further reduce distortion and to lower output impedance.

Precision Resistor Array Attenuators, the second technical novelty in the IA-1z, adjust each channel's gain. They are so precise that volume, balance, and system-calibration adjustments can all be made with the same set of attenuators and whatever gain offsets are needed to balance and calibrate the system will track precisely over the full range of volume settings. The Precision Resistor Array is controlled digitally, but it adjusts the signal in the analog domain. The digital circuitry simply selects the appropriate metal-film resistors; they, in turn, adjust the gain of an analog operational amplifier. In the 1z, two gain-controlled stages are cascaded in each channel to produce a 96-dB control range with exquisite tracking ability. The resistor elements, used as the resistive ladders in a pair of 12-bit DACs, adjust volume in steps that vary with level (in 0.5-dB steps over the uppermost 34.5-dB gain range, in 1-dB steps from –35 to –54 dB, and in 2-dB steps from –55 to –75 dB).

THE CONTROLS ARE BLESSEDLY LOGICAL, AND YOU DON'T NEED ON-SCREEN DISPLAYS FOR SETUP.

The IA-1z's rear panel bespeaks quality. With S-video jacks doubling every composite-video input and output, there's little chance you'll run out of one type or the other. And every connector (even the S-videos) is gold-plated for long-term reliability. The amp has provisions for four A/V and five audio program sources, including a recording output for the VCR. I would have liked a second VCR interface. Perhaps more important, instead of the single "DVD/DBS" input, I'd have liked separate inputs to get more use from the amp's Dolby Digital section. And when you finally retire your

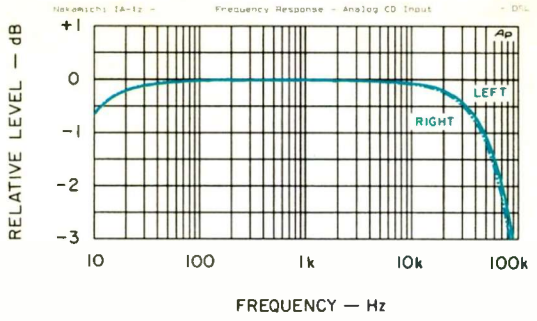

Fig. 1—Frequency response, stereo mode.

The IA-1z has input and output jacks for virtually anything.

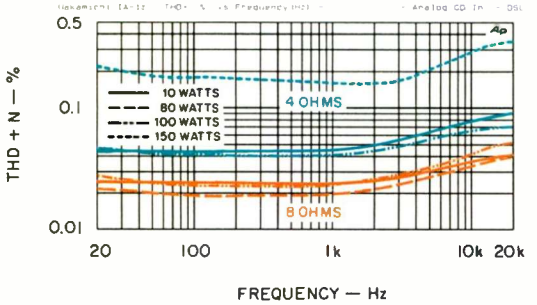

Fig. 2—THD + N vs. frequency, stereo mode.

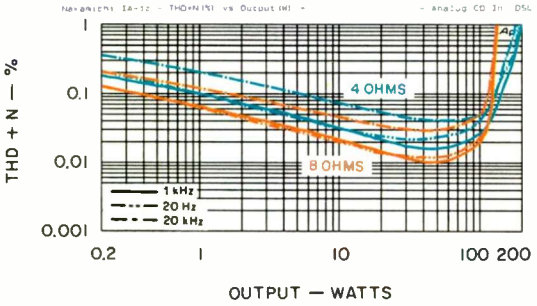

Fig. 3—THD + N vs. output, stereo mode.

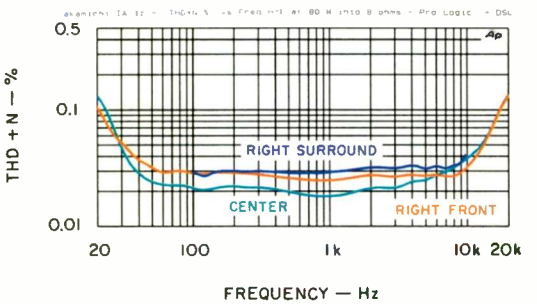

Fig. 4—THD + N vs. frequency, Dolby Pro Logic mode.

laserdisc player, by the way, the 1z's "LD" input set will become available for a second Dolby Digital source.

The audio connections include three high-level analog inputs, two tape loops (with provisions for dubbing "Tape 1" to "Tape 2" but not the other way around), plus three digital inputs. Of the digital inputs, "CD" has a coaxial jack, "LD" has a Toslink optical input for PCM and a coaxial jack for AC-3 bitstreams (not RF, for which you'll need Nakamichi's DE-1 demodulator), and "DVD/DBS" has Toslink and coaxial connections (selected by a small slider placed between them), either of which will accept both PCM and Dolby Digital signals.

In addition to its video record output, the IA-1z has composite- and S-video outputs for "Monitor" and "Remote." The main difference between them is that "Remote," intended to feed video to a TV monitor in a second room, does not carry the on-screen menus generated by the 1z. The jacks that feed audio to the second room carry only stereo signals from analog sources. So if you're also feeding video to that room, be sure to connect your video components' analog audio outputs, even if you're using their digital outputs for surround listening in your home theater.

Line-level audio outputs are provided for all six channels ("Center," "Subwoofer," and left and right "Front" and "Rear"). The heavy-duty, gold-plated multiway speaker binding posts are logically arranged. Each pair of posts is spaced to accept double-banana plugs, and there's enough space between the pairs to make good, solid connections.

Four ⅛-inch miniature phone jacks augment the amp's remote-control functions. One jack accepts input from a remote sensor; the other three can be used to control Nakamichi CD players, tape decks (if connected to "Tape 1"), and remote amplifiers. Power feeds in through a removable, heavy-duty IEC grounded line cord; there's an equally heavy-duty switched, grounded convenience outlet that's rated at 200 watts.

The front-panel controls are blessedly simple and logical. The source selector has generously sized buttons, five for audio-only sources in one row and four for audio/video sources just below them—all with LEDs to show which buttons have been activated. You can use any audio source as the soundtrack for any A/V source (e.g., for simulcast reception). A "Digital Input" bar, to the left of the bottom row of source selectors, toggles between the digital and analog audio inputs for whichever input you've selected; another LED indicates when a digital input is active. Above this bar is another, "Multi Zone," and three indicator LEDs. Depending on the mode you select by tapping the bar, you can choose the program source for the main and remote zones independently or feed the same source to both areas.

THE VOLUME CONTROL TRACKED SO PRECISELY THAT I COULD MEASURE NO ERROR OVER ITS MOST USEFUL RANGE.

At the top left is the on/off button and an LED that glows in standby mode and is off when the amp is on. This may sound odd, but other LEDs on the panel show that the amp is up and running; this one glows to tell you that the amp's plugged in but off.

You select "Dolby Surround Mode" by using buttons marked "AC-3" and "Pro-Logic," each with an indicator LED, or you can turn surround off. These three keys are at the bottom center of the panel, and above them are two "Speaker" pads (one to select a channel and the other to change its operating mode), a row of three speaker-mode LEDs, and an array of seven LEDs (for each of the six channels plus one marked "S" for mono surround). These controls and indicators let you set up the 1z from its front panel without using the remote or on-screen menus, which is most unusual. This

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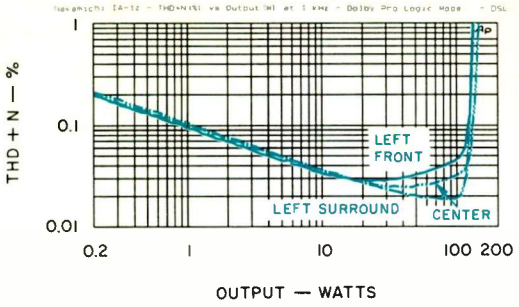


Fig. 5—THD + N vs. output, Dolby Pro Logic mode.

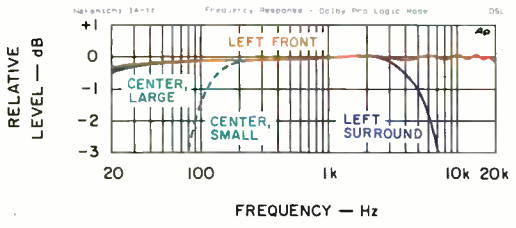


Fig. 6—Frequency response, Dolby Pro Logic mode.

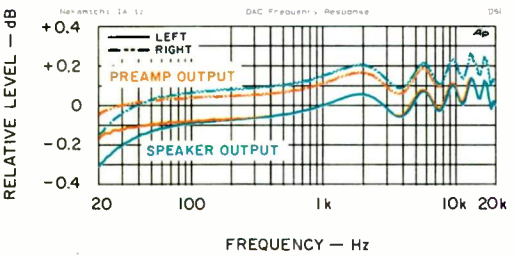


Fig. 7—Frequency response, DAC section.

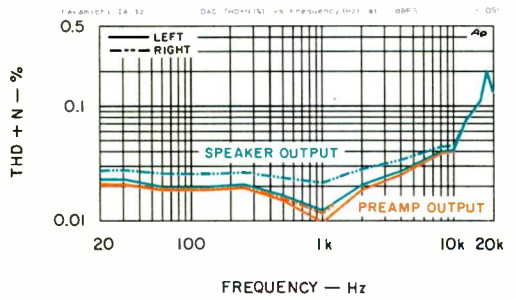


Fig. 8—THD + N vs. frequency, DAC section.

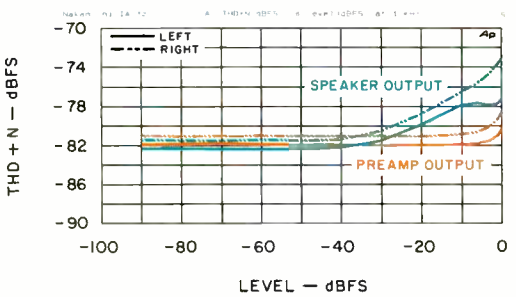


Fig. 9—THD + N vs. level, DAC section.

may appeal especially to audio purists, who'll no longer have to risk contaminating their audio by routing video through the amp just to use on-screen setup menus.

System setup is simple and intuitive. As you cycle through the various speakers by pressing "Select," the chosen speaker's LED blinks for a few seconds, during which time you can change its settings. For the main and surround speakers, the choices are "Large" and "Small." The center channel offers the same two choices plus "None" (phantom center). And the subwoofer choices are "Normal" (which feeds the subwoofer LFE information plus the bass from all channels designated "Small"), "LFE Only" (which redirects bass from all "Small" speakers to the left and right front channels), and "None." All you need do is glance at the LEDs to see the present operating mode, press the mode switch to change that setting if you wish, and then go on to the next speaker. Nothing could be simpler!

In normal operation, the LEDs for the different speakers show the selected surround mode. A 5.1-channel Dolby Digital signal will light up all the LEDs except "S"; a two-channel Dolby Digital signal with matrix Dolby Surround encoding will light up the "L" and "R" front-channel LEDs and "S," and conventional Dolby Surround (or stereo) signals leave all seven LEDs dark.

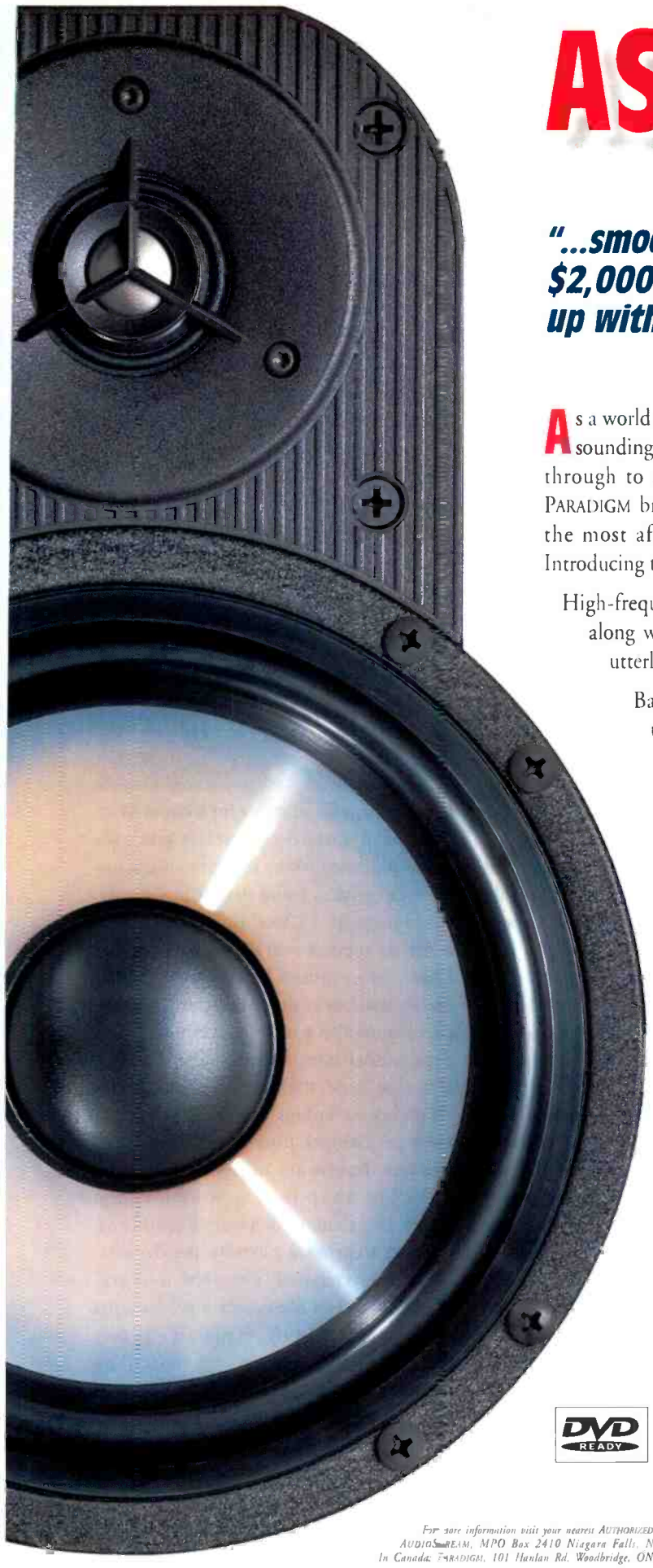
To the right of the speaker LEDs is a four-digit display that also contains the remote control's infrared sensor. Normally, it indicates what volume you've set with the stylish "Output Level" pads at the right. But if you press a tiny button just next to these pads, they become a balance control (an LED glows in this mode) and the display shows the balance settings. If you hold down the nearby "Mute" button, you can use the pads and display to set the muting level over a 31-step range. Thereafter, tapping "Mute" toggles between normal volume and your selected muting level.

Beneath the display are four system-calibration buttons to toggle the usual cycling test tone on and off, select a channel for adjustment, select delay-adjustment mode, and increase or decrease the level or delay of the selected channels. Main-channel levels can be adjusted over a range of ±3 dB, all other channels over a range of ±10 dB; delay can be adjusted from 0 to 5 milliseconds for the center channel and 0 to 15 milliseconds for the surrounds.

The Nakamichi IA-1z comes with two infrared remotes, a full-featured main remote, the RM-1m, and a simpler RM-1s that just enables you to select sources, adjust volume, and turn the power and the muting on and off. The main remote is fully programmable and controls audio or audio/video components, depending on the setting of its "Audio Video" slide switch. It has a bank of controls for the usual transport functions of a tape recorder or VCR, another bank of controls for a CD or laserdisc player, and a third bank to handle a tuner or TV. The controls are appropriate for their purposes (seek and preset pads in the "Tuner/TV" bank; disc selection, random, skip, and search pads for disc players; and fast wind and recording controls for tape components). Each control bank also has a "Power" pad to toggle sources on and off independently. Needless to say, with the RM-1m you can also choose surround mode, activate Dolby Digital's dynamic range and LFE attenuators (indicated by LEDs on the front panel), perform or check system setup and calibration, choose a mode for two-zone operation, toggle the on-screen displays, and adjust balance.

Measurements

No question about it: Nakamichi's Precision Resistor Array is a fantastically accurate volume control. It reduced gain by 0.5 dB per step over the top 70 steps of its range and then by 1 dB per step for the next 20 steps, all with an accuracy of ±0.01 dB (the limit of my test equipment's resolution). In other words, I could detect no errors over the most useful 55 dB of the control's range! Below that, where gain changes in 2-dB steps, the control was accurate within ±0.03 dB for the first three steps (down to −61 dB) and within ±0.1 dB for the next



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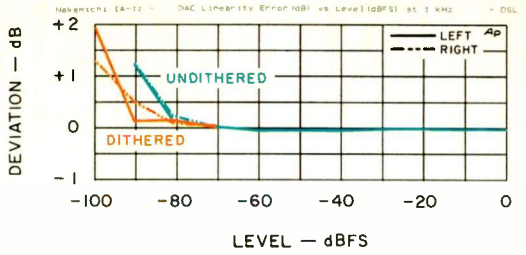

Fig. 10—Deviation from linearity, DAC section.

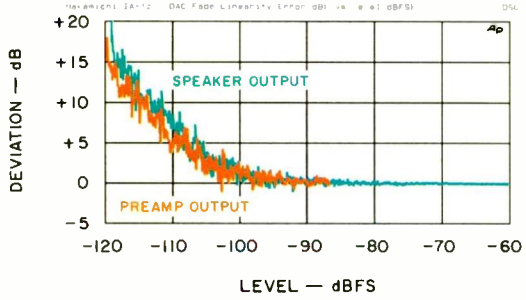

Fig. 11—Fade-to-noise test, DAC section.

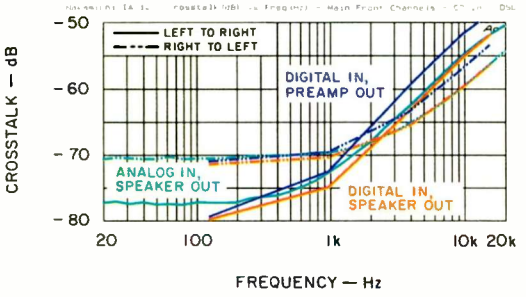

Fig. 12—Crosstalk, DAC section.

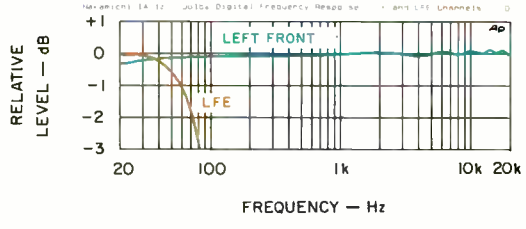

Fig. 13—Frequency response, Dolby Digital mode.

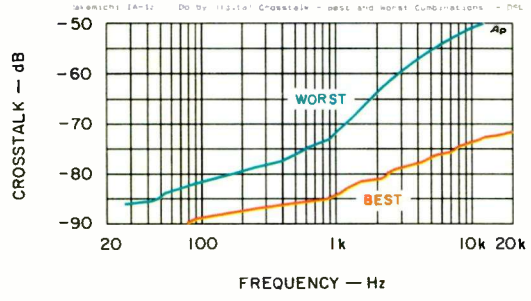

Fig. 14—Crosstalk, Dolby Digital mode.

three (down to –67 dB). "Mute," factory-set for total muting, was adjustable for anywhere from 10 to 46 dB of attenuation.

The IA-1z's frequency response for analog input in stereo mode (Fig. 1) is flat and fairly extended, within +0, –0.22 dB from 20 Hz to 20 kHz; the –3 dB points are below 10 Hz and at 91 kHz. Note how precisely the left and right channels match in both response and level. Below 10 kHz, this amplifier has virtually no channel imbalance whatsoever!

The crossover between the front channels and the subwoofer occurred at about 80 Hz, where response was 3 dB down. Both sections had nominal slopes of 12 dB per octave; I'd have preferred a sharper slope in the low-pass section, but Nakamichi's choice is not unusual.

Nakamichi rates the IA-1z's output power into 8 ohms as 100 watts per channel in stereo and 80 watts per channel in its five-channel surround modes. The company provides no 4-ohm ratings and requested that I not make constant-frequency power tests into that impedance. I can't quite fathom this exceptional conservatism, as the 1z did fine on my bench with both 8- and 4-ohm loads. With the IHF tone burst and 2-ohm loads, the output protection relay clicked in and out when I asked the amplifier to deliver more than 200 watts per channel. The 1z was not showing any sign of stress; I just couldn't get it to put out any more without triggering the protection circuits. With 8- and 4-ohm loads, it behaved normally when fed continuous and pulsed signals.

Figure 2 shows total harmonic distortion plus noise (THD + N) versus frequency. With 8-ohm loads, I measured it at output levels of 10 watts per channel, 80 watts per channel (the five-channel rating), and 100 watts per channel (the stereo rating). Distortion tops out at 0.04% at 80 watts per channel and at 0.052% at 100 watts per channel, about half Nakamichi's spec of 0.1%. With 4-ohm loads, I took measurements at 10, 100, and 150 watts per channel. Although distortion reaches about 0.4% at 20 kHz when the amp is feeding 150 watts per channel into 4-ohm loads, it's only 0.074%, worst case, when feeding 100 watts a side into 4 ohms.

My choice of 150 watts for the maximum power into 4 ohms in Fig. 2 was based on my tests of the IA-1z's THD + N versus output with both channels driven (Fig. 3). At 20 kHz, the 4-ohm curve turns up at about 75 watts and the 8-ohm curve turns up at about 50 watts. Since 50 watts is half the rated power at 8 ohms, I doubled 75 watts to get my unofficial rating for 4 ohms. With either load, distortion increases gradually above the point where the curve turns upward rather than rising sharply at clipping. (This suggests a Class-AB topology with relatively modest overall feedback, just as Nakamichi claims.) When clipping ultimately does occur, output reaches 135 watts per channel into 8-ohm loads and 200 watts per channel into 4-ohm loads. With the IHF tone burst, the clipping points were a bit higher. At 8 ohms, the 1z clipped at 145 watts per channel, from which I calculated dynamic headroom to be +1.6 dB; at 4 ohms (for which there is no rating from which to calculate dynamic headroom), clipping occurred at 225 watts per channel.

WONDER OF WONDERS, SURROUND-CHANNEL NOISE AND THD ARE ALMOST AS LOW AS THE MAIN CHANNELS'.

Despite its relatively low global feedback, the IA-1z had an adequately high damping factor of 115 at 50 Hz. Output impedance did rise with frequency, just more than doubling between 1 and 20 kHz, but at 20 kHz it was still lower than that of many other amplifiers I've tested. Analog input impedance was a relatively low 21.2 kilohms, but this shouldn't present a problem for any decent source. The input circuit was essentially overload-proof. It didn't clip until

JOERAMA: Any hot babes out there wanna chat?

PHIL007: Any ladies in the room like magic and fishing?

DEREK69: Any chicks looking for a cyberstud? ;-)

I fed in almost 8 volts, and I don't know any program source that has such high output. Sensitivity seemed fine, as did recording output level and source impedance.

The major fly in the ointment was noise, which I measured as –74.1 dBW with "A" weighting. I suspect that this higher-than-expected noise level was related to the amp's cascaded volume attenuators, whose topology is not conducive to minimum noise. Technical trade-offs are inevitable in circuit design, and in this amp Nakamichi elected to achieve highly precise gain control rather than minimize noise. Fortunately, the noise spectrum was relatively benign, essentially "white" from somewhat below 1 kHz on up. Power-supply hum components at 120 Hz (and a smaller one at 240 Hz) appeared in the right channel but were mostly absent in the left. Overall, the right channel was slightly noisier than the left in the sample I tested. (The results in "Measured Data" reflect this worst-case condition.)

The IA-1z performs Dolby Pro Logic as well as Dolby Digital decoding by means of Motorola 24-bit DSP chips (DSP560009), followed by 20-bit DACs. (Analog signals go through 18-bit A/D converters before surround decoding.) On the whole, the test results for Pro Logic operation are exemplary. At rated output, THD + N (Fig. 4) in the main channels is less than 0.05% from 30 Hz to 13 kHz and less than 0.03% from about 50 Hz to 9 kHz; even at the bass and treble extremes, it doesn't go much higher than 0.1%. Distortion in the center channel is a bit lower still. And, wonder of wonders, THD + N in the surround channels is almost as low as in the main channels.

As you can see from Fig. 5, in Pro Logic mode the Nakamichi amplifier's output stages deliver well beyond their rated 80 watts per channel into 8 ohms before clipping occurs. At 1% THD, I measured 135 watts per channel from the main and surround channels and a trifle more, 145 watts, from the center.

Frequency response in Pro Logic mode (Fig. 6) is essentially the same in the main and center channels, about +0.1, –0.3 dB from below 10 Hz to 23.15 kHz. The ripple of approximately ±0.06 dB in the upper frequencies is caused by conversion to and from the digital domain; less ripple would be better, but this amount is not unusual. Few manufacturers use digital filters and converters in their home theater components that are of the same caliber as those in their CD players, but the 1z's are at least among the better ones I've seen in A/V receivers and amps.

SEPARATION WAS BEST (A SUPERB 81.7 dB) JUST WHERE IT MATTERS MOST.

The high-pass curve in Fig. 6 for the center channel's "Small" speaker setting has a 12-dB/octave slope and is 3 dB down at 80 Hz, matching the subwoofer crossover's low-pass filter. The same filter characteristics applied to every channel set up for a "Small" speaker. The surround channel's 7.1-kHz rolloff is almost exactly on target for Pro Logic operation.

The IA-1z's A-weighted noise in Dolby Pro Logic mode ranged from –71.9 dBW in the worst channel (right front) to –74 dBW in the best (center). For the most part, channel separation at 1 kHz was between 65 and 70 dB. The least amount of separation, only 44.7 dB, was from either surround channel to the left front. But separation was best (a superb 81.7 dB) from center to surround; that's where it's most critical, because you don't want dialog popping up at your side or behind you.

I usually test A/V amps' and receivers' main-channel DACs at the speaker terminals rather than the preamp outputs. For one thing, it's the speaker terminals that you're most likely to use. And because not all A/V amps and receivers have preamp outputs, measuring at the speaker terminals

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puts all such products on the same footing. (Actually, neither output gives me a pure look at DAC performance, because of the noise, distortion, and response irregularities imposed by intervening circuitry, especially power amp sections.) To see how results from each output would compare, I measured the Nakamichi IA-1z both ways. Wherever there were distinct differences between the two sets of data, I'm presenting both, but it was gratifying to see how few I found and how easily those differences that did occur can be explained.

Frequency response for the amp's DAC is shown in Fig. 7 with an extremely sensitive relative level scale so that you can see the filter ripples of ±0.06 dB more easily. Aside from a very slight difference in channel balance and slightly more bass rolloff at the speaker terminals, there are no differences in performance at the two outputs.

The IA-1z's THD + N versus frequency at 0 dBFS (Fig. 8) reaches the same maximum (0.198%) at both outputs, primarily because the DAC's sampling-rate cross-modulation dominates the situation. Over some of the audio range, however, THD + N is slightly higher at the speaker terminals than at the preamp outputs because of the noise and distortion contributed by the power amp. When DAC distortion dominates power amp distortion, the results are the same at either output. Truly first-rate DACs, with less cross-modulation at 18 kHz, might perform differently at the two outputs, but I think this will be rare.

There are noticeable differences between the outputs in the DAC section's THD + N versus level (Fig. 9), but only over the top 25 dB, where power amp distortion is the controlling influence. At lower levels, the curves are quite similar and likely reflect performance of the DACs. Had preamp and power amp noise been the prevailing factor, the curves would have risen as level decreased rather than staying flat, as these do. In other words, one can determine from the shape of these curves where in the circuit the distortion originates. In this case, it's from the DACs.

The tracking filter used in testing DAC linearity error eliminates the effect of distortion and almost completely eliminates the noise contribution of the analog electronics. Therefore, the IA-1z's linearity error was virtually the same at its preamp and speaker terminals. Although the results (Fig. 10) are quite good down to –90 dBFS with a dithered signal, I've measured a number of converters that produced less error at –100 dBFS.

Random noise always adds fuzziness to the linearity plots in DAC "fade-to-noise" tests. Even so, you can see that the curves from the IA-1z's speaker and preamp outputs (Fig. 11) match up very well. The greater error measured at the speaker terminals as the curve approaches –120 dBFS is probably due to power amp noise that squeaked by the tracking filter. We're dealing with mighty small signal levels here!

The DAC section's signal-to-noise ratios (both A-weighted and CCIR-weighted) at the two outputs were not significantly different, which suggests that the power amp contributes negligibly to the noise floor. The same applies to the results for quantization noise and dynamic range (whether unweighted, A-weighted, or CCIR-weighted). Furthermore, when I compared third-octave noise analyses for digital input signals to those for analog input signals, the curves (not shown) tracked almost precisely. This suggests that the noise has its origin in the analog circuitry. Note also that crosstalk (Fig. 12) is pretty much the same above 2 kHz for analog or digital input and for preamp or speaker output.

The great similarities I found between the IA-1z's performance at the preamp and speaker outputs do not prove that results will be identical at both outputs for every conceivable integrated product. Still, it was reassuring to have my past test procedures validated in this manner.

Finally, we come to the IA-1z's Dolby Digital performance, which is about as fine as I've encountered. The levels of the front and surround channels balanced within ±0.15 dB, and their responses were identical (within the limits of experimental error). I picked the left front channel at random for Fig. 13, which also shows the response of the LFE channel. The main-channel response is the same as that plotted in Fig. 7 for the DACs; the LFE curve is the same as the response curve I obtained for the low-pass filter of the subwoofer crossover (not shown).

The Dolby Digital decoder's THD + N, measured at 1 kHz and 0 dBFS (the only point feasible with Dolby Laboratories' test DVD), ranged from a low of 0.0109% in the

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left front channel to a high of 0.0276% in the right surround. These results correspond quite closely with those from the DACs, especially in the left and right front channels.

In Fig. 14 are the best and worst of the 20 crosstalk curves taken in Dolby Digital mode. (You can assume the other 18 lie somewhere in between.) Worst case turned out to be between the right surround and right front channels; best case was between right and left surround.

Use and Listening Tests

I found the Nakamichi IA-1z very intuitive to use, from its front panel and its remote. The main remote does not light up and has wads and wads of identical buttons, but I had no problem with it. Although I did need reasonably bright ambient light to see what I was doing, I'm really getting tired of on-screen menus, so the ability to do without them was a blessed relief.

As you might expect from the Nakamichi IA-1z's excellent Dolby Digital and Pro Logic test results, this A/V amp sounded great in my home theater. But as I've said before, movie soundtracks are inadequate for judging sound quality, so I set the 1z up in my listening room. My primary source was a Sony CDP-XA7ES CD player, which I hooked up to both the analog and digital CD inputs on the 1z. Then I matched levels and toggled back and forth with the "Digital" button on the amp's main remote.

NAKAMICHI'S IA-1z HAS SUPERB IMAGING AND WARM, WONDERFUL, FULL-BODIED SOUND.

Overall, I preferred Sony's current-pulse converters to the 20-bit DACs in the IA-1z. The Sony DACs produced a more pleasing ambience and cleaner reverb tails. These differences were especially noticeable on Enya's *Shepherd Moons* (Reprise 9 26775) and Beethoven's Sonata No. 15 in D Major, Op. 28, "Pastoral" (Telarc CD-80185). I also found female voice edgier with the Nakamichi's converters than the Sony's on the Enya recording and on Julianne Baird's voice in *The English Lute Song* (Dorian DOR-90109). I then played several of my own CD recordings of piano and chamber orchestra. The Nakamichi DACs make them sound somewhat hard, but I admit that this was a pretty tough comparison. Against lesser converters, those in the 1z could probably hold their own, but I consistently preferred the sound from the DACs in the Sony CD player (which costs about as much as the 1z integrated amp).

What's significant, however, is how much I liked the sound through the Nakamichi's analog inputs. DACs aside, everything about the IA-1z was wonderful. It had a warm, full-bodied sound, and its imaging was superb. Despite my concern about the residual noise level I measured, I could hear no noise at my listening position and could barely discern any with my ear glued against the speaker—and this was when I was using very efficient loudspeakers. So I dismissed my worries about noise and sat back to enjoy the beautiful sound. The more I listened, the more I liked! A

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A In many cases this is the question that will stump an otherwise competent Home Entertainment specialist, or at least cause a little embarrassment. Even though we would like to think the products being shown have been recommended on their own merits, many stores select their mix on the basis of such questionable elements as; profit margin, brand name recognition and even a manufacturers national advertising budget. These may be primarily concerns of the ownership, but certainly not in the best interest of the end user. At Sounds Like Music we see this conflict of interest as a chance to earn a competitive edge. We've found that selecting products as a group, i.e., the entire staff from top to bottom, and offering no financial rewards for selling one product over another, our staff has become more focused on the customer's needs, and therefore more enthusiastic and confident about their recommendations.

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—Dave Gilbert
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EQUIPMENT **PROFILE**

D. B. KEELE, JR.

JBL SVA1600 SPEAKER

The SVA1600 has a lot in common with JBL's recent studio monitors, which combine direct-radiator woofers with Bi-Radial constant-coverage horn tweeters. The major difference between the SVA1600's horn and the horns in JBL's pro models is its use of a dome driver rather than the more expensive compression drivers, which are better suited for professional use.

The SVA1600 has two 6½-inch woofers and is the second smallest of the five main-channel speakers in JBL's SVA series. The others, whose woofers range from 5¼ to 10 inches, are priced at $899 to $2,000 per pair. All the SVA systems have vented enclosures, magnetically shielded drivers, and black, wood-grain vinyl finishes. There's also an SVA Center, at $549; it's essentially identical to the SVA1500, but with its horn rotated 90° for horizontal operation.

Each of the SVA models has a Bi-Radial horn with soft-dome driver, placed between a pair of woofers that operate in parallel over the whole low-frequency range. In the SVA Center, the woofers flank the tweeter horn. In the other models, the woofers are above and below the horn; that's the so-called D'Appolito arrangement, which JBL calls a Symmetrical Vertical Array (hence SVA for the line's name). The company says this configuration produces "a virtual full-range source that appears to radiate from a single location, or point source, on the loudspeaker."

Using the Bi-Radial tweeter in these home speakers lends them the cachet of JBL's professional monitors. But a better reason to use them is that, as in recording studios, the constant-coverage horn helps control the speaker's directivity and thus its imaging characteristics. The Bi-Radial horn has wide but controlled horizontal coverage and a narrower vertical coverage, rated by JBL as 90° and 40°, respectively, to minimize sound bouncing off the side walls and ceiling. This gives the listener more direct and less reflected sound, just what's required for accurate imaging of music and for intelligible reproduction of dialog in movies. JBL also states that the SVA speak-

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Stereophile Magazine (USA), Recommended Components:

1996: RCD950BX CD Player
RB980BX Power Amplifier
RB985 Power Amplifier
RSP960AX Surround Processor
RT990BX Tuner
1995: RP900 Turntable
RSP960AX Surround Processor
RT990BX Tuner
RHT10 FM Tuner
1994: RCD955BX CD Player
RCD965BX CD Player
RB980BX Power Amplifier
RHT10 FM Tuner
1993: RCD955BX CD Player
RCD965BX CD Player
RB980BX Power Amplifier
RHT10 FM Tuner
1992: RCD955AX CD Player
RCD965BX CD Player

Hi Fi Choice Magazine (UK), Hi fi Choice Awards:

1996: RA920AX Integrated Amplifier
1993: RA960BX Integrated Amplifier
RA935BX Integrated Amplifier
RT960BX Tuner
1992: RA930AX Integrated Amplifier
RC960BX Preamplifier
RB960BX Power Amplifier
1991: RCD965BX CD Player

Audio Video Intl, (USA), Hi Fi Grand Prix Awards:

1996: RCD950 CD Player
RA985BX Integrated Amplfier
RX950 AM/FM Receiver
RCC945 CD Changer
RSP980 THX® Surround Processor
RC995 CD Player
RT940AX Tuner
1994: RB980BX Power Amplifier
1993: RCD965BX CD Player
RB980BX Power Amplifier

Audio Magazine (Germany), Golden Ear Awards:

1994: RB980BX Power Amplifier
RC980BX Preamplifier
1993: RB980BX Power Amplifier
RC980BX Preamplifier
1992: RB980BX Power Amplifier
RC980BX Preamplifier

Sound & Vision Magazine (Canada), Critics Choice:

1995: RB970BX Power Amplifier
RB985 Power Amplifier
RA985BX Integrated Amplifier
RSP960AX Surround Processor
RTC940AX Tuner Preamp
RT940AX Tuner
RCD930AX CD Player
1995: RC980BX Preamplifer
RB980BX Power Amplifier
RSP960AX Surround Processor
1994: RC970BX Preamplifer
RB980BX Power Amplifier
RB990BX Power Amplifier
RA980BX Integrated Amplifier
RT950BX AM/FM Tuner
RTC940AX Tuner/Preamp
RX940AX Receiver
RX950AX Receiver
RCD945AX CD Player
RCC940AX Carousel CD Player
RSP960AX Surround Processor
1993: RX950AX Receiver
RC960BX Preamplifier
RB960BX Power Amplifier
RB990BX Power Amplifier
RA980BX Integrated Amplifier
RT930AX FM Tuner
RT950BX AM/FM Tuner
RCD965BX CD Player

What Hi Fi? Magazine (UK), What HiFi Awards:

1993: RCD945AX CD Player
1992: RT950BX AM/FM Tuner
RA920AX Integrated Amplifier
RCD965BX CD Player
1991: RCD965BX CD Player
RA930AX Integrated Amplifier

Consumer Electronics Show (USA), Innovations Awards:

1997: RSP980 THX® Surround Processor
1995: RMB100 Monoblock Amplifier
1992: RB980BX Power Amplifier

Consumers Digest (USA) Best Buys:

1996: RX950AX AM/FM Receiver
RA970BX Integrated Amplifier

Home Cinema Choice (UK) A/V Power Amp of the Year:

1997: RB985 Power Amplifier

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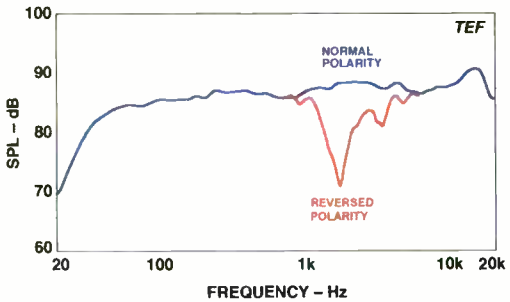

Fig. 1—Frequency response.

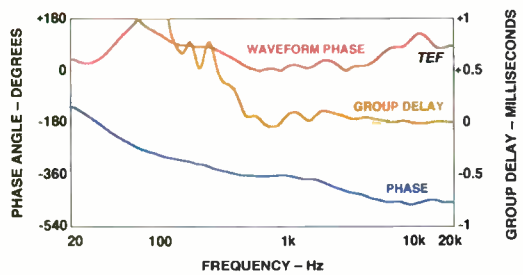

Fig. 2—Phase response, group delay, and waveform phase.

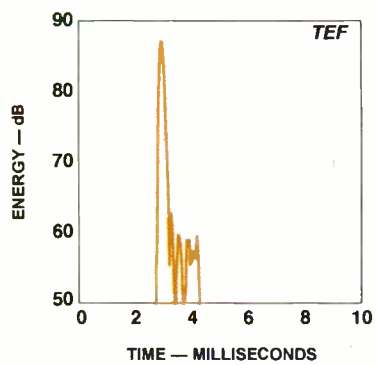

Fig. 3—Energy/time response.

ers' high and uniform directivity, coupled with frequency response that stays relatively constant off axis, enables them to provide good sound regardless of room acoustics and listener position.

(The Bi-Radial constant-coverage horn holds special interest for me, because I hold the patents on it as well as on Electro-Voice's constant-directivity horn design. I developed them when working for those companies in the '70s and early '80s. However, having signed away my rights to these patents when I left each company, I have no financial stake in them.)

The SVA1600's 6½-inch woofers have frames made from cast aluminum for strength and rigidity, and their magnet structures have been optimized to decrease distortion. The woofers' four-layer copper voice coils are wound on high-temperature fiberglass formers. The cones are felted fiber attached to rubber surrounds.

The SVA1600's 1-inch soft-dome tweeter, made by JBL's sister company, Audax, is cooled with Ferrofluid. The horn is designed to operate with this tweeter and is made of ABS structural foam, which damps resonances. According to curves sent to me by Greg Timbers, the SVA systems' designer, the dome driver by itself is quite flat from 2 to 16 kHz. The horn not only restricts the tweeter's directional coverage but greatly increases its sensitivity between 1 and 4 kHz. Because of the increased sensitivity, the tweeter's drive level in this band must be reduced to match the sensitivity of the woofers. This, in turn, greatly reduces distortion.

The SVA1600's cabinet is solidly built of ¾-inch medium-density fiberboard. Molded-plastic grilles for each woofer attach with pegs to the front of the cabinet; the horn is not covered. Adjustable spiked feet beneath the cabinet's front let you tilt the speaker back to direct the horn (which is only 24 inches above the floor) toward the listeners' ears. Under the rear panel are two other feet, 1 inch in diameter and 1 inch high.

The SVA1600's crossover is mounted on a small board inside the cabinet, just above the input connection panel on the back. Some of the crossover's 16 components are paralleled, so there are effectively only 11 circuit elements. The crossover consists of a second-order (12-dB/octave) high-pass filter and a second-order low-pass. The feed to the tweeter includes a series resistor bypassed by a capacitor, a simple equalization circuit to flatten the response of the dome-driven horn. The tweeter level can be adjusted by switching in a resistor to ground; the switch is centered among the input terminals. The SVA1600 is said to have flat response when this switch is in its "0 dB" position and to have a smoothly rising high-frequency response in the "2 dB" position. Audiophile-quality parts are used throughout the crossover network, including small polypropylene capacitors in parallel with the filter capacitors.

The gold-plated input terminals, of JBL's own design, are very widely spaced for easy connection; the high- and low-frequency input-terminal pairs are 3¼ inches apart, and the positive and negative terminals for each pair are on 1¾-inch centers. Two robust, gold-plated straps connect the high- and low-frequency terminals but can be removed for bi-wiring.

Measurements

I measured the SVA1600's frequency response (Fig. 1) on the tweeter's axis, the height JBL recommends. I made the tests in a large anechoic chamber and also outdoors, using ground-plane techniques. If you exclude the peak at 15 kHz, the curve made with normal tweeter polarity fits within a tight, 3-dB, window from 100 Hz to 20 kHz. Even with the peak, the curve fits within a 6-dB window from 50 Hz to 20 kHz, still good performance. Compared to the level at 100 Hz, the SVA1600 is 3 dB down at 41 Hz and only 6.7 dB down at the low frequency of 30 Hz. A shallow hump, two octaves wide, is centered at 1.75 kHz, the crossover frequency.

When I reversed the tweeter's polarity by reversing the connections at its terminals, a large dip developed at the crossover point and the level from 1 to 4 kHz was reduced. This indicates that when the tweeter is connected for normal polarity, the horn and woofers are essentially in phase through the crossover region. That's very desirable, as it minimizes lobing (which the D'Appolito configuration's vertical symmetry should virtually eliminate anyway) and puts the SVA1600's maximum radiation on axis.

THE SVA1600'S CONTROLLED COVERAGE STEMS FROM ITS HORN AND THE ARRANGEMENT OF ITS DRIVERS.

Averaged from 250 Hz to 4 kHz, sensitivity was 87.1 dB, about 2 dB below JBL's rating. The right and left speakers matched

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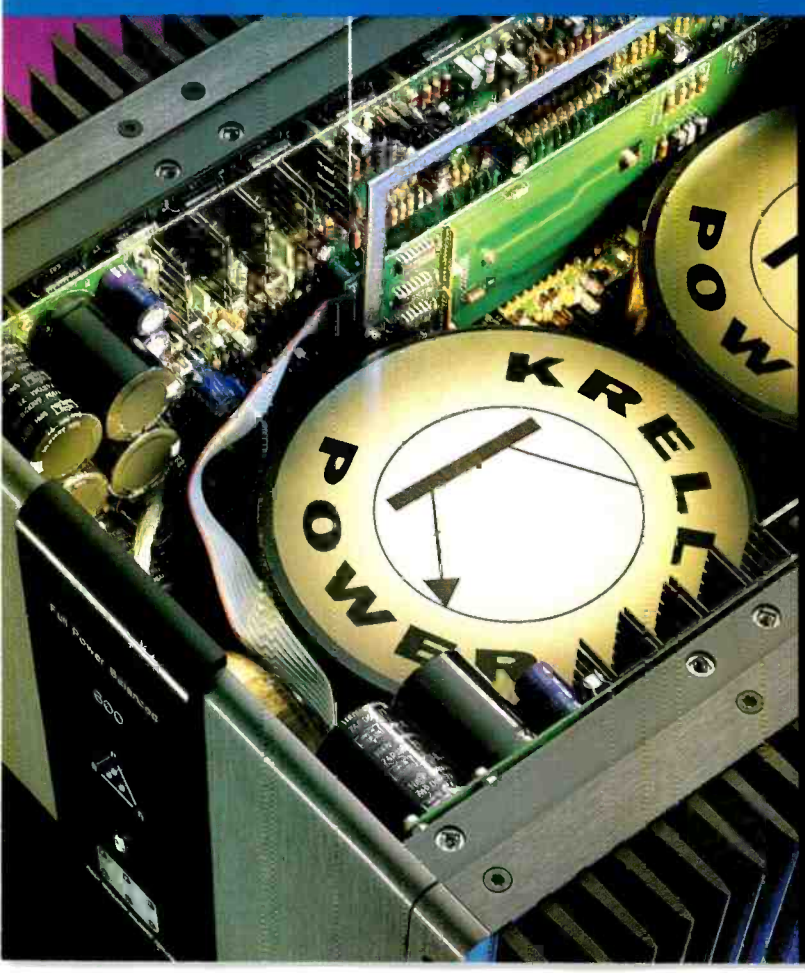

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closely, within ±0.5 dB, between 20 Hz and 10 kHz. Above 10 kHz, one speaker's sensitivity slightly exceeded the other's, with the greatest difference, 1.1 dB, occurring at 16 kHz. The woofer grilles caused no significant change in response.

Figure 2 shows the SVA1600's phase and group-delay responses, referenced to the tweeter's arrival time. The phase curve falls with frequency before leveling off to about –450° above 8 kHz, in the horn's range. Above 500 Hz, the group-delay curve indicates that the woofers lag the tweeter by only 25 to 50 microseconds, a sign that the tweeter horn and woofers are very close to being aligned in time and position. The close alignment between this speaker's drivers is also reflected in the waveform phase. This curve (actually the absolute value of the wrapped waveform phase) indicates how well a speaker will preserve waveforms. Because failure to preserve them well (which is the norm) doesn't seem to affect sound quality significantly, I don't regularly present this curve. However, the SVA1600's waveform phase stays between 0° and 40° from 400 Hz to 5 kHz, which means that this speaker *will* preserve waveforms whose energy is concentrated within that frequency range.

THE JBLs' SOUNDSTAGE WAS EXCEPTIONALLY CLEAR, DELINEATING EACH INSTRUMENT VERY WELL.

Figure 3 shows the JBL SVA1600's energy/time response. The main arrival, at 3 milliseconds, is very compact and sharp; later responses are quite low in level and mostly more than 28 dB below the main arrival's level. This is one of the best energy/time response curves I have obtained and is another indication of close time coherence between the tweeter horn and the woofers. (I have not been including energy/ time measurements in my equipment reviews lately, as most of them have been quite similar and not very revealing. My new policy is to present the results of this test only if they are significantly better or worse than normal.)

As you can seen in Fig. 4, horizontal off-axis response is extremely uniform up to 12.5 kHz. It narrows slightly above that but is still very uniform out to ±20° off axis. The vertical off-axis responses (Fig. 5) are quite symmetrical above and below axis; however, except for the two ridges above and below the axis at about 800 Hz and 1.7 kHz, you can't clearly see this in the figure. In the main vertical listening window, ±15°, the curves are quite uniform except near the crossover. Even in the crossover range, from 1 to 4 kHz, the responses are quite flat within 5° of the axis; farther off axis are obvious depressions, where the vertical coverage narrows significantly. This narrowing is caused by the SVA1600's woofers being 17 inches apart (from center to center), corresponding to 2.2 wavelengths at 1.75 kHz, the crossover frequency.

The JBL's impedance magnitude (Fig. 6A) has the two bass peaks that characterize vented enclosures; the 36-Hz dip between them indicates the enclosure's approximate tuning frequency. The maximum impedance is 41.5 ohms and the minimum is 5.7 ohms, yielding a high overall variation of 7.3 to 1 (41.5 divided by 5.7) within the audio band. Because the minimum impedance is not very low, you can use cables having relatively high resistance: Cable series resistance can be as high as 0.077 ohm before cable-drop effects will cause response peaks and dips greater than 0.1 dB. For a typical run of about 10 feet, that would correspond to 16 gauge (or larger), low-inductance cable.

The SVA1600's impedance phase (Fig. 6B) reaches a maximum angle of +47.5° and a minimum of –47°, so a single SVA1600 should not be a difficult load for most amplifiers.

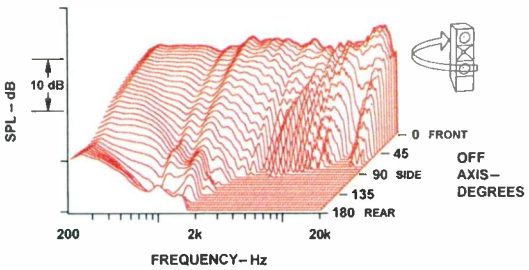


Fig. 4—Horizontal off-axis frequency responses.

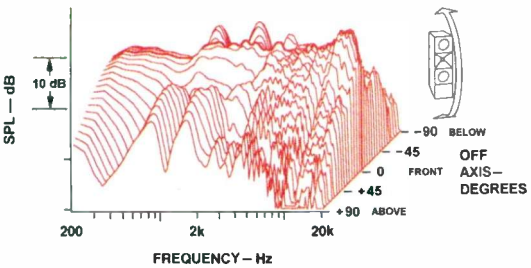
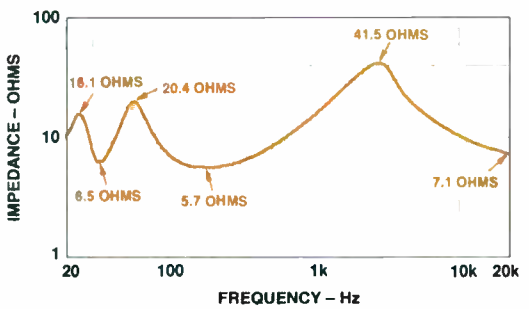


Fig. 5—Vertical off-axis frequency responses.



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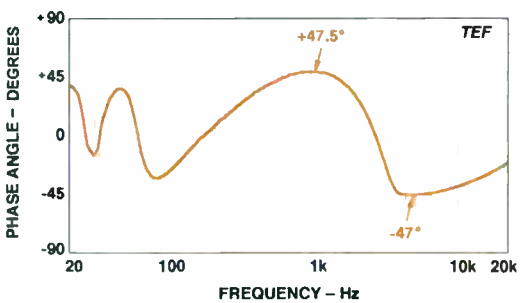

Fig. 6—Impedance magnitude (A) and phase (B).

B

The SVA1600's cabinet is quite solid. Generally, it was quite free of vibration; a high-level sine-wave sweep revealed only one noticeable cabinet vibration, at about 235 Hz. The woofers overloaded quite gracefully when overdriven and exhibited a maximum excursion of about 0.5 inch, peak to peak. At the 36-Hz box resonance, the vent reduced the woofers' excursion only moderately, by about 40%, which I found by closing the port for a comparison measurement. I did not detect any dynamic offset.

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Lobing is minimized by the design and placement of the JBL SVA1600's horn.

To test the SVA1600's 3-meter room response (Fig. 7), I raised the front of the cabinet by adjusting the spikes so that the tweeter horn was aimed at my measurement microphone. Except for a slight dip at 510 Hz and the high-frequency peak at about 15 kHz (which is also seen in Fig. 1), the averaged curve is very flat and smooth, fitting a tight, 5.5-dB, window.

Figure 8 shows the SVA1600's E_1 (41.2-Hz) harmonic distortion for power levels up to 50 watts. The second harmonic rises to a moderate 9.3% and the third to a slightly lower 8.6%; higher harmonics are less than 2%. The speaker sounded quite clean at all the power levels in this test, and port wind noise was moderately low.

The SVA1600's intermodulation distortion rises gradually, reaching the fairly low level of 4.8% at 50 watts (Fig. 9). This is quite good for a system whose woofers are reproducing both test tones, 440 Hz (A_4) and 41.2 Hz (E_1).

Short-term peak power input and output are shown in Fig. 10. Peak input power starts at a moderately low 18 watts at 20 Hz, rises to a plateau of about 170 watts between 40 and 50 Hz, rises again to about 3 kilowatts between 250 and 500 Hz, and winds up at a high 5 kilowatts or so above 1 kHz. With room gain, peak acoustic output starts at a high 91 dB SPL at 20 Hz and rises very rapidly, passing through 100 dB at 26 Hz, 110 dB at 39 Hz, and 120 dB at 140 Hz; output is a bit greater still at higher frequencies. The SVA1600's bass output is well above the average of speakers I've tested. That's worthy performance, considering the size of the woofers and the cabinet.

Use and Listening Tests

I found the JBL SVA1600s to be of reasonable weight for their size. They were fairly easy to lift and move, using the port and the top as handholds. The adjustable spiked feet made it easy to set up and aim the speakers. These spikes are part of a metal bracket assembly that extends across the bottom front of the cabinet. By turning a knurled knob, you can retract the spikes to move the SVA1600 around or extend them, by about ¾ of an inch, to lock the speaker into position and to tilt it back.

JBL has a reputation for not stinting on visual design or on fit and finish. The SVA1600's solid and well-constructed cabinet shows this attention to appearance, exemplified in such details as the horn and its flange, the input terminals, the woofer grilles, and the adjustable spikes and their frame assembly.

The eight-page owner's manual covers placement, hookup (including wire size and bi-wiring), angle adjustment, tweeter-level adjustment, and troubleshooting. In the section on angle adjustment, a diagram shows how to adjust the spikes but there's no explanation about how high these speakers should be aimed or whether they should be canted in. My listening tests revealed that the horn must be aimed at your ears for proper sound, so I canted the speakers in and tilted them accordingly.

I listened to the SVA1600s with their woofer grilles in place and with the tweeter-level switch at its "0 dB" (unboosted) position. I used single-wire connections. The other components in my system included an Onkyo Integra DX-7711 CD player, a Krell KRC preamp, a Crown Macro Reference power amp, and Straight Wire cables and interconnects. I used B&W 801 Matrix Series 3 speakers for comparisons. The JBLs and B&Ws matched quite closely in sensitivity.

The first disc I listened to during these sessions was *No Borders* (GRP Records

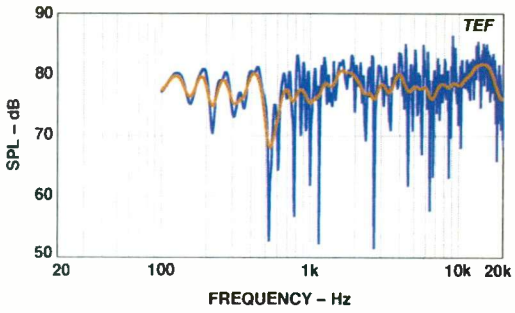

Fig. 7—Three-meter room response.

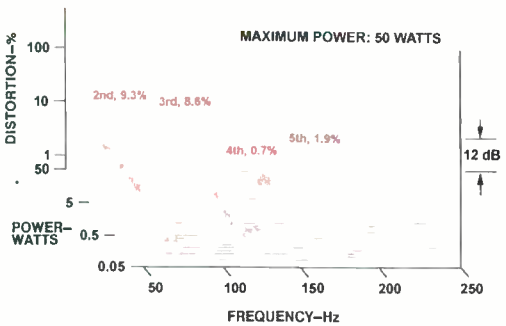

Fig. 8—Harmonic distortion for E_1 (41.2 Hz).

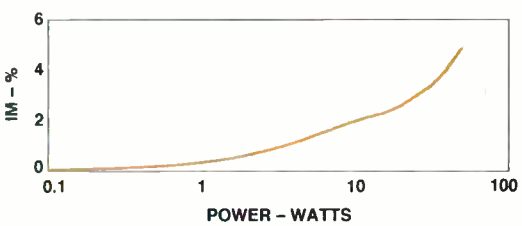

Fig. 9—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

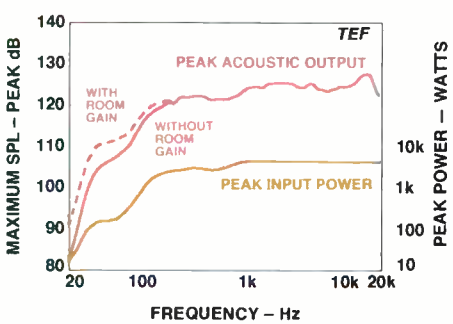

Fig. 10—Maximum peak input power and sound output.

GRD-9676), a most interesting and well-recorded jazz album by Don Grusin. The JBL speakers performed quite ably, presenting an exceptionally clear soundstage and delineating individual instruments very well. The JBLs' sound was significantly closer, more up-front, and less diffuse than the comparatively laid-back, staid sound of the B&Ws. I was strongly impressed by the SVA1600's tight and extended bass and its spectral balance and timbral accuracy. Dynamic range was likewise impressive, and percussion and rim shots were particularly realistic.

On third-octave band-limited pink noise, the SVA1600s' output was strong and clean from the 32-Hz band on up. There was no usable output at 20 Hz but some in the 25-Hz band. I heard a bit of wind noise from the speakers' ports in the 32- and 40-Hz bands. And the JBLs sounded somewhat strained on noise peaks when I raised the 50-Hz band's input level until the woofers reached their excursion limits. When I listened sitting down, the SVA1600s exhibited only minimal tonality on pink noise, but with a slight high-frequency lift and a more forward, less reverberant sound than the 801s. When I stood up, however, the JBLs presented a much less up-front sound, closer to the B&Ws' presentation yet with significant midrange differences and some treble loss.

On cleanly recorded vocals, the SVA-1600s did emphasize sibilants a bit but did not have the harshness that some speaker systems impart. The SVA1600s' up-front character worked quite well on most vocals. On cathedral-recorded choral music, their close-up sound was less appropriate and I preferred the more diffuse sound of the 801s even though the lyrics were more intelligible on the SVA1600s. In any case, if you don't like the JBLs' front-and-center character, you can modify it by reducing the speakers' upward tilt (or by standing up, for that matter).

On big-band jazz, the SVA1600s' up-front character did very well by the bands' horn sections. Front-and-center horn solos were particularly well and realistically reproduced. The speakers' side-to-side coverage was excellent.

The SVA1600s' imaging was second to none. On intimately recorded chamber music, placement of the instruments' images

Wide spacing between pairs of terminals allows easy access for making and tightening connections.

was spot on, and center images were noticeably cleaner and better delineated than with the B&Ws. On most recordings having centered soloists, the center images were quite palpably realistic. That's probably because the high directivity of the SVA1600s' horns increased the proportion of direct to reflected sound I heard, a characteristic that would also be advantageous if you used these speakers in the main channels of a home theater.

The SVA1600s could play loudly and cleanly. Rock, country, and complex symphonic music sounded equally natural when played loud. Kick drums were solid and tight, though they had a bit less punch than they did over the 801s at the same level. Although the JBLs' output in the very low bass didn't match the B&Ws', the JBLs reproduced most pipe organ music with appropriate authority. Pedal notes were good and solid, and I noticed no intermodulation of upper frequencies.

The JBL SVA1600s were very good all-around performers. They offer quite distinctive looks, features, and sound at a very competitive price. Their horn-loaded tweeter gave the sound a distinctively up-front character but without any of the anomalies often associated with horn loading. And the SVA1600s' controlled directionality should help them deliver excellent sound and accurate imaging, even in rooms whose acoustics are less than ideal. A

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EQUIPMENT **PROFILE**

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AYRE ACOUSTICS K-1 PREAMP

Back in the September 1994 issue, I favorably reviewed Ayre's V-3 power amplifier, which had a fully balanced FET circuit with no negative feedback. That same approach is used in the K-1, the top of the company's preamplifier line. The K-1 also incorporates Ayre's Direct-Path Technology, which keeps the signal path's length, from input to output, less than 6 inches.

The standard version of the K-1 has three balanced and three unbalanced line-level inputs; each of the six can be selected from the front panel. So that you can customize the panel's markings to match the equipment in your audio system, the preamp comes with preprinted labels ("CD-R" and "DVD" among them).

In its basic form, the K-1 includes neither a phono stage nor the circuitry and motor for the optional remote volume and muting control. These options can be installed at the factory when you buy the K-1 (or later; the price is the same either way).

The phono stage takes the place of one balanced input and uses that input's XLR jack. Therefore, you cannot plug your turntable in without the nuisance of using an XLR-to-phono adaptor or grafting an XLR plug to your turntable's output cable. However, if you run a two-conductor shielded cable (available from Ayre for $500) to your arm or turntable, you can then run your phono cartridge in balanced mode; few, if any, other phono preamps have this feature. Phono gain and input load resistance can be changed by inserting different resistors in miniature terminal blocks on the phono boards. Ayre supplies resistors for 40-, 50-, and 60-dB gain, together with load resistors of 100 ohms to 1 kilohm for moving-coil cartridges.

Prominent on the left side of the K-1's front panel is a 46-position volume knob. A pair of smaller knobs, near the panel's center, serve as listening and recording source selectors for the preamp's six inputs. Near the right side, in a horizontal row, are the remote control's infrared sensor, a muting switch, and a three-color LED. The LED glows red during warm-up, green during muting, and blue during normal operation. Conspicuously absent is a balance control. Ayre's designers believe that most people rarely use these controls and that the extra circuit elements required would compromise the sound.

The layout of the rear panel is a bit unusual. The output connectors for each channel (an unbalanced phono jack and two balanced XLRs) are at opposite edges; the inputs cluster about the panel's center. However, because of the audio circuit board's layout, the connectors are not exactly mirror images. The right channel's XLR output jacks are rightside-up, above its RCA output, and its XLR inputs are upside-down, above the RCA inputs and tape output; the left channel's layout is the reverse. An unusual but nice touch is that each connector has an extra label, upside-down, so you can tell which jack is which while looking over the top of the K-1.

The power supply is a separate box, permanently connected to the preamp. It has no connectors except for an IEC power-cord socket.

Parts and construction quality of the K-1 are first-rate. This is a beautifully executed piece of gear.

Dimensions: Main chassis, 18 in. W x 5½ in. H x 11 in. D (45.7 cm x 14 cm x 28 cm); power supply, 13 in. W x 3 in. H x 8 in. D (33 cm x 7.6 cm x 20.3 cm).
Weight: 45 lbs. (20.4 kg).
Price: $5,250; optional remote control, $250; optional phono stage, $1,600.
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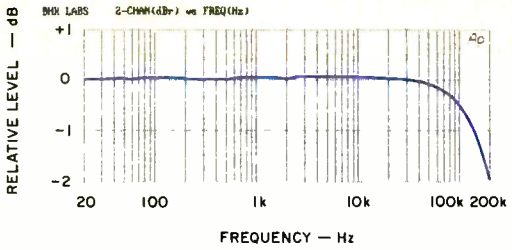
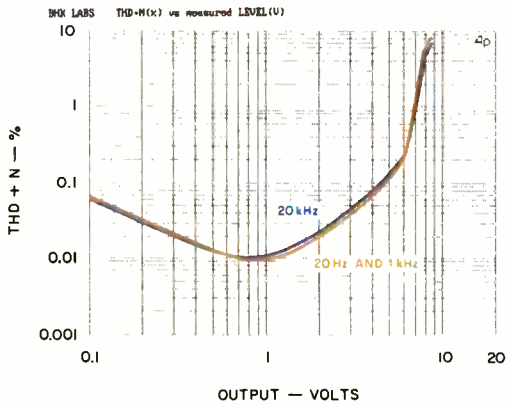


Fig. 1—Frequency response.



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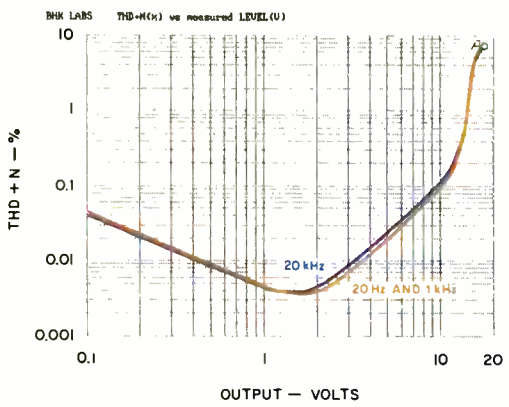


B

Fig. 2—THD + N vs. output level for unbalanced input and output (A) and for balanced input and output (B).

Measurements

The Ayre K-1's frequency response—with volume control at maximum, balanced input, unbalanced output, and instrument loading—is quite flat within the audio band and reaches its –3 dB point at about 250 kHz (Fig. 1). Response was essentially the same for the other three combinations of balanced and unbalanced input and output, but IHF loading increased the attenuation at 200 kHz by about 1 dB at the unbalanced outputs and 2 dB at the balanced outputs. Response was essentially constant for all positions of the volume control, which is admirable and uncommon.

Rise and fall times for ±5 volts at the unbalanced outputs were 1.4 microseconds with instrument loading and about 1.6 microseconds with IHF loading. When the unbalanced outputs were delivering ±5 volts, the balanced outputs delivered ±10 volts. IHF loading did not affect rise and fall times on the unbalanced outputs but did change the balanced outputs' results to 2 microseconds.

As mentioned, the Ayre K-1 has fully balanced circuitry. Common-mode rejection ratio (CMRR) at the unbalanced output of a fully balanced component tells us indirectly how well each phase of a balanced input signal is represented in the signal from that output. Up to 3 kHz, the K-1's CMRR was the same at its unbalanced outputs as at its balanced outputs, 65 dB. Even at 20 kHz, the unbalanced outputs' CMRR was about 55 dB, although the balanced outputs' CMRR decreased only to 63 dB. These results, and the fact that they are the same for both output modes over most of the audio range, are quite good and demonstrate that both input phases are well represented at the unbalanced outputs.

Volume-control tracking was exceedingly good. The channels matched within hundredths of a dB over the control's entire range.

The K-1's distortion performance was quite good, especially considering that the circuit uses no overall negative feedback, and I'm impressed that it wasn't much different at 20 kHz than it was midband. In general, there wasn't much difference between distortion with the balanced or unbalanced inputs. With unbalanced input and output (Fig. 2A), the minimum distortion achieved is slightly higher than with balanced input and output (Fig. 2B). The main difference is that the curves in Fig. 2B are shifted to the right of those in Fig. 2A because the balanced outputs deliver twice the voltage of the unbalanced outputs. (These curves are all for instrument loading; IHF loading did not materially affect the results.)

THE K-1 PREAMP USES FULLY BALANCED FET CIRCUITRY WITH NO NEGATIVE FEEDBACK.

Loading the balanced outputs with 600 ohms reduced maximum output at clipping to about that of the unbalanced outputs. From 20 Hz to 20 kHz, total harmonic distortion plus noise (THD + N) was less than 0.008% at 1 volt out, rising to 0.1% at about 3.5 volts.

In all the distortion measurements, the third harmonic was dominant, as it should be in a well-balanced differential or complementary circuit. This can be seen in Fig. 3, a spectrum of distortion residue for a 1-kHz signal at 2 volts out into a 600-ohm load on the unbalanced outputs. The amplitude of the third harmonic, at 3 kHz, is about 40 times greater than that of the second harmonic (2 kHz), which is next biggest.

Interchannel crosstalk was just about the same from left to right as from right to left, as might be expected from the symmetrical circuit layout. Crosstalk was better with balanced input and output, less than –110 dB from 20 Hz to 20 kHz when I set the K-1's

Table I—*IHF input sensitivity.*

	Sensitivity	
	LEFT	RIGHT
Unbalanced In to Unbalanced Main Out	156.2 mV	156.0 mV
Balanced In to Balanced Main Out	80.1 mV	80.1 mV
Unbalanced In to Balanced Main Out	80.0 mV	80.1 mV
Balanced In to Unbalanced Main Out	155.9 mV	155.9 mV
Unbalanced In to Tape Out	554.4 mV	554.5 mV
Balanced In to Tape Out	1.114 V	1.111 V
Phono In to Unbalanced Main Out	185 µV	190 µV
Phono In to Balanced Main Out	96 µV	95 µV
Phono In to Tape Out	131 mV	131 mV

All of the Ayre K-1's audio circuitry is on one main p.c. board, which is attached with spacers to the inside of the rear panel. Most of the parts on this board, except for film capacitors, are surface-mount devices. This board also carries the selector switches, the 46-position volume attenuators (which have two switch decks per channel, one for each signal phase), and the attenuator resistors. The placement of these parts is optimized to keep signal paths short. The tape recording switch, in the center of the board, serves both channels. The phono preamp boards, one for each channel, are mounted to the inside of the K-1's side plates with standoffs.

The attenuators are elaborately constructed. The front-panel volume knob is directly connected to one of the four attenuator-switch shafts; a toothed wheel on this shaft moves a Kevlar-reinforced timing belt that turns toothed wheels on the other three shafts. (A similar arrangement ties the two channels' input selectors together.)

Another p.c. board, behind the front panel, carries the circuitry for the remote control, the muting switch, the front-panel status-indicator LED, and the volume control's motor drive. The motor itself, a stepper type, is on a bracket attached to the bottom plate. A drive belt couples gear wheels on the motor and the volume control's shaft.

Like Ayre's V-3 amplifier, the K-1 preamp has a complementary differential FET input stage. In the K-1, however, all the active signal devices are large-geometry, low-noise J-FETs rather than the MOS-FETs of the V-3. Drain outputs of the differential amplifier are directly coupled to the source terminals of opposite-polarity devices; that is, the drains of the differential amp's two N-channel FETs feed the source terminals of P-channel devices, and the P-channel pair's drains feed the sources of N-channel devices. The topology of this composite connection is termed a folded cascode. At the output of the folded cascode, opposite-polarity drains that have the same signal phase are connected together, forming a two-phase complementary output. These two signal phases are each coupled to complementary source followers, whose outputs serve as the line amplifier section's outputs.

Although the folded cascode can be thought of as a single stage, it is useful to analyze it as two stages: the input differential amplifier and the "folded" second stage (which is also a differential amplifier). Overall gain of the circuit is controlled by local feedback, via source resistors in the input stage and drain loading of the folded cascode's outputs. The overall circuit is DC-coupled from input to output, which calls for some means of adjusting the output DC offset. This is provided by potentiometers in the gate circuits of the folded cascode's second stage and in the source circuits of the output source followers.

Two voltage regulators per channel supply the line amplifier's circuitry with +15 and –15 volts. One regulator feeds the first stage of the folded cascode and the supply ends of the voltage dividers in the gate circuits of the folded cascode's second stage. The other regulator powers the output source followers.

These voltage regulators are interesting circuits in themselves. The regulating element is a MOS-FET. It's connected with drain-to-gate feedback, to lower impedance and to provide adjustable DC voltage between its drain and source (very much like a bias-spreading regulator for a power amp's output stage). Resistors connect this MOS-FET's drain to the incoming +23 volt supply and its source to the –23 volt supply. Two adjustable resistors and a fixed resistor, connected in series from the drain to the source of the regulating MOS-FET, set each end of the fixed resistor to the desired positive and negative voltages. Each end of the resistor is then connected through an RC filter network for each polarity into the gates of two complementary MOS-FETs that act as source followers. The sources of the source followers are the +15 and –15 volt regulated outputs. The voltages that feed these regulators come from similar main voltage regulators in the external power supply.

The phono preamp circuit comprises two gain blocks similar to those of the line amplifier. In the first gain block, each of the four input-transistor positions is made up of four FETs in parallel, for lower input noise. Each second-stage transistor in this block is made up of two FETs in parallel. There are no source followers in the output of this block. The first gain block's drain outputs are loaded with a parallel RC network to produce the RIAA equalization curve's 2.1-kHz high-frequency rolloff. These drain outputs are RC-coupled to the input of the second gain block. In the second gain block, the outputs of the folded cascode section are loaded with series RC networks (which provide the RIAA equalization's bass boost between 500 and 50 Hz) and are then capacitor-coupled to output source followers. As in the line amplifier, separate regulators power each channel's first gain block, the input stage and second stage gate circuits of its second block, and the output followers of its second gain block.

The external power supply has four magnetic components, all with toroidal cores: the main power transformer, two main filter chokes, and an AC-line filter choke. The rectifier diodes, filter capacitors, and main primary voltage regulator are on a single circuit board. The supply has ultra-high-speed soft-recovery rectifier diodes and choke input filtering for the raw positive and negative DC. In a choke input filter, the filter inductor is the first element following the rectifier diodes, before the filter capacitors. This arrangement yields better voltage regulation with changing loads. It also ensures that the current in the power-transformer windings is sinusoidal, disrupting the AC supply less than the high-peak-current pulses of far more common capacitor input filters. However, the +16 volt supply for the remote-control and motor-drive circuitry does use a capacitor input filter. *B.H.K.*

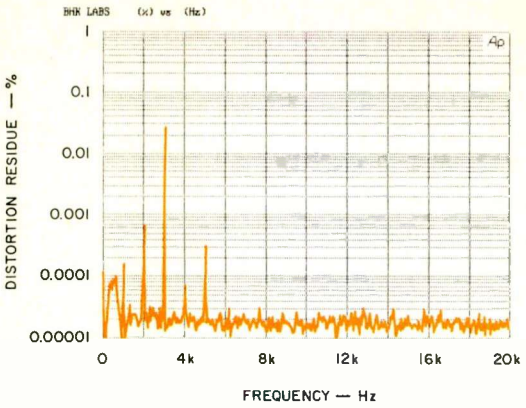


Fig. 3—Harmonic-distortion residue.

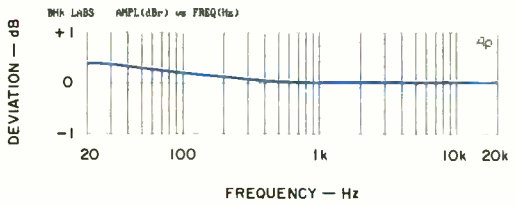
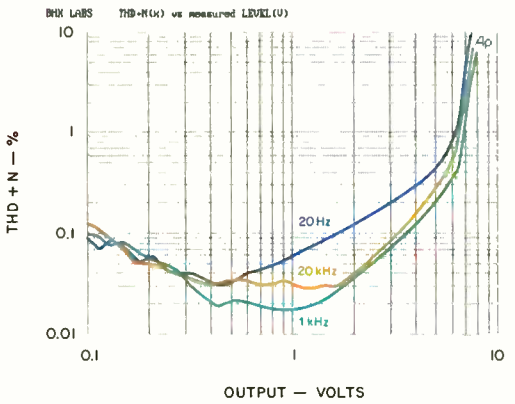
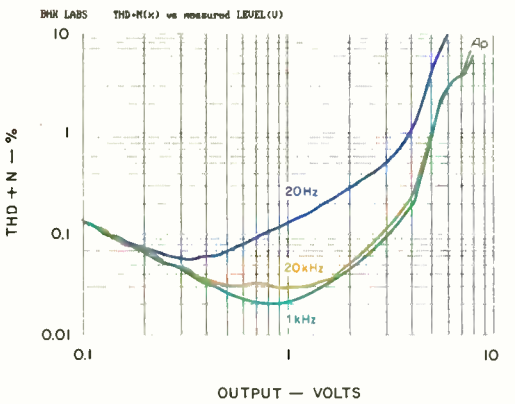


Fig. 4—RIAA equalization error.



A



B

Fig. 5—Phono stage's THD + N vs. output level for left channel (A) and right channel (B).

record-output selector to a different input from the main selector. When I set the record selector to the same input as the main selector, crosstalk increased: It was a bit above –110 dB from 20 Hz to about 2 kHz and was –90 dB at 20 kHz, still great performance. With unbalanced input and output and the record and main selectors set to different inputs, crosstalk was below –110 dB from 20 Hz to about 3 kHz and rose to almost –92 dB at 20 kHz. With both selectors set to the same input, crosstalk started rising above 700 Hz and climbed to about –82 dB at 20 kHz. This, too, was very good.

Output noise was nearly identical between the channels. For the balanced outputs and with the volume control set for 6 dB of attenuation (usually the worst-case conditions), wideband noise was 89 microvolts and A-weighted noise was 19.8 microvolts. At the unbalanced outputs, the results were 50 microvolts and 12 microvolts, respectively. The IHF signal-to-noise ratios were 92 dB for the unbalanced outputs and 88 dB for the balanced.

The K-1's optional phono preamp was tested at its nominal 60-dB gain setting, as it came from the factory. Figure 4 shows the RIAA equalization error for the left channel (the right matched quite closely), measured at the tape output jack with instrument loading. The RIAA error with IHF loading was essentially the same at the tape or the main outputs.

Distortion in the phono preamp's left channel (Fig. 5A) is lower than in its right (Fig. 5B). This is most noticeable at 20 Hz, where the right channel has almost twice as much distortion as the left over most of the output range, but you can also see it in the curves taken at 1 and 20 kHz for levels above about 4 volts. (The curves in Fig. 5 are for instrument loading; IHF loading reduced the available signal level by about 1 volt but did not otherwise affect distortion.)

The phono-input overload point measured 20 millivolts for 2% THD + N at 1 kHz in the left channel and stayed pretty much the same across the audio frequency band, which is ideal. (The right channel's overload point was slightly lower than the left's below 400 Hz.) Setting the gain to 50 or 40 dB would have yielded overload points of about 66 or 220 millivolts. In my pre-equalized square-wave test (which is also a test for phono overload above the audio band), the phono preamp put out

Associated Equipment Used

Equipment used in the listening tests for this review consisted of:

CD Transports: Sonic Frontiers SFT-1 and PS Audio Lambda Two Special

CD Electronics: Genesis Technologies Digital Lens anti-jitter device and Threshold DAC 2, Sonic Frontiers SFD-2 MkII, and Classé Audio DAC-1 D/A converters

Phono Equipment: Goldmund Studio turntable, Goldmund T3 straight-line-tracking arm, Jeff Rowland Complement moving-coil cartridge, and Vendetta Research SCP-2C phono preamp

Additional Signal Sources: Nakamichi ST-7 FM tuner, Technics 1500 open-reel recorder, Nakamichi DR-3 cassette deck, and Denon DMD-1300 MiniDisc deck

Other Preamplifiers: Sonic Frontiers Line 3 and Threshold T2

Power Amplifiers: Sonic Frontiers Power-3 mono tube amplifiers, Ayre V-3, Threshold T800D, and Arnoux Seven B digital switching amp

Loudspeakers: Genesis Technologies Genesis Vs and B&W 801 Matrix Series 3s

Cables: Digital interconnects, Illuminati DX-50 (AES/EBU balanced); analog interconnects, Transparent Cable MusicLink Reference (balanced) and Tara Labs Master and Music and Sound (unbalanced); speaker cables, Transparent Cable MusicWave Reference and Tara Labs RSC Master Generation 2

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2 volts, peak to peak, without any high-frequency compression occurring. Symmetrical high-frequency compression started to occur between 3 and 4 volts, peak to peak.

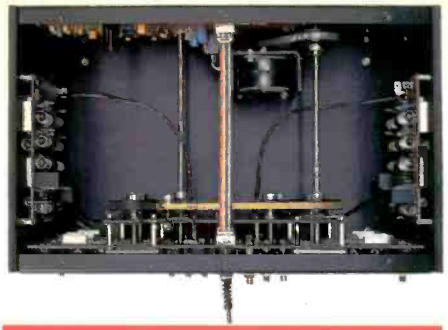
The phono preamp's CMRR, measured using an RIAA pre-equalized input signal, was greater than 80 dB over the whole audio range; this is exceedingly good. As with the line amplifier, the phono section's interchannel crosstalk was quite symmetrical in both directions. With the inputs terminated by 100 ohms, crosstalk with RIAA pre-equalized input signals was better than –100 dB up to 7 kHz and improved to about –92 dB at 20 kHz.

The phono section's referred input noise with a 100-ohm source resistance was about 320 nanovolts, wideband, and about 110 nanovolts, A-weighted, whether the source resistance was connected across the balanced inputs or from either phase to ground. That's not state of the art, but it's still good. The IHF S/N for a 100-ohm source with an output of 500 millivolts (equivalent to a moving-coil cartridge) was 73.2 dB. For the IHF dummy moving-magnet source with a 5-millivolt output, IHF S/N was 87.5 dB. Table I lists the K-1's IHF sensitivity.

The K-1 did not invert signal polarity at the balanced and tape outputs but did at the unbalanced outputs. Impedance was 280 ohms at the unbalanced main outputs and 570 ohms at the balanced ones. At the tape outputs, impedance was 1 kilohm higher than the source impedance for unbalanced input and also 1 kilohm higher than the source impedance of the positive phase for balanced input; for the phono inputs, it was 1.3 kilohms. Line input impedance was 8 kilohms for the unbalanced inputs and 18 kilohms for the balanced. The K-1 drew 0.26 ampere from the AC line.

Use and Listening Tests

The owner's manual states that the Ayre K-1 should be run for 100 hours before it will sound its best, but I burned it in for only a few days before putting it into my system. At that point, the preamp didn't sound quite as transparent and open as the Threshold T2 I had been using before it. But the next time I listened to the K-1 in my system, after it had spent time on my test bench (though it was still short of the 100-hour mark), it sounded quite a bit better. As



AYRE ACOUSTICS' K-1 PREAMP IS A BEAUTIFULLY EXECUTED PIECE OF GEAR.

I continued to use the Ayre preamp, its sound continued to improve, becoming most musically satisfying.

Phono reproduction through the K-1 was very good indeed. Even when I used a low-output moving-coil cartridge, noise was just detectable at the speaker when the preamp's gain was set for normal playing level. However, I felt that the sound was a bit more transparent and musically believable when I fed the cartridge through a Vendetta Research SCP-2C phono preamp into one of the K-1's unbalanced inputs.

The K-1 operated flawlessly in the lab and in my system. The remote worked farther off axis than many, and I very much liked its swift operation of the motorized volume control. I did feel that the volume knob was shaped a bit awkwardly and was slightly hard to use. My only other gripes were that the unbalanced outputs inverted signal polarity and that the permanently attached cable between the preamp and power supply made the K-1 somewhat awkward to move around (which is mainly a problem for reviewers who have to move equipment between a listening system and a lab in another room).

I now find myself with three preamps whose operation and sound I really like: the Ayre K-1, the Sonic Frontiers Line 3, and the Threshold T2. As with very good power amps, my preference for one or another of these preamps depends on my mood and the music I'm playing. I enjoyed the K-1 very much. It sounds excellent, and its accuracy and musicality should impress just about everyone. A

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AURICLE

ANTHONY H. CORDESMAN

ADCOM GFA-5802 AMP AND GFP-750 PREAMP

It's nice to see components that assault the state of the art but not the state of your wallet. The Adcom GFA-5802 amp and GFP-750 preamp come surprisingly close to state-of-the-art sound at surprisingly affordable prices. With the amp priced at $1,750 and the preamp at $1,250, no one will call either product cheap. But these are realistic prices, particularly for a preamp with remote control and balanced inputs and outputs and for an amp having balanced inputs and rated output of 300 watts per channel.

Company Address: 11 Elkins Rd., East Brunswick, N.J. 08816; 732/390-1130.
For literature, circle No. 93

Both components represent important steps forward for Adcom. The GFA-5802 has the cleanest, most open upper midrange and treble I have heard from an Adcom amplifier, the kind of sound you'd expect from amps costing more than $3,000. And the GFP-750 preamp is the company's first real contender for high-end sound, notably more transparent than any previous Adcom preamp.

That transparency is hinted at by the GFP-750's specs. It has an unusually good signal-to-noise spec of 102 dB, A-weighted, and the vanishingly low rated distortion you expect from a well-engineered modern preamp. (If that performance isn't enough for you, you can bypass the 750's active gain stages and use it as a passive controller.) Its rated output impedance (1.2 kilohms, balanced, and 600 ohms, unbalanced) is low enough for long runs of interconnect.

The GFP-750's features are well chosen. It does give up the phono gain stage found in past Adcom preamps. But it also gets rid of the tone controls, filters, and loudness-compensation controls, which simply got in the way of the sound path without being particularly useful. What it retains is a mode control for switching between stereo, reverse stereo, and mono. The reverse-stereo setting is more useful than you might suspect, to deal with recordings whose channels are reversed. By feeding the same sound to both of your stereo speakers, the mono setting makes it easer to position them and adjust balance.

All signal switching is by relay, to eliminate the sonic problems common to IC switches; LEDs show which of the five inputs you've selected. Three lever switches enable you to turn power on or off, select active or passive operation, and control an external processor loop.

The GFP-750's balance control is the type that doesn't fully attenuate the opposite channel when one channel is at maximum gain; I prefer balance controls that do. Being able to hear only one channel is quite helpful in setting up and checking out a system.

The preamp's remote, though small enough to be suitably inconspicuous, controls every feature except the passive-mode switch. It also has muting control, which the front panel lacks. All buttons are clearly labeled. The remote's balance-control rocker makes it a cinch to lock in the best imaging and soundstage from

Photo: Michael Groen

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the listening position. That may seem like a minor point, but it's amazing how much better most recordings sound if you adjust balance precisely for each disc to get the same level from each channel, the clearest imaging from left to right, and the maximum apparent soundstage size. A balance control really regulates the soundstage; it's a very important yet often underutilized feature.

On the GFP-750's rear panel are a pair of balanced XLR inputs and outputs, four sets of RCA input jacks, and RCA input and output jacks for tape and an external processor. You also get a double set of RCA main outputs, which comes in handy for bi-amping. An input and two outputs for remote infrared repeaters can be used for controlling the preamp from other rooms and for controlling other components. The rear panel also holds a power switch and a switched AC outlet.

The preamp's circuit design emphasizes sonic purity. The hefty power supply's oversized toroidal transformer has dual secondary windings, to keep control signals separate from audio signals. The audio section is a true differential balanced circuit, and Adcom has paid special attention to its rejection of RF interference, for reduced noise and coloration.

The GFP-750's passive mode is about as pure as you can get. It bypasses all active circuitry and the balance control, leaving only the volume control in the circuit. On the other hand, when you use the external processor loop (which is buffered), the volume control is bypassed. This ensures that you won't accidentally change the balance between the front and surround channels when you're using a surround decoder, though it might limit the loop's utility for some other processor types.

The GFP-750's single gain stage operates without feedback and uses only discrete devices. Nelson Pass, this preamp's designer, believes this circuit offers exceptional transparency and neutrality together with low noise.

He's right. The GFP-750 is not going to put elite preamps like the Krell KRC series or Pass Labs' Alephs out of the running, but it is very, very good. Past Adcom preamps, such as the GFP-555II, did very well for the money but did not approach the 750's degree of refinement and freedom from coloration. In fact, you have to listen very hard to hear the difference between the 750's active and passive modes. (Your interconnects may add as much coloration as this preamp does.)

I found the GFP-750 to be free of the GFP-555II's slight warmth and lack of detail; transients seemed crisper and cleaner, particularly for low-level signals, and the soundstage was more open and detailed. Dynamics were better, and music had more natural energy and life. The 750's sound was exceptionally detailed, neutral, and pure, without hardness or upper-frequency overemphasis. It came damn close to the sound of some of the best preamps around. If you're used to mass-market electronics, you'll hear the difference immediately.

The GFA-5802 amplifier is less of a departure from past Adcom designs than the preamp is. The GFA-5802 shares many design features with the GFA-5800 amp from which it evolved. The 5802 has, for example, the same multi-segmented power supply as the 5800, featuring a large toroidal transformer with dual secondary windings, high-current regulators, and large storage capaci-

tors. A heavy-duty transformer isolates the input stages from the high-current output sections. Like the 5800, the new amp has two sets of five-way binding posts per channel, for easier bi-wiring. Front-panel LEDs for each channel warn if the amplifier is being driven into distortion or if its thermal-protection circuitry has been activated. Thermal problems are unlikely during normal operation (the 5802 has massive heat sinks, which eliminate the need for fan cooling), but the thermal protection could be useful in case of short circuits or other setup and operating problems.

Like the older Adcom amp, the GFA-5802 has only three, low-feedback gain stages in the signal path (versus four or five gain stages in most amplifiers), but it adds a pair of transistors to drive the output stage. This is said to provide excellent linearity and

THE GFA-5802 AMP AND GFP-750 PREAMP REPRESENT IMPORTANT STEPS FORWARD FOR ADCOM.

make the output stage's bias current extremely stable. The older model's PNP devices have been replaced with NPNs; because NPN and PNP MOS-FETs differ in such properties as gain linearity and input capacitance, using only N-channel devices simplified the design of the quasi-complementary output stage. These changes in the 5802 are intended to provide increased power output and increase the current capability for driving low-impedance loads, eliminate the possibility of mechanical noise from fans, and improve the sound quality and transparency of the upper octaves. They succeed on all counts.

The GFA-5802's rated 8-ohm power of 300 watts per channel is 50 watts higher than the GFA-5800's. With 4-ohm loads, the 5802 is rated at more than 450 watts, but it is designed to deliver far more power than this. It can handle the lowest load impedances. In fact, thanks to new power-protection circuitry, it can even drive a dead short. Rated power bandwidth of the 5802 is 3 Hz to 130 kHz, dynamic headroom into 4 ohms is 2.3 dB, and rated intermodulation (IM) and harmonic distortion are less than 0.1% at full power.

The GFA-5802 did an excellent job of driving various speakers. In addition to my usual reference speakers (the Apogee Studio Grand, B&W 801 Matrix Series 3, and Thiel CS6), it handled the Quad ESL-63, the Spendor BC-1, older Apogees, and the Thiel CS5i. Good as the older Adcom amp was, the 5802 was definitely better at reproducing extremely high peak volume levels, even into low-impedance loads. Yet it sounded more transparent and detailed at low volume than at peak power (unlike earlier high-power solid-state amps, whose performance often diminished at low levels). This is a major virtue, since most classical music, voice, and acoustic jazz consist primarily of low-level passages.

The GFA-5800 had deep bass power and control, but the GFA-5802 definitely outperformed it. This showed up clearly below 35 Hz, where the 5802 simply seemed to move more air, providing excellent dynamics. To the extent that any amplifier can, the 5802 also did an excellent job of taming

problem woofers, reducing excessive bass warmth or overhang and making the sound more natural and detailed.

What really makes this amplifier outstanding, however, is its ability to deliver midrange and upper midrange information, particularly at low levels. Soft choral passages were delightfully clear, and instrumental detail was exceptional. On live recordings, there was more soundstage information and a more natural sense of space.

The GFA-5802 was better than the GFA-5800 in reproducing solo piano, bass viol, violin, and harpsichord recordings, almost equaling some of the most expensive amplifiers around. Brass and woodwind reproduction were extremely accurate, most strikingly on those low-level details needed to keep the sound of solo French horns from hardening. On voice, particularly challenging soprano recordings, the 5802 did not soften or "improve" the sound, yet it made sibilants sound more natural. And I heard slightly more detail and texture in male voices.

The GFA-5802's imaging, soundstage, dynamics, and transparency were excellent. It did not quite equal the soundstage detail, low-level resolution, and spaciousness of today's state-of-the-art amplifiers. But it came surprisingly close, matching many far more expensive amps, and it had more resolving power than all but a handful of cartridges, D/A converters, and speakers can fully exploit. Even demanding and wealthy audiophiles just might be tempted to buy the GFA-5802 and put the money saved into better speakers or source components.

THE GFP-750 PREAMP'S CIRCUITRY STRESSES SONIC PURITY, AND ITS PASSIVE MODE IS EVEN PURER.

As you might expect, the Adcom GFP-750 and GFA-5802 have a natural synergy. Both have the same basic design emphasis and sound character, and the combination provides very high resolution without any loss of dynamics or life. It may not quite match the $10,000-and-counting amp/preamp combinations at the high end of the high end, but, at less than one-third their price, the Adcom duo clearly demonstrates how the sound quality of "unaffordable" components becomes very affordable over time.

This amp and preamp are styled with a bit more flair than is usual for Adcom, and it's nice to see a departure from the pervasive black box look. The GFP-750 preamp's front panel has a touch of gold and some nice, slightly retro lever switches with indicator LEDs. Its gold trim and switches match similar details on the GFA-5802 amp and Adcom's new GCD-750 CD player, all of which are distinctive without being gaudy.

If I have any caveat about the GFP-750 and GFA-5802, it is that they do not "improve" the sound. They may be a bit too neutral for those who rely on their electronics' softening the upper octaves to make up for the hardness of their program sources or speakers. And their bass may be too tight for those who rely on poorly damped amplifiers for an apparent increase in their speakers' bass energy. But if accuracy is what you want, the GFP-750 and GFA-5802 are among the best buys around. A

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Wes Phillips, Stereophile Guide to Home Theater, Spring 1997

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AURICLE

COREY GREENBERG

NHT 2.9 SPEAKER

I got the strangest letter the other day. It read:

> Dear Corey,
>
> How can you call yourself an expert reviewer when you've been using the same NHT 3.3s as your main reference speakers for, what is it, four years now?! Hell, other reviewers swap their reference speakers every issue! What's your problem, little man?
>
> Sincerely,
> D. Trump

Hey, what can I say? I love my NHT 3.3s. I've auditioned plenty of excellent high-end speakers, but I still haven't found anything I'd rather use day in and day out as my main reference speakers. Okay, so I've been tempted over the years by some really outstanding speakers from M&K, Paradigm, and a few others. Can't a guy look? But even after these dalliances, I always come back to the NHTs. (I think reviewers who jump to a new reference speaker every issue are sluts and whoremongers. There, I said it! Sluts! Whoremongers! Schlubs, even!)

The way I see it, in order for me to hear all the sonic minutiae that *Audio* pays me $7.50/hour (plus tips) to report on, I have to rely on the accuracy, neutrality, and just plain transparency of whatever speakers I choose as my reference. In other words, I have to trust the sound of those speakers. The more accurate my reference speakers, the more accurate my reviews of *other* gear will be. And I have to say that of all the speakers I've heard, price be damned, there aren't any whose accuracy I trust more than the NHT 3.3s.

But I'll tell you something. Like any long-term relationship with someone who weighs 250 pounds and has pointy toes, living with these big muthas hasn't always been a bed of roses. You think I like putting on my truss (and matching sock garters) every time I need to move them? At some point, every 3.3 owner must learn the 3.3 Waltz, where you lean the heavy speaker up against your body and two-step it across the room, trying desperately not to punch a hole in your foot with the pointy cones.

And let's face it: Even though they're designed to sound the same no matter what room you put them in, the 3.3s are just too big and brutish for many rooms. I've tried setting them up in a few rooms that happily invited stand-mounted bookshelf speakers and even some smaller towers, but I just couldn't get the big NHTs to work right. It wasn't their fault; they just need a good-sized room and enough distance from the listener for the optimum listening angle. When you get it right, *man* do these speakers throw up an accurate sound field! But if your room isn't big enough, you'll never hear half of what these slabs can really do.

None of this was lost on the 3.3s' designer, NHT's Ken Kantor. In fact,

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when he moved into a new house a while back, he told me his new living room wasn't big enough for his own 3.3s! You know, now that I think about it, that *was* right about the time he told me he'd started work on a junior version of the 3.3 that would work better in smaller rooms. You don't think...? Naw, it was probably just coincidence, like when Andy Gibb and Divine kicked at the same time.

Whatever its reason for being, the smaller, more livable 3.3 has arrived: the Model 2.9, which, at $2,500/pair, costs just a little more than half the price of the $4,300/pair 3.3. NHT calls its new second-in-command the 3.3 for the rest of us, designed to provide the acoustic benefits of the 3.3 from a smaller, less demanding cabinet. The 2.9 is a couple of inches shorter and 9 inches shallower than the 3.3 (it's 40 inches tall, 7 inches wide, and 22 inches deep). And instead of the 3.3's expensive brushed laminate finish, the 2.9 has the same high-gloss, black laminate finish as NHT's SuperZero, SuperOne, and VT-2. (The 2.9 is also available in sycamore or mahogany for $2,675/pair.)

Like the 3.3, the 2.9 is a four-way, floor-standing tower with a built-in subwoofer mounted low to the ground, on the inward-facing side panel. This ensures that the woofers see their own corners regardless of where your room's real corners may be, which has the dual advantages of flattening and extending deep-bass response.

So how does NHT save you almost 2,000 clams here? By pinching off just a bit of booty at the bottom. Whereas the 3.3 has a 12-inch polypropylene acoustic-suspension woofer in a massive, 75-liter sub-enclosure, the 2.9 has a 10-inch version of the same driver working in a smaller, though still massively braced, 48-liter sub-enclosure. NHT rates the 3.3 as being flat in-room down to 23 Hz and the 2.9 as flat down to 26 Hz. Three less hertz of bass saves you almost 2,000 bucks?! Wouldn't it be great if you could tell an amp manufacturer, "Go ahead and shave the last 5 watts off that big 250-watt monster I've been drooling over, and I'll take it home for a little more than half price!"

Other than the woofer and cabinet sizes, though, we're talking about the exact same speaker as the 3.3. The 2.9 has the same inward-angled front panel, the same three upper drivers (from bottom to top, a 6½-inch polypropylene mid-woofer operating from 100 to 320 Hz, a 1-inch aluminum-dome tweeter operating from 3.5 to 26 kHz, and a 5¼-inch polypropylene midrange operating from 320 Hz to 3.5 kHz), the same crossover circuit, the same baffle width, and the same radiation pattern. From 100 Hz on up, the NHT 2.9 *is* a 3.3.

The two speakers have identical features as well. Both have dual sets of heavy-duty, gold-plated binding posts for bi-wiring or biamping (the speakers ship with gold-plated jumpers for use with single-wired systems) and a pair of stabilizing outrigger bars screwed to the bottom of the cabinets, both fore and aft. The bars are fitted with height-adjustable spikes that anchor the speakers in place and allow for leveling and tilting (more on this later, because it's very important in terms of getting the best sound).

THE 2.9 DELIVERS 90% OF THE 3.3'S MAGIC AT A LITTLE MORE THAN HALF ITS PRICE.

I compared the 2.9s to the 3.3s in my reference system. Theta Digital's Data III transport spit bits from CDs and laserdiscs, and the company's Casablanca digital surround preamp served as system controller. LP playback was handled by a Rega Planar 3 turntable and Sumiko SHO cartridge, with a McCormack Micro Phono Drive phono stage. I started the sessions with Aragon's 200-watt 8008 power amp and later switched to Krell's 100-watt KAV-500; both drove the NHTs superbly. Cables were mostly Kimber, 8TC for the speakers and Silver Streak interconnects, while Canare 75-ohm digital cables and Audio Power Industries' Power Pack AC line filters completed the picture.

Although the 3.3 was designed to butt up against the wall behind it for best bass response, NHT recommends that you pull the 2.9s out into the room a bit more. When I first hooked them up, I made the mistake of placing the 2.9s right up against the wall, like my 3.3s, and the bass was *way* over the top. NHT says the 2.9 is voiced to have the best bass balance when it's pulled forward from the wall behind it—until its pointy front-panel edge is approximately the same distance from the wall as a 3.3's, which is 36 inches in my room.

First I broke in the review pair with a few days worth of loud pink noise. Then I lined them up right next to my 3.3s and went back and forth a few times for some quickie comparisons before starting the heave-ho routine of moving one pair out of the way while I listened to the other.

On first listen, the 2.9s sounded *very* close to the 3.3s, but not quite identical. The new NHTs had a brighter, more forward sound, and their imaging wasn't quite as focused and detailed as the 3.3s'. But the big surprise was in the low end. I'd expected a bit less outright bass heft from the smaller speakers, yet the 2.9s actually had *more* bass kick, not less! What the hell?! I went back and forth, even going to the trouble of swapping the positions of the two pairs of speakers to see if maybe a few inches made that much difference in the bass. But the 2.9s consistently sounded meatier and punchier in the low end on all my rock CDs.

So I moved the 3.3s out of the way and settled in for some real listening. Same deal: The 2.9s sounded more forward and didn't image quite as well. It was easy to see why this could be so, as the 2.9's shorter cabinet effectively moves the front-panel driver trio a good 3 inches down from where it is on the 3.3. So really, being that it's shorter and its drivers (and thus their complex radiation pattern) are lower, the 2.9 can *never* sound identical to the 3.3! *Aha!* Another manufacturer boast bites the dust! I called Kantor to crow, but my caw was cut short.

"Have you tried tilting them up?" he asked me. "Makes all the tonal balance and imaging differences go away."

Ahh, the magic tilt. I flashed back to a few years ago, when I bought a new couch for my living room and all of a sudden my system didn't sound as clear and focused as it used to. Turned out my new couch was a few inches shorter than the old one, so Kantor suggested I tilt the 3.3s a bit downward, toward the listening position, by raising their rear pointy feet. Sure enough, the sound snapped right back into focus. I'd forgotten all about the magic tilt until he brought it up again with the 2.9. I took his advice, raising the front feet so the speakers

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tilted back a bit, and damned if the 2.9s didn't sound *just* like the 3.3s!

And I do mean *just* like them. Properly positioned and with the right degree of vertical tilt, the 2.9s may as well have been my trusty 3.3s above a couple of hundred hertz. They had the same incredible neutrality, in both tonal balance and spatial coherency, as the larger NHTs. Instead of making every recording sound about the same size and width, the 2.9s share their big brothers' ability to present every recording's spatial properties exactly as they are, without any exaggeration. This means that many recordings will sound smaller than you thought, and the well-recorded discs in your collection will stretch wider and deeper than you've ever heard them before.

Tonally, the 2.9s have the same extreme, analytical-to-the-point-of-ruthless accuracy as the 3.3s, which rewards well-recorded material and exposes every nose hair and caraway seed stuck in the teeth of crappy recordings. Forgiving the 3.3s are not, but that's why they're so useful as a reviewer's tool: They come closer to being a precision audio microscope than any other speakers I've heard. Except, of course, the 2.9s, which sounded just like them. Because they pretty much *are* them. They imaged just as incredibly, threw just as big and deep a soundstage, and played just as terrifyingly loud without distortion when driven by the likes of an Aragon or a Krell.

The one area where they still didn't sound the same was in the bass. The 2.9 goes very low, but the 3.3 goes significantly deeper and does so with much greater reserves of output. These speakers may be rated a mere 3 Hz apart, but ultra-low bass effects, like the infamous arc-lights scene in *Apocalypse Now*, gave the 2.9 a tougher time than the 3.3: The 3.3s shook the room to its core without audible distortion, a feat the 2.9s couldn't match. One of the strengths of the 3.3 is its incredibly powerful deep-bass foundation, surpassing most separate subwoofers I've heard. While the 2.9 has an extremely well-defined and powerful low end, it doesn't share the 3.3's sense of effortless, all-the-way-down bass.

The irony is that on most of my CDs and records, the 2.9 actually sounded meatier and punchier in the low end than the 3.3. There was a bit of added mid-bass kick in the 2.9 that the more strictly neutral 3.3 didn't have, and let me tell you something: It's a *good* thing. A *very* good thing. Electric basses popped off the 2.9s like fresh baseballs off corked bats. The new NHTs delivered a gut punch on loud rock bass and drums that I'd never heard from the 3.3s, which are too busy being flat and neutral through the bass range, all the way from the deepest rumble to the highest frets on a Fender P-bass. The 2.9, on the other hand, is a little bit ripe in the meatiest part of the bass spectrum, and this is what gives it a gutsier balance on pop music, even as it lacks the 3.3's ultimate extension and power in the deepest octave.

But god almighty, I wish my 3.3s had this mid-bass kick, even just a taste of it! All right, all right—ultimately, I'm glad they don't have it, because I value accuracy above guilty pleasure. I guess. Couldn't I have just a *tiny* bit of that 2.9 bass kick? No!! What am I saying? I'm a responsible reviewer, damnit, not some pathetic mid-bass junkie willing to debase himself for a mere whiff of added bass kick on rock CDs. You should hear it on the 2.9, though. It's not as accurate as the 3.3's mid-bass balance, but it's sooo gratifying if you listen to a lot of rock and pop or blues—anything with strong bass and drums.

I've always said that if a speaker came along that were more accurate and sounded better overall than NHT's $4,300/pair 3.3, I'd switch over in a heartbeat. But it's been four years since I started using it as my reference, and though I've been tempted by a few sterling newcomers, it's the 3.3 I continue to turn to for the truth. That you can now get this kind of accuracy and utter excellence for just $2,500/pair is some of the best news audiophiles will hear this year. Throw in its easier-to-live-with size and positioning ease, and the 2.9 becomes the speaker to beat at this price. And two pairs of 2.9s plus NHT's $450 timbre-matched AudioCenter-1 center-channel speaker will make a Dolby Digital-ready $5,450 home theater package that'll mess up your mind just as bad as the two pairs of 3.3s and AC-1 in my own system have messed up mine.

The 2.9 delivers 90% of the 3.3's magic at a little more than half its price. If you've lusted after the NHT 3.3 but couldn't handle its price, room-size requirements, or both, the 2.9 is the answer to your prayers. Highly recommended. A

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No audio equipment in history has achieved the legendary status of the Marantz vacuum-tube electronics. So timeless are the sonic and aesthetic attributes of this classic trio that, almost four decades after their introduction, pristine examples are still eagerly sought by committed music lovers and audiophiles alike.

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Ultimately, these jewel-like components could have you listening to music from a whole new perspective, while providing the kind of satisfaction that comes from possessing a timeless classic.

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AURICLE

ANTHONY H. CORDESMAN

KRELL AUDIO + VIDEO STANDARD PREAMP/ SURROUND PROCESSOR

The Krell Audio + Video Standard preamp/surround processor is one of the most complex and interesting products to appear on the high-end market in years. Designed to keep up with home theater's rapid evolution, the Audio + Video Standard offers the same high degree of transparency, transient life, dynamics, and musical realism as Krell's KRC stereo preamp, which I use as one of my references. Like the KRC, the Standard has a highly detailed and natural soundstage yet is free from the edge and aggressiveness found even in some of the most expensive solid-state preamps.

The Standard delivers superb reproduction of Dolby Surround and Dolby Digital (AC-3) soundtracks, and it adapts easily to different kinds of loudspeakers and system configurations. Also, I found that the quality of its D/A conversion rivals that of some of the best stand-alone converters around. On video, it has outstanding performance with composite signals, together with the best ability to drive long runs of S-video cable (up to 20 feet) that I have yet encountered. Its overall ergonomics are excellent—even in the setup phase, where many components falter. And its remote offers the best and most flexible access to a complex mix of A/V inputs of any remote I have seen.

THE AUDIO + VIDEO STANDARD DELIVERS THE TRANSPARENT SOUND OF KRELL'S STEREO PREAMPS.

At $12,000, the Audio + Video Standard is anything but cheap, so it must be judged by far more demanding criteria than A/V receivers or preamp/processors costing $3,000 or less. But the investment you make in the Krell is intended to evolve and grow, through board and software upgrades. (I'm told that a board to decode DTS, for example, should be available very soon.) The boards and processing chips are easy to change (the relevant chips are even mounted in quick-clamp, zero-insertion-force sockets). The motherboard can be swapped to keep up with more radical changes in technology, such as the 24-bit, 96-kHz DVDs that Chesky is planning to introduce on an experimental basis or DVD-Audio when it finally arrives.

The Audio + Video Standard is designed with the future in mind, but its owners won't sacrifice any aspect of the present. For one thing, the Standard does as good a job of processing CDs as stand-alone D/A converters costing $5,000 or more. A few, such as the Mark Levinson No. 30.5 and Theta Digital DS Pro Generation V-a Balanced, may provide more detail and dynamic contrast, but none offers a sweeter and more musically balanced sound.

The Audio + Video Standard has one balanced analog input and five (plus the tape input) that are unbalanced; these feed nine channels of discrete Class-A, direct-coupled, complementary circuitry. The channels are: left, center, and right front, left and right for side and rear surround, and two

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subwoofers—all with balanced and unbalanced output jacks. In addition, there are unbalanced tape outputs for one audio and two video recorders. The digital connections include five inputs (one AES/EBU XLR, two coaxial RCA, and two Toslink) plus an RF input for AC-3 signals from laserdisc. You'll find two digital outputs, one coaxial and one Toslink optical. The Krell also has four composite-video inputs on RCA jacks, another on a BNC jack, and four S-video inputs. A similar mix of video outputs is provided: four composite (three RCA and one BNC jack) and three S-video. On-screen menus for display on your TV are available through one S-video and one composite-video RCA jack.

Having so many connections may seem like system overkill, but it really isn't. If you have a complex audio system, DVD and laserdisc players, and satellite and cable TV, you'll be filling up most of the Audio + Video Standard's inputs in a hurry. As for the number of outputs, no one in his right mind should buy an expensive surround processor that lacks facilities for rear as well as side surround speakers. I believe many owners of high-end home theaters will want to include stereo subwoofers or subwoofers at the front and rear of the room. These systems may also need component-video connections, and Krell is already considering an option for this.

Speaker frequency ranges, delay times, relative levels, and so on are individually selectable for each channel, not just by channel pairs. The on-screen display is exceptionally easy to use, and setup is easier and more intuitive than with the Theta Digital Casablanca and Meridian 565 surround processors I used for comparisons during my evaluation.

The Standard's surround processing (which is disengaged in two-channel mode, for purer sound) is all digital. For surround, analog input signals are fed through a buffered 20-bit Crystal A/D converter that operates at a 128-times oversampling rate. Dolby Pro Logic surround decoding is handled by a 66-MHz, 24-bit Motorola DSP-56007 signal processing chip that has a 56-bit accumulator. Crossover filtering to the subwoofer is also performed digitally.

For Dolby Digital Surround, the Audio + Video Standard has a built-in RF demodulator for laserdisc and direct digital inputs for DVD and other sources. At the heart of its Dolby Digital processing is a 24-bit, 80-MHz Motorola DSP-56009 chip. Krell claims the 56009 yields 20 dB better signal-to-noise and an order-of-magnitude reduction in harmonic distortion, compared to the 20-bit, 66-MHz DSP chips used in many competing units.

Decoded Pro Logic or Dolby Digital signals are processed by two more Motorola DSP-56009 chips per channel, running Krell software, which oversample the signals. The critical left, center, and right front signals are then fed to 20-bit Burr-Brown PCM-63P DACs; the side, rear, and subwoofer channels use 18-bit Burr-Brown DACs. This will not enable reproduction of 24-bit, 96-kHz recordings. However, it will be a long, long time before such recordings are more than cutting-edge curiosities, and we don't yet have the technology and chip sets to handle them on consumer equipment. And the Krell's DACs can be changed at the factory to handle sources whose sampling rates are higher than usual; making this change would require replacing the motherboard in many other A/V components. In the meantime, the Krell's 20-bit D/A conversion in the main and center channels is as good as in any surround processor I know of, and only Theta Digital's Casablanca currently offers 20-bit DACs for the surround and subwoofer outputs—as an option. (Krell, too, is considering this option if demand emerges for it.) Further, the existing Audio + Video Standard enables you to reproduce critical musical information with 20-bit resolution and a 48-kHz sampling rate. That's higher resolution than you can get from CD, though it is available from professional digital recorders and could be from DVD.

THE KRELL'S BOARDS AND PROCESSOR CHIPS ARE EASILY CHANGED TO ACCOMMODATE NEW DEVELOPMENTS.

In my system, the Krell Audio + Video Standard breathed new life into old movie soundtracks and sometimes produced better results from the Dolby Surround tracks on DVDs and new laserdiscs than from the Dolby Digital soundtracks. Music in Dolby Surround often had less midrange and treble glare and harshness than many Dolby Digital recordings.

Playback of Dolby Digital material was, however, outstanding. The Krell produced the cleanest upper midrange I have heard from Dolby Digital. I have not been able to get similar sweetness and natural musical harmonics from the Meridian 565 (although improvements to this model are in progress). And I have to use equalization to reduce brightness in Dolby Digital playback with the Theta Casablanca (though new boards are being shipped as I write). No other processor I know of comes close to the Krell in terms of "taming" Dolby Digital.

If you are a serious audio/videophile, I suspect you will demand such taming. To my ears, Dolby Digital tracks often exhibit a slight edge or hardness. There seems to be a lack of transparency, the detail in complex musical passages is not all that clean, and dynamics in the upper midrange don't seem quite as good as in the lower midrange and bass. These problems may be caused by the mixing engineer's failure to properly cut back on the treble to correct the balance for playback in the confines of a domestic listening space or his failure to remix the directional data for a more realistic soundstage in homes. Or the flaws may be inherent in Dolby Digital and its AC-3 coding system.

None of the music I have heard on Dolby Digital soundtracks and test discs (with the possible exception of Delos's *DVD Spectacular*, of which I have only a preliminary release) compares favorably with the classical recordings John Eargle has made in ordinary Dolby Surround. Among Eargle's Dolby Surround CDs on Delos, I particularly recommend *Spirit Murmur* by Hovhaness (DE 3162), the Voices of Ascension singing *Beyond Chant* (DE 3165), and Mendelssohn's Symphony No. 2 (DE 3112). Unfortunately, there are no discs that enable meaningful direct comparisons of Dolby Digital, DTS, conventional PCM, and Dolby Surround, so it's impossible to make any firm judgement of their relative quality.

The Krell Audio + Video Standard offers unusually flexible bass management. It has a proprietary bass-redirection algorithm and two sets of subwoofer outputs that may


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be configured for mono, stereo, or front and rear placement. After experimenting with different surround-system configurations, I have come to believe that such flexibility is of critical importance. High-end home theater systems with serious music capability cannot rely on a single subwoofer for their deep bass. My listening to DTS, Dolby Digital, and experimental 20-bit CDs has made it utterly apparent that the left and right front channels in a truly demanding high-end home theater or surround music system should be reproduced through full-range speakers with subwoofer-like bass capability. Relying on a single subwoofer produces at least slightly smeared, vague bass with problems audible well above the crossover region. Such spongy bass is fine if you just want home theater boom but bad if you want music and soundtrack detail.

My listening to the Krell Audio + Video Standard led me to expand my Polk SRT home theater speaker system to include five Polk SRT subwoofers and full-range surround speakers roughly equivalent to the main-channel speakers. (Limited-bandwidth surround speakers may be adequate for Dolby Pro Logic, but today's discrete-channel systems can provide enough directional information, bass, and treble that you probably should trade up if you're building a reference-quality home theater.) Four of the subwoofers add bass to the main and surround channels, and the fifth reproduces the LFE channel. Few home theater enthusiasts are likely to be this ambitious (or insane), yet the Krell's flexible bass management can accommodate such a system, just as it accommodates less extravagant setups.

The Krell's ability to provide stereo subwoofer bass for music listening really does help with stereo and surround music having a strong bass line. It also can make the crossover between the main speakers and subwoofers far less audible in stereo.

You can configure the Krell for front and rear subwoofers, to minimize room interaction problems or emphasize the impact of front/rear directional information on soundtracks. I found this less desirable than the stereo subwoofer mode, however.

As for stereo music, I would stress again that the Krell Audio + Video Standard is an excellent stereo preamp. I did a great deal of A/B listening to the Standard, the Classé Audio CP-60, the Krell KRC, and the Pass Labs Aleph P preamps. The Standard's sound quality in its preamp mode was directly comparable to that of the KRC. And its D/A converters were directly competitive with those in Krell's stand-alone converter and CD players, long recognized as some of the best available.

I found the "Music" mode on the Audio + Video Standard to be totally unlike the hellish "Hall," "Jazz," "Concert," and similar digital ambience simulations of many A/V preamps and receivers. Properly adjusted, Krell's "Music" mode produced highly listenable center-channel and surround effects while preserving the best of stereo. (Like virtually every preamp/surround processor I've tried, the Krell's default level in "Music" mode fed too much signal to the subwoofer outputs. However, it was easy to change.)

I believe that improved music processing has real promise. Circle Surround has shown that it may be possible to add surround effects without degrading stereo. The "Trifield" mode in the Meridian 565 and the music modes in the Lexicon DC-1 also represent real progress. Once again, upgradability offers a critical advantage, enabling owners of the Audio + Video Standard to use any improvements Krell develops or adopts.

The value of such flexibility became clear during my evaluation of the Standard. I didn't like the way it handled DVD when DVD was still settling down, but a new chip with fixes was in the mail before I even called Krell about the problem. I also had suggestions about changing the handling of music in the surround and three-channel stereo modes: Software changes are underway. High-end audio is always an expensive adventure, but these days you had better choose equipment for a long voyage into the unknown.

For now, the Krell Audio + Video Standard delivers superb audio and video from all of today's recorded media and over virtually any speaker configuration. It is easy to set up and operate and has excellent on-screen displays. Its ergonomics are as friendly as the current state of the art permits (only the most determined neo-Luddite is going to have problems using this preamp). In short, the Audio + Video Standard will give you the years of pleasure and excitement that you deserve for the money. A

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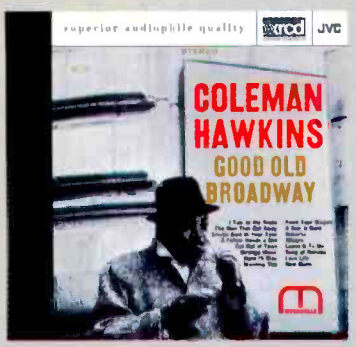

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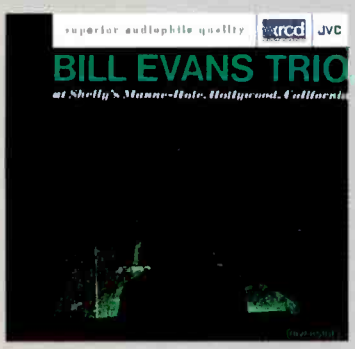

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CLASSICAL RECORDINGS

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The Stokowski Stereo Collection (works by various composers)
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RCA GOLD SEAL 09026-68443
ADD; 14 CDs
Sound: B+, Performances: A to B

This blockbuster box honors Leopold Stokowski, the first conductor to attain movie-star status and also the most famous audiophile-oriented conductor. He appeared in films and even stepped down from classical's lofty perch to shake hands with Mickey Mouse at the end of *Fantasia*. He never stopped performing and recording; in fact, when Stokowski died at age 95, he had a contract to conduct a gala on his 100th birthday in 1982.

Some of Stokowski's best recorded performances came from his association with RCA Victor from 1954 to 1975. This collection is from that era and includes his 53 surviving stereo recordings; 25 of them have never been issued on CD before, and two are issued for the first time in any format. The music, of course, is from analog tape masters, but this time BMG's restoration engineers have used just the right amount of noise reduction to tame annoying hiss without losing the upper frequencies.

Having Classic Records' recent LP reissue of four selections in the collection (*Rhapsodies*, LSC-2471), I couldn't resist comparing CD versus LP. There was more low bass on the LP, but they are otherwise virtually identical.

Stokowski recorded for several different labels in the late 1950s. The Gold Seal set's sound is superior to the EMI CD reissues of the original Capitol recordings but isn't up to the high level of Omega's CD reissues from Everest's original 35-millimeter masters.

An interesting technical point is that about half of the recordings in this set were originally done in four-channel during the quad era. BMG's engineers have remastered them in three-channel Dolby Surround (left, right, and surround), as they have done with quad masters of Tomita, Charles Gerhardt, Henry Mancini, and others. As with earlier efforts, comparisons against the original quad open-reel tapes reveal the CD versions to be rather poor imitations. As a matter of fact, when I applied Dolby Pro Logic decoding (or

maurice ravel

Le Tombeau de Couperin, Pavane pour une Infante Défunte, Ma Mère l'Oye, Une Barque sur l'Océan, and Alborada del Gracioso
Lyon National Opera Orchestra, Kent Nagano
ERATO 0630-14331; DDD; 68:50
Sound: A, Performance: A

The selections on this CD were composed for the piano first and orchestrated later. Since Maurice Ravel was a master orchestrator, conductors often program these gorgeous works as showpieces for their players, with little thought as to interpretation. But Kent Nagano has given great attention to the subtle nuances, articulation, and rubato phrases of Ravel's music, and the result is marvelous. His creative approach is evident in almost every movement, creating an album that will satisfy not only the Ravel connoisseur but also the audiophile who loves grandiose orchestral recordings. *Patrick Kavanaugh*

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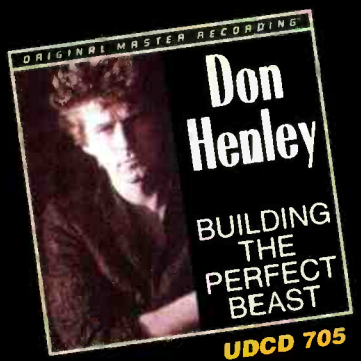

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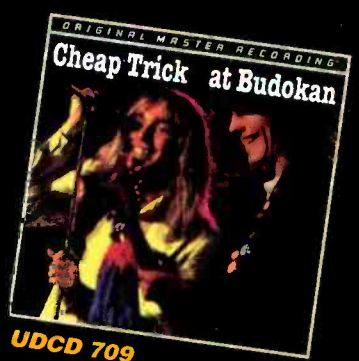

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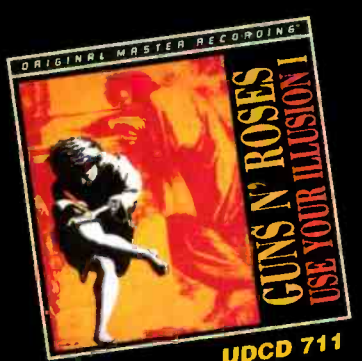

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simple L – R ambience extraction), I heard little difference in the surround sound fields generated from the Dolby Surround-encoded and standard stereo material in this 14-disc collection.

While not every selection in this massive set is a must-have, there are many standouts. Among them is a smashing Mahler Second Symphony I'm sorry I didn't know about years ago; it's nearly as emotional as Bernstein's performance but has better sound. Stoky's version of Menotti's ballet *Sebastian* is definitive. Dvorák's "New World" Symphony receives a fresh and vital interpretation, and Stokowski's avoidance of the maudlin gives the hackneyed "Pathétique" of Tchaikovsky a sense of strength. Beethoven's Third Symphony is a bit rough but certainly heroic. Wagner was among the colorful conductor's favorites, and the two discs devoted to selections don't disappoint; they even excited me, and I'm not a Wagner fan.

The Shostakovich Sixth and Khachaturian Third (both of which the conductor premiered for U.S. audiences) are about as close as we get in this collection to Stokowski's well-known support of contemporary works, but he conveys their Russian modernism in peerless fashion.

A couple of nits to pick: Reiner has it over Stoky in Rimsky-Korsakov's *Scheherazade*, and although the orchestral backing in Canteloube's Songs of the Auvergne is superb, Anna Moffo is no Natania Davrath.

Stokowski's overblown but undeniably exciting transcriptions of Bach open and close this collection. Pedants had a fit over these arrangements, which made Bach's music more colorful and "hi-fi." Stokowski not only rearranged the music in his quest for better sound but also frequently experimented with repositioning sections of the orchestra. In live performance, he created the "Philadelphia sound" during his years with that orchestra. And for recording sessions, he tried different miking and mixing techniques. (He must have had a ball recording in quad!)

Four excerpts of Stokowski at work in rehearsals, some up to 22-minutes long, fill out the set. Stoky's politeness with his players shows he was not a martinet, though he was also not a jokester, à la Beecham.

Each CD in this compact box has an accompanying small booklet of notes, but the lack of an overall essay booklet, with photos, on one of the greatest conductors of the century seems a glaring omission in this otherwise fine offering. *John Sunier*

AARON COPLAND

Fanfare for the Common Man, Rodeo, Appalachian Spring, Quiet City, and Billy the Kid
Cincinnati Pops Orchestra, Erich Kunzel
TELARC CD-80339; DDD; 76:40
Sound: A–, Performance: A

Presumably this CD is intended to replace the earlier Telarc disc (CD-80078) devoted to much of this same music as performed by the Atlanta Symphony under Louis Lane. The earlier CD omitted "Quiet City" and *Billy the Kid*, for a total playing time under 45 minutes. So the new one is a much better buy in terms of cost per minute and because it contains more of Aaron Copland's best-loved scores. Neither the sound nor the performance is quite up to the earlier standard, however. The Atlanta orchestra appears closer, and its soundstage is perhaps a mite shallower on my system, but detail is marginally crisper, and it sounds—well, more convincing. The Cincinnati sound is subtly more artificial, with what I'd call a slight phasiness at times. Perhaps partly because of this sonic difference, small as it is, the Atlanta performance sounds more alert and fresh—though this difference, too, is minimal.

Let me guess. Judging from the sound in my listening room, I'd imagine that the earlier recording was made with a simple, spaced pair of omnidirectional microphones, probably suspended above the conductor, while the Cincinnati pickup involved touchup mikes here and there. Perhaps not, but that's the way it sounds.

In sum, the present recording seems to take a big step forward in repertory but a tiny one backward in sound quality. But if you like the outgoing side of Copland's musical nature, you should find that the added repertory more than compensates for that misstep. *Robert Long*

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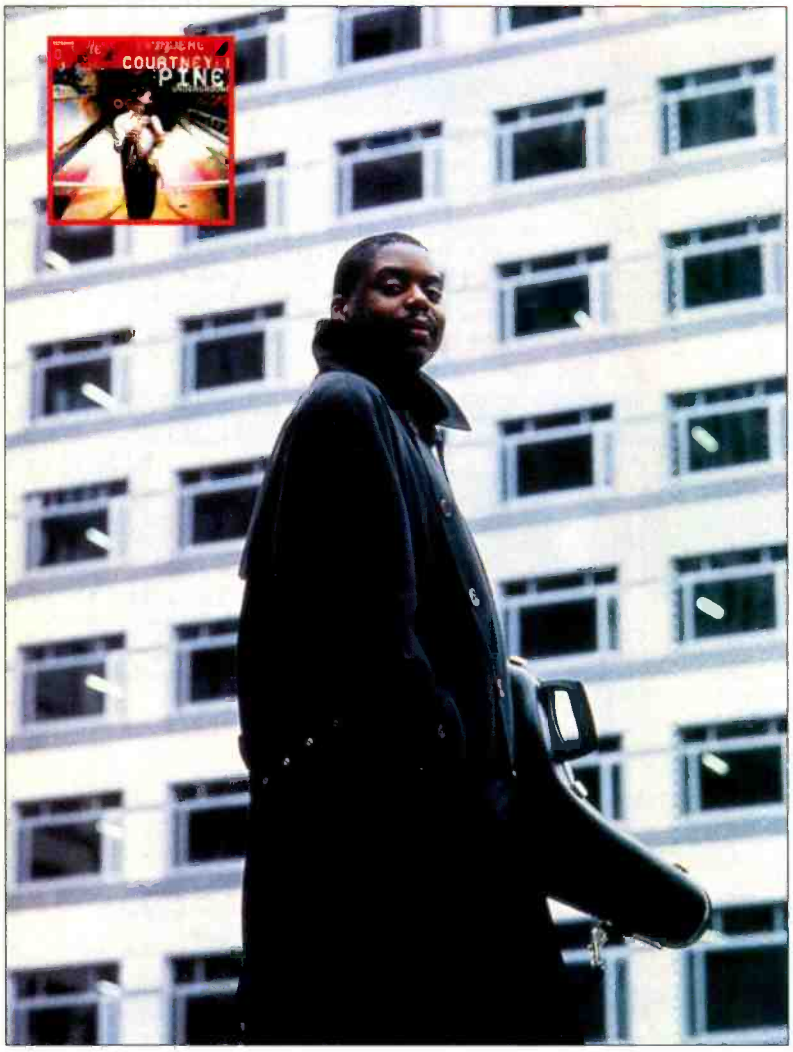

Underground

Courtney Pine

ANTILLES 314 537 745, 68:42

Sound: B, Performance: A

With his big, burnished tone and colossal technique, tenor saxophonist Courtney Pine reigns as the crown prince of England's jazz scene. As a composer, however, he clearly reflects the U.K.'s fascination with hip-hop, acid jazz, and trip-hop, successfully merging divergent genres from past and present into his own vision of contemporary jazz.

Arriving in the late '80s as a Coltrane-modeled multi-instrumentalist (playing tenor, soprano, and baritone saxophones and bass clarinet), Pine began pushing boundaries and stretching his talents as soon as he began making records. *Closer to Home*, in 1990, appropriated reggae, 1991's *To The Eyes of Creation* explored boundary-stretching improvisation, while last year's *Modern Day Jazz Stories* entered electronica's sonic mayhem, grafting a noisy programmer and turntable-scratching DJ with jazz and funk. None of this genre-hopping would matter if Pine weren't a blazing soloist and an inventive composer, which his records have proven.

On *Underground*, Pine references such '60s soul-jazz progenitors as Eddie Harris and Cannonball Adderley for melodic focus. And with a fully American band comprising drummer Jeff Watts, pianist Cyrus Chestnut, trumpeter Nicholas Payton, bassist Reginald Veal, and guitarist Mark Whitfield—plus the now familiar DJ Pogo (a holdover from *Modern Day Jazz Stories*) raising the instrumental ruckus with his turntable scratching—Pine seamlessly integrates musically current affairs with a bedrock of hard bop, free jazz, and soul jazz.

The album opens with the booming hip-hop beat of "Modern Day Jazz," then veers from the scorching free-form blowout heard on "The Book of. . .(The Dead)" to the prime soul jazz of "Oneness of Mind," where Pine doubles a brisk melody on tenor and soprano over Watts' bubbling cymbal pulse. The buoyant aplomb of "Children of the Sun" (where Pogo's turntable mixes it up with Whitfield's funky chording) gives way to the evocative "The In-Sense Song," on which Pine performs an exhilarating bass clarinet solo. Grooving easy like a song from Donald Byrd or Lee Morgan, "Oneness. . ." goes left after a Chestnut electric-piano solo as Pogo fires a barrage of turntable bullets, his brief cacophony sounding as natural as any horn player.

In fact, "natural" is *Underground*'s one constant. In the '60s, jazz responded to both pop culture and national politics as easily as it accompanied grabbing a beer at the local bar. By melding '60s jazz with '90s influences through palatable melodies and powerful musicianship, Pine redresses the balance. *Underground* is evolution. *Ken Micallef*

3rd Perspective

United Future Organization

ANTILLES 314 534 487, 52:27

Sound: B, Performance: B

From jarring Latin jazz to *Kind of Blue*-tinted noir-scapes, the third album from Tokyo-based United Future Organization is a pyschotic sonic cocktail that draws from '60s pop culture and music, particularly spy flicks. Mixing together spoken-word sound bites, swooping bass trombones, Farfisa organ, and twangy tremelo guitar, *3rd Perspective* resembles a deranged production with a cast of thousands.

"Spy's Spice (Mon Espionne)" uses a funky big band as action-adventure cyclone, while "Nica's Dream" reworks Horace Silver's jazz standard with baritone sax, *Dr. Who* sirens, and *Goldfinger*-ish guitars. Moody piano and Raymond Chandler dialog informs "The Moving Shadows," closing this rambunctious effort with a cinematic, late-night feel. ***Ken Micallef***

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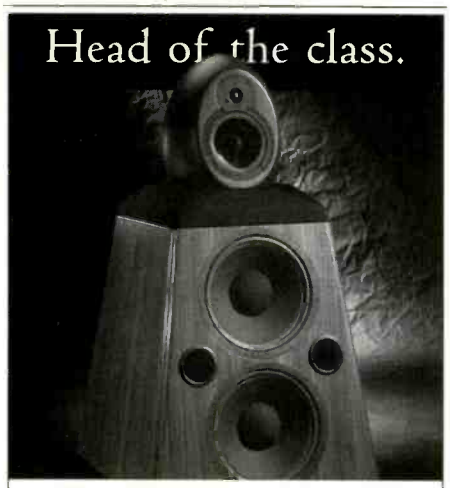

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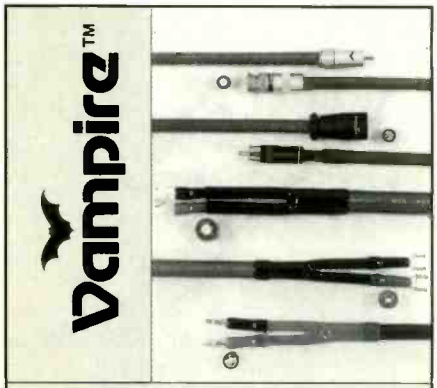

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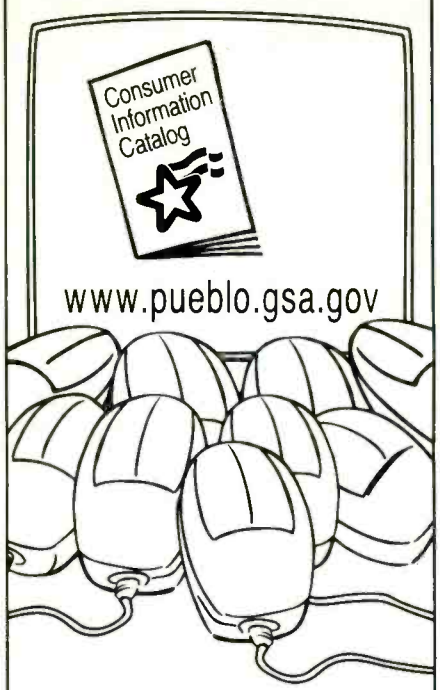

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1997 AUDIO ANNUAL INDEX

SUBJECT INDEX

AUTHOR INDEX

AD INDEX

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PlayBack

PARASOUND R/EQ-150 ROOM EQUALIZER

Parasound's versatile stereo R/EQ-150 room equalizer ($145) is meant for speakers and rooms that require response tweaking rather than for general equalization. It controls five, ½-octave-wide bands (centered at 40 Hz, 80 Hz, 120 Hz, 2.5 kHz, and 6 kHz), selected with common room anomalies in mind. Each band's output can be boosted or cut by up to 8 dB. The equalizer also has a bypass switch and an output level control. The R/EQ-150 is 8½ inches wide and just a couple of inches tall, so it will fit easily into tight spaces. And because of its half-rack width, several units can be grouped compactly to control the sound of a multiroom installation.

I found the R/EQ-150 useful in taming an 80-Hz bump in one of my listening rooms. I also tried it as the EQ part of a low-buck processor

GRADE: A–

system for my project recording studio. Routing audio through the R/EQ-150 and a compressor/limiter, I made some nice recordings with an old Sony PCM-701ES, which records on videocassettes (the only audiophile digital recording format before DAT).

The R/EQ-150's controls were silent in operation, and only when the output level was cranked wide open was there a hint of noise. My only complaint was the lack of an on/off switch; luckily, this equalizer draws little power and generates little heat. It's a neat little unit. (**Parasound:** 950 Battery St., San Francisco, Cal. 94111; 415/397-7100.) **John Gatski**

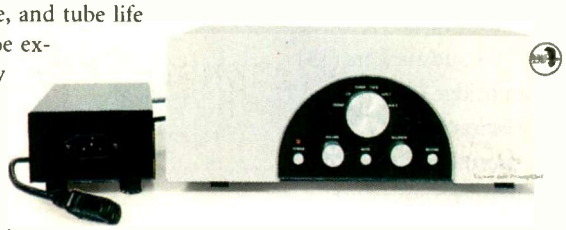
For literature, circle No. 120

ROGUE AUDIO SIXTY-SIX PREAMPLIFIER

I became aware of Rogue Audio last summer at an audiophile show, where this small Pennsylvania company's Model Sixty-Six tube preamplifier caught my eye. The preamp had an interesting look, reminding me of old Dynaco and Marantz gear, yet there was something modern about it.

Priced at $1,195, the Sixty-Six is a minimalist design, with phono and four line inputs plus a tape monitor loop. Its controls include the usual power and selector switches, balance and volume controls, and a muting button. But there's also an unusual "Record" button, which disconnects the tape output when you're not recording in order to isolate the load presented by your tape deck. The tube complement consists of 12AU7s in the line stage and 6DJ8s in the phono stage, and tube life is said to be extended by an auto slow-start circuit.

GRADE: A



The power supply is housed in a separate chassis. Build quality is very good: precision components, copper circuit boards, Noble volume and balance controls, and heavy-duty, gold-plated RCA jacks.

Although it has somewhat of a retro look, the Rogue Sixty-Six doesn't sound old-fashioned. It has none of the soft, plump bass of old preamps (and even some newer ones) that I've heard. The Rogue's bass is tight, its high end extended but not hard-edged, and its stereo image is well focused. When I linked it through Pass Aleph 2 MOS-FET monoblocks to Legacy Classic II loudspeakers, violin and cello CDs sounded incredible. Playing through Westlake Lc8.1 speakers, the Rogue was a perfect companion for my McIntosh MC275, a three-decades-old grandpa of an amp—especially on Merle Haggard's California-style country music from the same era.

Many audio companies make tube components these days, but this Rogue preamp definitely caught my eye and my ear. (**Rogue Audio:** 2827 Avery Rd., Slatington, Pa. 18080; 610/760-1621.) **John Gatski**

For literature, circle No. 121

OPTIMUS PRO LX 10 LOUDSPEAKER

The Pro LX 10 has two 7-inch cone drivers covering the bass and midrange and a 2 x 4-inch dipole tweeter (licensed from Linaeum) for the treble. The tower cabinet's 34-inch height, small footprint (9 x 11 inches), and black wood-grain vinyl finish make a pair of them inconspicuous, even if they're a few feet out from your walls.

The LX 10s seemed to achieve the low distortion and 45-Hz bass that Radio Shack claims, but the treble never sounded as extended as I'd expect from the tweeter's 25-kHz spec. The speakers were well behaved at all frequencies, with no uncontrolled resonances and a bottom end that died out quietly rather than simulating bass through resonance or doubling. Like most dipoles and bipoles, they spilled a more natural sound into other rooms than monopoles do; even so, however, the soundstage in the listening room lacked depth.

GRADE: B–

In my living room, the Pro LX 10s sounded best when they were positioned 2 to 3 feet from the wall behind them, with the tweeters an inch or two below ear height. I got more bass power by moving these Optimus speakers right up to the wall, but that hardened the dipole tweeter's treble, especially when I tried it against a stone fireplace. Depending on your room's acoustics and your tastes, you may want to dial in one click of treble (and possibly bass) boost, an easy allowance to make for speakers priced at just $249.99 each. Overall, the sound was clean and natural. An excellent value. (At **Radio Shack** stores, or call 800/843-7422.) **Ivan Berger**

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