THE B.A.S. SPEAKER

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In This Issue

This month's issue features an audiophile's whirlwind tour of (audio) Wonderland -- Japan. Peter Mitchell doesn't report seeing any white rabbits with watches or smiling cats, but he has seen such amazing sights as the Yamaha factory (one of them, anyway), a PCM audio recorder for consumers, and a new approach to ambience recovery that does not involve: (a) matrixing, (b) high-frequency whistles, (c) extra amplifiers, or (d) extra speakers in your listening room)

The feature articles this time around are, straight from the horse's mouth, the details on AR's computer digital delay system and from John Puccio a statistical look at the truth dispensed by the golden ears.

We also bring you follow-up reports on Mike Riggs' modified PAT-5 (impressive specs) and Bob Graham's treatment for acoustic suspension speakers (too much of a good thing?). Al Foster hooks up his test gear to a recent Sheffield record and likes what he sees as much as what he hears. Plus our customary collection of reader comments, classifieds, and periodical highlights. After you've read this issue you should feel informed, entertained, and inspired to send us your contributions for forthcoming issues. We say it elsewhere, but it's worth getting it in here at the front as well: our mailbox has been nearly empty of late, so if anything in this issue clicks a responsive chord, and something should, let us know. That way the next issue will be bigger and better. -- Henry G. Belot (Massachusetts)

Membership dues are $14 per year (October 1 to September 30) or portion thereof. Dues include a one-year subscription to the BAS Speaker. (Note that almost the full amount of dues is allocated to production of the Speaker. The local activities of the BAS are strictly self-supporting.) For further information and application form, write to: The Boston Audio Society, P.O. Box 7, Kenmore Square Station, Boston, Mass. 02215.

For Sale

*Advent 100A Dolby outboard, low-noise power supply, walnut case, $175. EPI 100 loudspeakers, walnut cabinets, still in warranty, $125/pr. Dual 1218 turntable with Shure V15II cartridge, $99 or best offer. Peter Bronk, (617) 734-9057.

*dbx 124 in factory-sealed carton, never used, $212. For information, call Dave evenings or weekends, (617) 729-5173.

*AR receiver, just back from factory service, $200 or best offer. Two SWTPC Universal Tiger amps (stereo pair) mounted in a single, custom walnut cabinet, output transistors mounted on extra-massive heat sinks, $100 or best offer. Call Ken at (617) 646-3427.

*B&W DM-70's (walnut), $800 for the pair, packing included. Sony TC-153SD with case and battery pack, like new, $275. Tandberg 9241XD, best offer. Two pairs of JBL-100's, $600. Bob Heenan, 1906 Beacon Street, Brookline, MA 02146, (617) 731-0140.

*One pair AR 3A's in very good condition in original cartons, $225. Denny Boyer, (617) 483-8734.

*One-year-old Dyna FM-5, aligned locally -- right on. Good price. Harry Brawley, Cambridge, MA, (617) 491-7210.

*Philips 202 turntable with Stanton 681EE and Audio-Technica AT-11 cartridges and two extra cartridge clips, $90. Bob Borden, (617) 276-3417, days.

*Two Sony CRS-3N anti-shock microphone mounts, for most cylindrical microphones of around one-inch diameter. Come with spare elastic and extra rubber fittings for use with smaller or larger diameter mikes. $40/pr. David Satz, (617) 492-2263.

*Highest quality sound at a very reasonable price: Marantz 8b classic tube amp in mint condition, $200; DB Systems electronic crossover prototype for stereo biamp or for triamp, with two selectable monitoring meters, level controls, and adjustable subsonic filtering, with power supply, $150; Harmon-Kardon Citation 12 classic transistor amp in good condition, $175. Wayne Robertson, (617) 648-4191 after 6:00.

Wanted

*Marantz 9's, JBL SE400's or 460, Marantz 7 or JBL SG520. Bob Heenan, 1906 Beacon Street, Brookline, MA 02146, (617) 731-0140.

*I am seeking to buy or trade for an ARC D-76a amplifier. Wayne Robertson, (617) 648-4191 after 6:00.

Dynaco Correction Correction

Michael Riggs' "Dynaco Correction" in the December Speaker indicates that I returned my Dyna FM-5 to the manufacturer twice without satisfaction. In fact, the tuner clinic staff and I were able to partially adjust and repair the tuner ourselves. I am now awaiting a reply to my request that Dyna resolve my difficulties completely. -- Jack Stevens (Massachusetts)

Pygmalion

The first reports are in on the completely rebuilt Lincoln Center Philharmonic Hall, now named Avery Fisher Hall after its saving angel. By all accounts, Dr. Cyril Harris's renovation has transformed an acoustical disaster area into a sonic showcase. The hall's sound is said to be unusually clear and well balanced except perhaps for, a slight tendency to bass-shyness. The result is an exceptionally detailed presentation with somewhat less warmth than is common in more reverberant structures such as Symphony Hall. Praise be to Science. The New York Philharmonic now has a fitting home, and the city another fine concert hall. -- Mike Riggs (Massachusetts)

Identity Crisis

We have on hand a report on a Fried speaker seminar in Maryland. Unfortunately, we can't use it because it's unsigned. If you are the author of this item, please identify yourself through Box 7. --Ed.

Bargain Moving Coils?

Superex is offering for sale at slightly more than half list price, the Satin M-117 series of high-output, moving-coil phono cartridges. These feature user-replaceable styli and rated outputs from .5 to .6 mV/cm/sec. Those interested should write Superex. (Yes, I mean the headphone people.) -- Michael Riggs (Massachusetts)

Build Your Own Time Delay?

Reticon, probably the country's leading manufacturer of bucket-brigade and similar solid state devices, has published several application notes concerning their products. The most interesting is number 104, "Acoustic Applications of Serial Analog Delay Devices." The chip is the SAD-1024, a dual 512 stage analog delay line. The number 512, by the way, is 2 to the 9 -- digital engineers work in powers of 2.

The chip is now available on a special SC-1024 plug-in circuit card. No price is given on the data sheet, but manufacturers often sell such prototypes at cost to encourage other manufacturers to incorporate them into their products. For someone interested in time delay, but without $600 or so for an assembled unit, this offer may be the answer. The price of the chip itself starts at $25 for quantities of one to nine and goes down from there. Perhaps the BAS could make a group purchase.

For the application note, write to: Reticon Corp., 910 Benicia Avenue, Sunnyvale, CA 94086 (right in the middle of Silicon Valley). -- Dana Craig (Massachusetts)

Setting the (Biggs) Record Straight

I would like to correct a bit of misinformation contained in the November 1976 issue of the Speaker. In the Meeting Notes of the October 24th meeting, Al Southwick reported that "special two-record sets of E. Power Biggs at the Methuen organ were available at the [Methuen Memorial Music] Hall, autographed by Mr. Biggs."

In reality, the Board of Trustees offers for sale, at its sponsored concerts at the Hall or by mail order, the Columbia album (one record) M34129, Stars and Stripes Forever, autographed by the artist E. Power Biggs. Albums at the Hall are priced at $6.99 each; mail order copies are $7.49 each. Many of the selections were recorded on the 1863 Walcker Boston Music Hall Organ now in the Methuen Memorial Music Hall. It is an SQ recording and was produced by Andrew Kazdin. -- Edward J. Sampson, Jr., Vice President, Methuen Memorial Music Hall, Inc., Methuen, Massachusetts

Richmond Audio Society

A few audio-minded engineers in Richmond, Virginia have formed the Richmond Audio Society. We plan to have monthly meetings with discussions of topics of interest and occasional guest lecturers. Our first meeting, in November, featured a talk by Harold Beveridge and a demonstration of his electrostatic speakers. Anyone interested in taking part should contact Roger Modjeski, 2215 East Broad Street, Richmond, VA 23223, (804) 782-9736. -- Collins Beagle (Virginia)

Sheffield Produces a Winner

Sheffield's recent direct-to-master-disc recording, "The King James Version" (LAB 3), brings back a respected member of the big band tradition, Harry James, and a respected recording technique -- real stereo. Producers Lincoln Mayorga and Doug Sax abandoned their 32 -channel (multiple mono) recording console and settled on a single AKG C-24 stereo microphone. The results are excellent. Lab-3 has none of the phony ambience and close-miked sound of Lab-2, "I've Got the Music in Me." Instead it captures the sound of the band as heard in the natural acoustics of the recording hall (a church). This natural sound helps make Lab-3 a real winner.

Like Lab-1, Lab-3 captures a wider dynamic range than Lab-2, i. e. , a greater peak-to-rms ratio. This ratio, expressed in dB, compares the maximum transient to the corresponding "0" VU recording level, and the highest ratio occurs in "Sweet Georgia Brown," one of my favorite cuts on the album.

Incidentally, the peak-to-rms ratio can't be measured with an rms meter (e. g. , AC-VTVM) because such meters are not fast enough and average out any instantaneous transient levels. To get good readings of these electrical peak levels, one needs an instrument capable of responding to signals of a few tens of microseconds duration -- an oscilloscope or specially designed peak reading meter.

The extremely high peak-to-average range found on Lab-1 and Lab-3 means two things. First, Sheffield has indeed produced a disc with superb high-level transients, and they've done it without decreasing the average signal-to-noise ratio. In other words, the average cutting level hasn't simply been reduced. Second, if one were to play back both Lab-2 and Lab-3 at the same average level in his listening room, Lab-3 might require about twice as much amplifier power as Lab-2 to prevent clipping. And this danger of clipping applies to all the other stages of the audio chain.

By the way, the January 1977 issue of Audio tells the Sheffield story and includes an excellent description of the Harry James recording. If you like the big band sound, you will love "The King James Version. "

Bargain-priced copies . Local BAS members will be able to buy a copy for $8 at the January 19th meeting. Out-of-state members can get one by forwarding $8.75 to the Boston Audio Society, P.O. Box 7, Boston, MA 02215. I expect the BAS supply will be exhausted by the end of February, so orders received after February will be returned. -- Alvin Foster (Massachusetts)

The More Compleat Acoustic Suspension

In November, Bob Graham described how he coated the edge suspension of an AR-1 with a silicone rubber solution to improve its air seal. Before treatment, the cone took three seconds to return from a fully depressed position; after coating, it took nearly seven. Since November two knowledgeable readers, Tom Tyson and Roy Allison, have shed light on the effects of this treatment and have sounded a cautionary note to experimenters. Here's what they say:

Tom Tyson (North Carolina). Bob Graham's article contains an interesting point concerning the seal of acoustic suspension loudspeakers, specifically, the importance of carefully sealing the enclosure and the speaker itself. That Cizek has taken extra care to design his speakers in this fashion is noteworthy, and this should contribute to low distortion if other design parameters are in line.

Top quality acoustic suspension speakers, such as the Allisons and ARs, are indeed acoustically sealed, but not pneumatically sealed. That is, the speaker system is airtight with respect to audio frequencies and can maintain air pressure different from atmospheric pressure long enough to cover one-half cycle of the lowest frequency to be reproduced. To the degree that the pressure can be held for several seconds, the safety margin is very large. But if the speaker were pneumatically sealed, the cone would act as an aneroid barometer.

The "classic" AR-1W is now over twenty-two years old in its earliest form. After years of operation the butyl-impregnated cloth skiver oxidizes and becomes somewhat brittle. Air begins to seep through the cloth, and the acoustic seal suffers, with resultantly higher harmonic distortion. A "fix, " as suggested by Graham, is to coat the skiver with a silicone rubber compound, but an easier and possibly better treatment is to apply an anti-oxidation compound, such as Armor-All GT-10. This material with the ludicrous name is well known to automotive types for its restorative qualities when applied to rubber, leather or vinyl, and when applied to the AR-1W skiver (at least three treatments), the material becomes more compliant and airtight, as originally intended.

Contrary to Graham's remarks, a badly-leaking AR-1W would actually have a lower system resonance, in that a leaking skiver reduces the acoustic resistance on the back of the cone. (Remember, the airtight properties of the system raise the free-air resonance of the AR-1W from 19 Hz to the system resonance of 43 Hz.) Restoring the air seal merely brings the resonance back to the proper frequency. Though it is true that, as Graham suggests, the Q would increase if the "springiness" of the suspension were increased by improving the air seal, reducing mechanical resistance in relation to mass reactance at resonance, the Q would not be raised to some higher-than-normal value for a properly-working AR-1W. Nor would a higher Q be desirable: a decrease in damping with the higher Q yields a rise in output in the region of resonance. And though speakers are damped mechanically, acoustically and magnetically, the bulk of damping in the AR-1W comes from the last. So, in effect, correcting a leaking skiver on the AR-1W doesn't turn the woofer into something magical, but restores the original quality of that remarkably fine loudspeaker.

Roy Allison (Massachusetts). Bob Graham's suggestion for improving the air seal in acoustic suspension systems should be followed with great caution.

First, a perfect (hermetic) seal is not advisable; in fact, it would be disastrous if achieved. A slow "leak" is necessary to maintain equal air pressure inside and outside the enclosure. If this were not provided, normal changes in atmospheric pressure would force the cone to assume a static position inward or outward of its design center. At the least, the speaker would then operate in a nonlinear fashion. At worst, it could be damaged easily by a low-frequency music signal. A seven-second recovery time indicates the presence of a leak still large enough, obviously, to accommodate even rapid atmospheric pressure changes. But one should not aim for a completely tight seal.

Second, a coat of gunk on the cone or edge suspension will certainly change the frequency response, especially at high frequencies. The change may be for the better -- perhaps it was in Bob's case -- and that may be why he found an improvement in the sound of his AR-1W's. In most cases, the response will be degraded. Gunk is cheap. If the speaker's performance could have been improved by another coat of such treatment, it is reasonable to believe that the manufacturer would have applied it himself.

How much of a seal is necessary? While returning to its rest position after being pushed in, the cone travels one quarter of a complete cycle. If this recovery time is 3 seconds, the system is "leaking" at the rate of 1/12 Hz. At a frequency greater than ten times this "leak" frequency -- say, at 1 Hz or higher -- the system can for all practical purposes be considered to be sealed. A leak that small can have no significant effect on the system's performance down to 1 Hz and no measurable nor audible effect on the system's Q. It is not possible.

If you fully depress the woofer cone of an acoustic suspension system, and it takes 1 1/2 seconds or more to return to its rest position, the seal is perfectly adequate. Don't worry about it, and apply gunk to the cone or suspension only if you like to take bets against very long odds.

Comments on the Modified PAT-5

From Jensens

I have a few comments about your review (October 1976 Speaker) of our modified version of the Dyna PAT-5. First, the preamp does not pass DC. All inputs and the unity-gain stage are still capacitively coupled. Only the output circuit is direct-coupled, and no DC can reach it. The reason we warn against use of this unit with amplifiers having direct-coupled inputs is that the pre-amp does have a very slight DC offset at the output, which could cause problems with those few amps which are not capacitively coupled at their inputs. Second, the 1.5 dB difference in channel balance you note must be caused by volume pot mistracking. All gain is set with 1% tolerance, metal-film resistors, and the two halves should be very close. Finally, just changing phono transistors and capacitors will not give the same performance, and an LM-301 IC is not a good device for audio amplification.

We are not surprised that you hear a slight additional "fuzz" in the sound with the tone controls switched in. That's because the output changes from our circuit back to the original Dyna output circuit. We believe our circuit is better, and the fact that you hear a difference confirms this. It does appear, by the way, that Underground Audio is trying to copy our work, but the IC they describe is nowhere close to the performance of the hybrid we use.

-- Frank Van Alstine (Minnesota)

From Dynaco

Aside from some of the wording in your first paragraph (wow! -- are we really that bad'), there are some specific points worth noting. For some time PAT-5s have been supplied with the Siemens transistors in the phono stage, and, as I recall, we even suggested them to Frank (Van Alstine). However, there have been times when they were not available. We really are not sure all that extra capacitance in the power supply makes any listenable difference but would like to hear from those who exercise the control of making one change at a time and then doing extensive listening. Also, there is an implication in the "just takes the pots out of the [tone control] circuit" statement that the job is not being done completely. We disagree. Though we have always been advocates of using the simplest circuit that does the job, I think it is necessary to establish the importance of each of these changes independently. The impedance of the circuit is so low that the treble control circuitry does not have any loading effect. We short across the entire bass control, rather than separately either side of the slider, because we can see no justification for the added switch complexity. Your comment about now being able to hear when the tone controls (set flat) are switched in, where you didn't hear any change before the modification, is interesting. The question is: was the design better before, or does the change elicit more differences?

We question that the preamp will now pass DC. I believe there are still some capacitors at the beginning of the high level board, even in Frank's variations. Removing the output coupling capacitor is not something we think is practical in any commercial design, because of the potential for damage to equipment downstream. And I understand that the output impedance at that stage has been changed again from the two ohms you indicate.

We are now using (and have been for some time) the Microsystems ICs and have used those by Signetics. These two brands have been found to have the best and most consistent sonic characteristics. Some other brands we have used apparently account for the variability on this score, though I don't recommend that anyone go to the trouble of changing them unless he has some reason to doubt their sonic accuracy. When tantalum capacitors are installed per Van Alstine, some of our people slightly prefer the Signetics, but they choose the Microsystems normally.

You make a justified criticism of the high-pass filter, but I don't believe there is a good one in any preamp, so here it looks as though you are singling us out.

Finally, if any of you have a PAT-5 that doesn't sound as good as something else, I'll send you a "case package" of the ICs and transistors, and then let's have your (collective) comments. I find it hard to believe that Dyna comes off as badly competitively as some BAS comments would have me believe.

-- Bob Tucker (Pennsylvania)

Reviewer Ravens Raven

I' m sorry I made that misleading comment about the preamp passing DC. Tucker is also correct in pointing out that the output impedance has been restored to its original 560-ohm value. Removing that resistor from the output causes 3-volt oscillation at 2 MHz into capacitive loads (e.g. , most cables) when the tone controls are switched in. Because Van Alstine uses very low capacitance cables, he built about ten preamps with ultra-low output impedance before he noticed the problem and corrected it in all those units. On the other side, Van Alstine correctly fingers the volume control as the source of my balance problems. Mine varies several dB over a small arc; Dyna is sending a replacement. And no, I am not singling out Dyna's inadequate low cut filter. Very few preamps have good ones -- a sad fact in every case.

Since my review, Van Alstine has made some other changes. He has doubled again the filter capacitance in the power supply, and he now replaces all the resistors on the phono boards with large, metal-film devices. The gain is now the same for both phono inputs, which eliminates the horrible switching transient I mention in the review. I understand Van Alstine prefers to set both inputs to 6 dB over standard (43.5 dB), but the gain in mine is only +1 dB (38.5 dB), so you should request your preference. (He has suggested to me that the distortion I heard through the high-gain input was caused not by the preamp but by arm/cartridge problems.) My impression is that the preamp is now a shade clearer and a trifle smoother at the top than before the latest changes, but I wouldn't swear to it.

Al Foster tested my revised FET-5 Mk. Ilc and found its performance on the white-noise and voltage bandwidth tests improved. Specifically, at high frequencies the phono section will now put out about twice the voltage it would before: 6.2 volts at 20 kHz and 3.2 volts at 50 kHz. In addition, Al's new test set-up made possible meaningful harmonic distortion tests. Through the phono section at 2 volts out the second-harmonic distortion was 90 dB down (.001%) at 1 kHz and 85 dB down at 20 kHz. The high-level section is clean as the proverbial hound's tooth. Distortion at 1 kHz was more than 97 dB down (below the residual at that frequency). At 20 kHz the third harmonic was down 99 dB, and the second harmonic was down 119 dB. No higher harmonics were in evidence. The 20 kHz distortion in the high-level stage is clearly lower than what Audio found in a stock PAT-5 (slightly under . 01%) with a similar testing procedure. The only odd thing we found was bass boost (6 dB at 30 Hz) in the left phono channel. I sent the boards back to Van Alstine, but he couldn't find any problem. Either it disappeared in transit, or there was some testing error at one end.

I hope soon to do some listening tests comparing the high-level section of a stock PAT-5 with Microsystems ICs to that of my modified unit, which should, given the controversy, be interesting. It may also be of some interest that Walt Jung is preparing a PAT-5 mod for The Audio Amateur and that Van Alstine will soon be bringing out his own "linear phase" (direct-coupled from input to output) preamp.

Finally, I have a few words on interpretation and a few on Dyna. I did not mean to imply that everyone will benefit from swapping transistors and ICs or that I know the Microsystems and Siemens devices to be better than others. I don't. Don't ask Dyna for replacements unless you think you have problems, and do send them the originals and your comments. Otherwise you won't help anyone but yourself. It does, after all, cost them money to perform that little service. Which brings me to my second point. I do indeed think Dynaco's quality control should be better. It's the manufacturer's responsibility to do everything he reasonably can to insure that his products work as advertised. Dyna is now building its own circuit boards, which may help. I hope so. I also hope that their devotion to sensible, economical, high-quality design won't disappear and that their willingness to give detailed answers to every question and help for (almost) every problem will continue. Dynaco (Tyco) has released Bob Tucker and Ed Laurent, ostensibly to cut costs in the face of red ink. These people are old-line Dynaco, which means they really care about all those things. They are audiophiles. I'm not so sure about Tyco. As it stands, I think most Dynaco products are very good values. Just remember that it's a good idea to have them tested.

-- Michael Riggs (Massachusetts)

Periodicals: Good News and Bad

Euro-Disc Gazzette

Ed Dell, editor and publisher of The Audio Amateur, is going into competition with Brian Leeming by providing a similar record-buying service. His new bimonthly newsletter, Euro-Disc Gazzette, will offer for sale to subscribers European and British imports the editors judge to be of superior musical and technical quality. Included will be reprints of reviews from The Gramophone and Hi-Fi News & Record Review. All prices will include postage, and all orders received before the deadline announced in the newsletter will be delivered no later than four weeks after that date. Subscriptions are available at $2 a year from: Euro-Disc Gazzette, Attn: Jim Callihan, P.O. Box 337, Peterborough, NH 03458.

Leach Amplifier Newsletter

Those building the Marshall Leach low-TIM amplifier may want to receive Damon Hill's aperiodic newsletter on the subject. The information in the first issue certainly appears useful. To get on the mailing list, write Hill at 3261 Circle Oak Drive NW, Atlanta, GA 30339. Hill asks for, but does not demand, a 25 to 50 cent donation to cover his costs.

"Audio-File" Obit

Member William Vincent of Connecticut informs us that Audio-File will not, for the present, be published. Editor Brian Sessions has been seriously ill and therefore unable to do the necessary work. Audio-File will return money advanced for subscriptions when requested. We extend to Mr. Sessions our regards and our hopes for his swift recovery.

In the Literature

The Absolute Sound, Volume 2, Number 8, Summer-Fall 1976

*In the first issue since May, Harry Pearson (editor and publisher) announces that he has quit the staff of Newsday in order to publish TAS on its (quarterly) schedule as he had originally intended. Well, we have heard that sort of thing before. Let's hope that in his new full-time duties he can clean up the magazine's (peculiar) fascination with parentheses [(!)]. (They enclose everything from single adjectives to complete paragraphs.) It is (really) frustrating to read articles punctuated (like this). TAS deserves a footnote (or a parenthetical reference) in a sequel to Edwin Newman's Strictly Speaking.
*This is quite a large issue, with over 120 pages.
*Components in Review: the Audio Research system, Thaedra preamp, Sonus Blue phono cartridge, and the Koss and Acoustat electrostatic speakers. (p. 355)
*Considerations: Stax DA-300 and SAE 2500 amplifiers; Gale, Avid 103, and STR Omega II and Theta III loudspeakers; Grace 707 and Formula 4 tone arms; ADC cartridge; and DB Systems preamp. (p. 383)
*Capsules: Denon transformer; Micro-Seiki LC-40, B&O 3000, Micro Acoustics 2002, Shure V-15 IIIG, Fidelity Research Mk. II, and EMT phono cartridges; Quatre, DEF 104, and KLH Model 9 loudspeakers; Luxman CL-35 Mk III, Dayton Wright SPS, Levinson JC-1 ac, Dayton Wright 535, and Epicure Model 4 preamps; Technics SL-120 turntable; Citation 16 and CM Labs 912 amplifiers; and the Zerostat. (p. 403)
*Further thoughts on the Rabco ST-7. (p. 414)
*Sneak previews on Sound Guard and Dayton Wright SPL Mk II-B preamp. (p. 414)
*Saul Marantz on modifying the Model 7 preamp. (p. 424)
*Reader advice on modifying the Marantz Model 9. (p. 426)
*Test reports on the M&K and Shreve modifications to the Rabco SL-8E, the Crown VFW-2 crossover, and the Heathkit 10-4510 dual-trace scope. (p. 427)
*The Weakest Link: Room Acoustics. (p. 439)
*An index for issues 1-7 is included on a separate sheet.

Audio, January 1977

*Remedying RF Interference: Various suggestions by Joseph Giovanelli. (p. 24)
*The Sheffield Story: An interesting story on the well-known direct-to-disc recording technique. The editors have skillfully selected those photos that reveal absolutely nothing about the recording setup. (p. 34)
*Battle of the Titans: A side-by-side test of the powerful Technics SA-5760 and Pioneer SX-1250 receivers. (p. 64)

The Audio Amateur, Number 4, 1976

*With this 64-page issue, the largest ever, Ed Dell is finally up to date. Congratulations and best wishes.
*Operation and Uses for the 570/571 IC Compander Chip: By Walter Jung. (p. 3)
*Modify Your Heath Tube-Type IM Distortion Analyzer. (p. 9)
*Dyna's Stereo 70: A Simple Modification. (p. 13)
*A -Z Tape Recorder Set-Up Part 2: By Craig Stark. (p. 16)
*A Tall, Portable Microphone Stand: It's 20 feet tall! (p. 26)
*Kit report on the Heathkit 10-4550 scope. (p. 38)
*TAA is having a sweepstakes for all subscribers who renew by February 14, 1977, with $3000 worth of prizes. They also have a life subscription offer for $150.

Journal of the Audio Engineering Society, November 1976

*On "Out-of-Head Localization" in Headphone Listening: One problem with normal headphone listening is that the sound seems to originate within the head. This effect can be eliminated by controlling the ratio of direct to reflected sound in a room. A new headphone system is proposed which is able to project a sound outside the head. (p. 710)
*Flutter Analysis for Identifying Tape Recorders: By members of the Advisory Panel on White House Tapes. (p. 728)
*Radiation from a Dome: James Kates of Acoustic Research examines the radiation characteristics of a rigid dome in an infinite baffle. (p. 735)
*Perspectives in Audio Analysis: Changing the Frame of Reference, Part II: Richard Hevser continues his essay. (p. 742)

db, December 1976

*Broadcast Sound column on Audio and the AM process. (p. 6)
*Theory and Practice column on filters and crossovers. (p. 12)
*The Sync Track reviews two books: Sound Recording by John Eargle and Sound Recording Practice by John Borwick, ed. (p. 18)
*The Making of the Ampex ATR -100: Larry Zide looks at this state-of-the-art tape recorder. (p. 32)
*The Art of Tape Editing: Describes some useful techniques. (p. 36)

FM Antenna Tests

*Not a periodical, this is a complete and rigorous fourteen-page, spiral-bound test report on seven popular models. The author is an electrical engineer and audiophile. His results show that the main differences, even between the least and most expensive and complex units, are not in gain, but in directivity. He also discusses the characteristics of various types of lead wire and how each antenna performs with each kind of cable. Good reading for anyone in the market for an antenna.
*For a copy send $2.50 to: Electronic Design Lab, California State University, Sacramento Foundation, 6000 J Street, Sacramento, CA 95819.

FM Guide, December 1976

*Profiles in High Fidelity: The BSR and Altec Stories. (p. 12)
*Feldman lab reports on the Sony STR-6800SD receiver and Rotel RA-1412 integrated amplifier. (p. 31)

The Gramophone, October 1976

*Reviews of the Monitor Audio MA3 II loudspeaker, of the Shure M24H phono cartridge, of the Strathern BTM4 turntable, and of the Hadcock GH228 Super damped unipivot tone arm and its associated lifting device.

Hi-Fi News & Record Review, November 1976

*November sees a report on the Harrogate audio fair and an article on loudspeaker sensitivity, plus part two of the compander construction article begun in October.
*The best is Bernard Keefe's attack on modern recording techniques, or, as he puts it, "fizzed-up music." He makes a strong argument for returning to the good old days of two-mike stereo.
*Also: A comparative review of the Harrison S-200, Technics SU-8600, Luxman L-80V, and JVC JA -S8 amplifiers; a review of the Nakamichi 600 cassette deck, 610 preamp, and 620 power amp; and a review of the improved KMAL M9BA Mk. III tone arm.

High Fidelity, January 1977

*Test reports on the Luxman T-110 tuner, Spectro Acoustics 202 power amp, Supex SD-900/E Super phono cartridge, Nikko 7075 receiver, and Levinson JC-1 DC pre-preamp. (p. 37)
*Several articles commemorating the 100th anniversary of the "talking machine."

Physics Today, November 1976

*Teaching the Physics of High Fidelity: A three-page letter from four professors at Southern Illinois University, Carbondale, IL, discusses a "physics" course which stresses the mechanical and electrical processes of high fidelity. A "lab manual" is offered for $5. (p. 9)
*Physics Today is easily found in any physics library, or can be obtained from almost any physicist, or optical or acoustical engineer.

Popular Electronics, January 1977

*Stereo Scene column is on various loudspeakers and phono cartridges. (p. 22)
*Test reports on Sansui TU-9900 tuner, Kenwood 600 integrated amp, and JVC JR-S300 receiver. (p. 26)
*Chemicals for Electronics Servicing: A useful article on various general purpose lubricants, cleaners, etc. (p. 44)
*Build a Low-Distortion Low-Cost Audio Generator: Simple circuit claims 0.02% distortion, uses five 741 op amps, and may also be used as a gyrator. (p. 59)
*Multimeters for Electronics, Part I: Focuses on traditional VOM's. (p. 61)
*Handy Circuit for Checking Phono Preamps and FM Tuners: Circuit uses two 747 dual op amps to provide pre-emphasis networks. (p. 71)

Radio-Electronics, January 1977

*Looking Ahead column notes that Henry Kloss has left Advent. (p. 4)
*Equipment report on Heath AS-1344 column speaker kit. (p. 26)
*TV Games, Part II: More on what's available. (p. 39)
*Analog Voltmeters: By Heath engineer. (p. 46)
*How Noise Is Measured in Hi-Fi: Len Feldman explains signal-to-noise measurements. Once again, the photos off the spectrum analyzer are fascinating. (p. 49)
*Test reports by Feldman on Sony STR-6800SD receiver, Yamaha B-2 amplifier. (p. 56)

Recording Engineer/Producer, October 1976

*A thick issue beginning with a good letter on time delay. (p. 8)
*A short discussion of studio monitor loudspeakers. (p. 51)
*A quite long, very basic, and rather good discussion of the magnetic tape recording process. (pp. 61-68)
*And, of course, ads and equipment to make technologists drool.

Tape Deck Quarterly, Fall 1976

*The Elcaset -- Superfluous or Significant: Martin Clifford examines the market for the new tape medium. (p. 24)
*Feldman Lab Reports on Comsette Corp. C-90 cassette tape, Teac A-100 cassette deck, Spectro-Acoustics 101B preamp/equalizer, Maxell UD 8-track tape, Sennheiser MD-421U microphone, and Maxell UD-XL-I and UD-XL-II cassette tapes. (p. 27)
*Profiles in Tape: The TDK Story. (p. 38) -- Dana Craig, Mike Riggs, Harry Zwicker

Parle Vous HiFi?

The French Hi-Fi magazine, Revue du Son, uses a method of commenting on equipment which would, I think, make our own equipment reviews more useful. At the conclusions of their essay-style reviews, they give lists of specific likes and dislikes. This type of description need not be judged for balance, only the usefulness of its particulars, and can be very helpful to somebody who is thinking of buying the type of equipment under discussion. For example, (in response to Cary Lu's recent article on portable tape recorders), take the Nagra IV-S:

Stereo Nagra: Things I Like

It's highly portable
Mike input transformers and power for condenser microphones
Socket for outboard noise reduction unit
Dual-needle peak-reading 40 dB-range meter
Anti-distortion circuitry
Tape tension idlers before and after heads
Very low flutter
Servo motor for fine-tuning speed
Recessed switches
Playback equalization for CCIR and NAB
Stepped level headphone output
Low-frequency filters
Quiet operation
Can be adapted for 10 1/2-inch reels
Microphone phase-check feature and switch for reversing phase of left mike

Things I Don't Like

Frequency response a little ragged
Soft heads (except erase)
Grossly overpriced, especially in USA
Can be optimized for use at only one speed at a time
No true fast forward mode
Official service station in NYC is slow and not always thorough
Audible distortion in spite of special circuitry

As further illustration, let me give two more lists:

Revox' A-77: Things I Like

Low flutter
Smooth frequency response
Meters show effect of record equalization
10 1/2-inch reel capacity
Many different. configurations with easy conversion from one to another
Servo motor allows speed to be fine tuned

Things I Don't Like

Transport makes annoying whining and mooing noises
Not fully interlocked against spilling or snapping tape
Long delays and confusion when trying to obtain replacement parts
Microphone input overloads rather easily
Playback amplifier overloads rather easily with modern tapes
Record level can be affected by position of Input/Tape selector
Dolby-equipped Revoxes have hum in playback and supply-reel brakes stick causing intermittent flutter and wow
It's too easy to enter the record mode from play

Nakamichi 550: Things I Like

User-accessible Dolby record calibration
Peak-reading 40 dB-range meters
Has servo motor for fine-tuning speed
Response up to 18 kHz using CrO2 or SA -type tapes and special equalization
Fairly powerful headphone amplifier built in

Things I Don't Like

Chrome playback equalization is not standard (2 dB bright)
Stray tones from Dolby oscillator, motor servo, and DC converter can get into the headphone amplifier or even onto the tape
Meters are ahead of record equalization
No monitor head
Line input inaccessible when machine is placed standing on floor
Erases unevenly (tape skew?)
About 10-times the measured flutter of a Revox at 7 1/2-ips
Slow shuttle speeds
Speed tolerance not close enough -- many samples seem to run fast
Somewhat noisy operation
No battery recharging circuitry
Service manual difficult to obtain

Lists like these can be fun to write as well as useful to the reader. Perhaps The Speaker could collect and publish such lists for the leading models of electronic and electromechanical equipment, if other members are interested enough to contribute their points of approval and disapproval. -- David Satz (Massachusetts)

Meeting Notes Unsounded

The December meeting was a change of pace from meetings of the recent past. Peter Mitchell presented an audiophile's travelog of Japan. We would have liked to have printed some of Peter's slides in these pages, but that being beyond our budget, Peter has adapted his presentation into the feature article which begins on the next page. And so, no meeting notes.

I will record two items from the Open Forum. First, there is a plentiful lack of volunteers for the refreshments team. Without volunteers, no refreshments. Each volunteer does duty only once a year (if we have volunteers), so c'mon. We repeat: no volunteers, no refreshments.

Second, the Box 7 mail box has run nearly dry. What with the holidays over, there's no further reason to put off those Speaker articles and contributions you have burning inside you. Get them off your minds and into our mail box. It will help if you type your item, but you don't have to be a literary giant. If need be we'll clean up your grammar and make you sound real good. -- Ed.

December BAS Meeting

A Tour of the Japan Audio Fair

(Ed. Note: The travelogue referred to on page one is scheduled to appear next month.)

The 25th Japan Audio Fair occurred under a large geodesic dome in Tokyo October 22-28. Crowds of tens of thousands of Japanese audiophiles, plus hi-fi writers from around the world, attended the 80 exhibits to see and hear the newest audio products. Of course some of the exhibits were operated by importers showing familiar American and European equipment, and some exhibitors were showing products intended only for domestic Japanese sale with no plans for export to the USA. So the most interesting exhibits were those of the major Japanese manufacturers with international markets, where the visitors could see the new products which will be marketed in the USA during the coming year. Many of these products will be introduced in the USA at the Consumer Electronics Show in Chicago in June.

In general the exhibits were substantially larger than those at an American hi-fi show; some were elaborate multi-room displays. For instance the Yamaha exhibit consisted of a large winding display area showing off the entire Yamaha product line, plus a fully enclosed sound room seating 20 or 30 people where live performances of pop music alternated with recordings, plus a "hands-on" exhibit. The latter contained several Yamaha tuners receiving a broadcast of the music occurring in the sound room, with each tuner connected to a Yamaha cassette deck and headphones, permitting the passerby to conquer his fear of the equipment by tuning the tuner, making a recording, playing it back, and then going into the sound room to hear the original sound.

Evidently the next major fad in turntables will be "quartz lock" direct drive, involving a quartz-crystal controlled oscillator and servo-control circuits to lock the rotational frequency of the turntable onto the exact 33 1/3 rpm rate. Nearly every major manufacturer at the Japan Audio Fair showed prototypes of such turntables. The audible benefit of this tight control of turntable speed is slight but not entirely negligible, since the servo control can eliminate the slight slowing of rotation that may occur with conventional platter drives due to the friction of the stylus in the groove and the pressure of a Dust Bug.

Nearly every manufacturer also showed an increased variety of cassette decks, adding to the already bewildering assortment of models on the market. In general the new cassette decks offer no significant improvement in performance compared to present machines, but they do offer the consumer a greater assortment of convenience features and gadgets.

An exception to this generalization is the Aiwa AD-7800, a three-head front-loading cassette deck with two unique features, one modestly useful and the second long overdue. (1) Each of its recording level meters has two needles instead of the usual one -- a green needle indicating conventional "VU" levels and a red needle registering peak signal levels on an extended-range 40 dB scale. The peak-reading function is the more useful one for the serious recordist, of course, but it is entertaining to watch the differing behavior of the "peak" and "rms" pointers. (2) Aiwa has done something which cassette decks makers should have done long ago: provided the user with built-in facilities for optimizing the recording bias to obtain flat frequency response with any cassette. With most cassette machines you have to take the recorder to a service shop and trust the technician to do a careful job of adjusting the bias for flattest high-frequency response with the particular cassette tape that you want to use. The Aiwa AD-7800 makes it easy for you to fine-tune the bias yourself, as carefully as you want, for each cassette that you put in the machine. The recorder contains the necessary 400 Hz and 8000 Hz test tones, metering circuitry, and bias fine-adjust controls (in addition to the usual front-panel bias and equalization switching for selecting tape oxide type). The AD-7800 may appear in the USA next fall under the Meriton brand name. It retails in Japan for $370, so by the usual rule of thumb its retail price in the USA should be around $550-$600. (In general, mass-produced Japanese hi-fi products have a retail price 50 percent higher in the USA than in Japan. On small-market specialized products such as tone arms and moving-coil cartridges the markup by the importer is higher.)

Whither Elcaset. The Elcaset, the large-size 3 3/4 ips cassette, is a new tape medium which some market analysts think will be a total flop. It is advertised as providing open-reel performance

with cassette convenience (like the BASF Unisette which never made it to the consumer market). But if it does turn out to be a popular idea the Japanese will be ready to supply machines. Sony and Technics exhibited production-line Elcaset decks, and Teac, Aiwa, Toshiba, and Sanyo showed prototypes. (Yamaha and others have a conservative wait-and-see attitude.) The Sony EL-7 is already available in the USA, but it carries a $900 price tag; would you gamble on the Elcaset when you can buy a ReVox A77 for the same price? It seems to me that if the Elcaset is to be a success it will have to be priced between the typical open-reel ($800) and the typical cassette machine ($400) in cost. It is true that there is another Sony Elcaset deck, the EL-5, priced in the right range ($650), but it has only two heads and so is incapable of source-tape monitoring, which disqualifies it from serious consideration in my view.

Technics showed a very attractive solution to the problem of making Elcaset technology available at a moderate price: the three-head RS-7500. It lacks some of the refinements of the Sony EL-7 (e.g. Dolby noise reduction, solenoid operation, dual-capstan 3-motor transport). But it looks and feels well-built and its raw performance figures are impressive: S/N 63 dB (without Dolby!), flutter 0.06%, frequency response flat to 22,000 Hz at -20 VU and flat to 15,000 Hz at 0 VU (indicating satisfactory freedom from the high-frequency saturation which is a principal limitation of cassettes). And the retail price of the Technics RS-7500 in Japan is identical to that of the Sony EL-5 ($440), so it should retail at the same price as the EL-5 in the USA, namely $650. At that price, in view of its apparent performance, I would expect the RS-7500 to be a substantial success when it appears here this spring. I would buy it myself. Unfortunately one of the trade magazines recently reported that the Technics USA import office is planning to set the US price of the RS-7500 at about $800, evidently on the theory that people will respect it better if it carries an exorbitant price tag.

Technics showed another tape machine which garnered a lot of attention: the RS-1500 open-reel deck which probably will sell in the USA for about $1400. For its capstan motor it borrows from current turntables the quartz-lock servo controlled direct-drive motor with a speed accuracy of better than 0.1%. A flutter percentage of only 0.01% to 0.02% is claimed, due to a novel "isolated loop" tape path which is conceptually similar to a dual-capstan drive but is accomplished with a single unusually large capstan having pinch rollers on both sides of it. The heads are arrayed vertically below the large capstan. The tape is driven down the left side of the capstan, over the record and erase heads, around an idler wheel which serves as a scrape-flutter filter, up past the playback heads, and up the right side of the capstan. This arrangement is also claimed to substantially reduce "modulation noise" due to scrape flutter (vibration of the tape as it slides over the heads).

Digital Tape. Of course as we know too well from experience, all audio tape recorders have audible imperfections: tape hiss, wow and flutter, tape-dependent distortion and frequency-response aberrations, phase aberrations, etc. What the world needs is a tape recorder as flat and distortion-free as a good amplifier. A couple of years ago Denon (the manufacturing arm of Japanese Columbia) announced the availability of a digital audio tape recorder in which the audio signal is converted into a pulse code which is then recorded. When the pulse code is played back and decoded the recovered audio signal is completely free of all the usual imperfections of tape recordings. Wow, flutter, and scrape flutter are totally banished. The frequency response, noise, and distortion are simply those of the digital encoding and decoding circuits, which can be made to be very good indeed. To record the pulse code requires a tape machine whose frequency response extends to about a Megahertz, so the Denon digital recorder was designed around an existing TV studio videotape recorder. At the Audio Fair Denon showed a new model, more compact and transportable than their earlier version. Unfortunately it still costs over $50,000 which is expensive even by recording studio standards. Of course the Denon digital recorder is not intended as a consumer product; it is for use by recording studios to make the master tapes from which records are cut. Incidentally, at the recent Audio Engineering Society convention in New York, Soundstream of Utah demonstrated a similar American-made digital recorder; its sound is so good that I would gladly mortgage my wife (if I had one) to get one.

Maybe I won't have to. One of the most mouth-watering exhibits at the entire Japan Audio Fair was quietly residing in the Sony booth. It was a Betamax (Sony's $1300 home videocassette recorder), with a cable connecting it to a simple-looking black box equipped with input level controls and recording-level indicators. This box contained the digital encoding and decoding circuitry to convert the Betamax into a stereo audio digital tape recorder! Sony representatives declined

to quote an availability date or a price for the audio/digital adapter, but reasonable estimates are two years and $2000. Of course you wouldn't buy a digital tape recorder just to copy records and most FM broadcasts, since these sounds have already been subjected to the aberrations of conventional tape recording. The real value of a digital recorder is to record live sound.

In addition to its professional studio gear, Denon makes an extensive line of consumer audio products (receivers, turntables, phono pickups, etc., most of which are not exported to the USA). Their most interesting new product is the Phono Crosstalk Canceller (PCC), available as an outboard accessory box and also built-into the new Denon amplifiers. The motivation behind PCC is the fact that in the real world few phono cartridges exhibit the stereo separation that they are capable of. Nearly-inevitable alignment errors of a few degrees when a pickup is installed in a tone arm, plus similar alignment errors in the factory assembly of the pickup itself, combine to cause the generating elements in the cartridge to be slightly mis -matched with respect to the 45-degree modulation axes of the record groove. Consequently a left-channel modulation will stimulate a small amount of right-channel crosstalk, and vice-versa; a pickup which is capable of 30 to 40 dB of stereo separation then exhibits only 15 to 20 dB of separation in a typical set-up. So the Denon PCC contains phase-inversion and variable -crossfeed circuits to cancel out the crosstalk signals and restore all the separation that the pickup is inherently capable of. A built-in null test circuit permits the user easily to adjust the cross-feed circuits to optimize the system.

Denon has made no change in its famous moving-coil cartridge lineup, but the competition in that field is becoming stiffer. For example Onlife Research showed the Dynavector 20 pickup, designed in the Denon tradition with modest compliance and a fairly heavy cartridge body (10 grams), but with so high an output level (2 mV at 5 cm/sec) that no "head amp" or transformer is needed to bring the signal up to normal phono levels. Curiously, the cartridge is offered in two versions; you may choose either a tapered aluminum cantilever or a straight beryllium cantilever, and the choice affects the high-frequency sound of the pickup.

Even more interesting is the Dynavector DV505 tone arm, a separated-pivot design like the lamented Transcriptors. The part of the arm which pivots laterally is quite heavy while the part of the arm which pivots vertically has very low effective mass (with the pivot located about an inch behind the cartridge), yielding good tracking of warped records. The mass of the main arm causes a very low-frequency lateral resonance which is attacked by two means. (1) A spring bob weight is mounted inside the arm, with its mass and spring-constant calculated to resonate precisely out-of-phase with the arm itself, thus cancelling the main resonance and splitting it into two subsidiary resonances. (2) These are then damped magnetically. According to the brochure, "A curved rod attached to the rear of the arm is embedded in a magnetic field supplied by two permanent magnets. Any minute movement of the rod, due to an undamped arm resonance, causes an eddy current to be induced in the rod, which in turn interacts with the magnetic field to return the system to its rest state. This highly effective damping also makes the arm impervious to acoustic feedback." It all sounds quite tempting. Incidentally, Dynavector also makes high-grade tube amplifiers, including a preamp for $1200 and a 50 watts/channel power amp for $900. But as far as I know Dynavector products are not scheduled to be marketed in the USA.

Ortofon of Denmark introduced their new top-of-the-line moving-coil cartridge, the MC-20, at the Japan Audio Fair. To step up its signal level Ortofon has finally given up on the transformer and has produced a "head amp", the MCA -76 having an effective sub-sonic filter and a low input noise level (better than -146 dBV, i.e. 60 dB below the standard 0.05 mV moving-coil reference level).

Speaking of record-playing equipment, perhaps the ultimate toy for the A/B comparison enthusiast is the Micro/Seiki DDX-1000 turntable with mounting points for <u>three</u> tone arms. Teac is importing it into the USA.

<u>Tuning Out the Pilot</u>. Two new Yamaha products seemed especially noteworthy. One is the CT-1000 tuner, a modestly-priced version of the classic CT-7000 supertuner (which costs $1200). The CT-1000 has a quoted signal-to-noise ratio of 80 dB in mono and 75 dB in stereo, retains the ultra-low distortion and excellent automatic fine tuning of the CT-7000, and contains one of those clever design ideas that seem so obvious (after you've heard it) that it is hard to understand why it hasn't been done before. In all ordinary FM tuners the pilot filter, used to suppress the 19 kHz stereo pilot, produces high-frequency phase shift and makes it impractical to maintain flat re-

sponse to 15 kHz; typically the response of most tuners starts to roll off at 13 kHz and is several decibels down at 15 kHz. However most current stereo tuners employ a phase-locked-loop (PLL) multiplex stereo decoder circuit which contains an oscillator which is precisely locked onto the broadcast pilot tone in both frequency and phase. So Yamaha has simply taken that PLL oscillator tone, inverted it in phase, and mixed it into the audio signal to cancel out the 19 kHz pilot! No pilot filter is needed, and Yamaha can guarantee the frequency response of the CT-1000 to be flat within 0.5 dB to 15 kHz. (Beyond 18 kHz a filter does cut in to eliminate the 38 kHz stereo subcarrier and other ultrasonic garbage.) The retail price of the CT-1000 tuner in Japan is only $200, so its price in the USA probably will be in the $300-$350 ballpark. Incidentally, 1 understand that Pioneer also plans to bring out a tuner employing a similar method of cancelling the 19 kHz pilot without need of a filter.

Yamaha also introduced a successor to their CA-1000 integrated amplifier, dubbed the CA-1000 Mark HI. Like its predecessor it can be operated either in conventional push-pull Class B (delivering about 120 watts/channel) or in ultra-low-distortion Class A (rated at about 20 watts/channel). The amplifier has two features of special interest. One is the inclusion of the same "head amp" for moving-coil low-output cartridges that is supplied in their C-2 preamp. The specified input noise level of the preamp, with shorted input terminals, is an amazingly low -156 dBV (i.e. 70 dB below the standard 0.05 mV rating level). Actually it won't be quite that quiet with a real cartridge attached; for instance with an Ortofon MC-20, whose rated impedance is 2.5 ohms, the theoretical minimum noise limit is -152 dBV, still very low. The other feature that I liked in the CA-1000 is its provision of two input selector switches, one which selects what you will listen to and another (labelled REC OUT) which selects the signal which will be fed to your tape recorder, thus making it very convenient for instance to tape an FM broadcast while listening to records or vice-versa. And the REC OUT control has an OFF position which disconnects the TAPE OUT jacks from the amplifier circuitry, ensuring that the input impedance of the tape recorder (or other device connected in the tape-monitor loop) cannot affect the quality of the signal that you are listening to.

Inevitably Pioneer expanded their already mammoth product line. Among the new products shown were an attractive and flexible three-way electronic crossover for bi-amping and tri-amping; a low-profile preamplifier modeled after the Yamaha C-2 (which, of course, was itself modeled after the Mark Levinson preamp); a $300 front-load cassette deck with a built-in digital clock and controls to start the recorder at precisely settable times; and the RT-701, an open-reel recorder which addresses my pet gripe about open-reel tape decks. In most open-reel decks the heavy motors are situated near the top of the machine and the electronic circuitry is isolated below the transport mechanism, with the result that the normal tape deck is tall, shallow, top-heavy (thus easy to tip over), and impossible to stack with other audio components. Pioneer's RT-701 is constructed as an open-reel version of a front-load cassette deck: the 7-inch reels occupy much of the front-panel area with the meters and controls artfully arrayed between and around the reels. The unit has the same proportions as a large amplifier or receiver 19 inches wide, only 9 inches high, and 14 inches deep, so it stacks neatly with the rest of one's stereo components. It is a three-head three-motor machine with a direct-drive capstan, a variable pitch control for playing off-speed tapes, and a claimed frequency response of 20 to 28,000 Hz at 7 1/2 ips and 20 to 20,000 Hz at 3 3/4 ips! The price in Japan is only $380.

Evidently the experience of developing and promoting the CD-4 system of four-channel records convinced the Japan Victor Corporation of the importance of reproducing the "sound of space" in one's living room, for JVC has jumped into binaural sound with both feet (both ears?). The JVC exhibit was dominated by a display promoting JVC's binaural demonstration record and cassette, with about a dozen headphone stations set up so that visitors could sample the delights of binaural reproduction. (The content of JVC's demo disc is similar to that of Stereo Review's .)

"Binaural Processing." The sonic shock of the Japan Audio Fair was inside the JVC exhibit. A very ordinary-looking stereo system was set up -- cassette deck, stereo amplifier, two speakers, plus an extra box called a "binaural processor." When the cassette was played I was stunned to hear around me the acoustics of a chapel with a choir singing antiphonal hymns. This was not four-channel sound; I checked, and it was clear that the only speakers in the room were the pair on the table in front of me. But I could clearly identify sounds located to the sides and above, including the reflections of the choral sound off the walls and ceiling of the recorded chapel! It has previously been shown that such a super-stereo effect is possible; it has been reported by Dr.

Manfred IL Schroeder of Bell Labs in New Jersey in his research on the perception of stereophonic sound and auditorium acoustics. But the experience of hearing it is stunning. The quoted price of the binaural processor is only $140 in Japan, so it could appear here for about $200, though JVC has not stated whether it will in fact be marketed in the USA. With such a device to free binaural sound from the prison of headphones, record companies could seriously consider issuing binaural recordings commercially -- which would be a valuable departure from the unnaturally-detailed, multiple-microphone recording practices which are common today.

Speaking of four-channel sound, one of the fascinating things about the Japan Audio Fair was the virtual absence of quad. It has been reported that quadriphonic sound had been a much larger success in Japan than in the USA, but it seems unlikely. Among the eighty or more exhibitors I could find only one promoting quad: the elaborate Sansui display which, aside from showing assorted QS gear, seemed to be devoted mainly to demonstrating how well Sansui's speaker designers have succeeded in making their speakers sound like JBLs.

Another product category which was conspicuously absent from the Audio Fair was time-delay equipment for re-creating in a living room the spacious acoustics of the concert hall; its absence was unexpected in view of the favorable publicity that time-delay has received in the USA and England. And it is all the more surprising when we recall that Matsushita, the parent company of Technics and Panasonic, makes the analog bucket brigade IC which has been widely accepted in the USA as an effective way to produce audio time delay. The other proven way to produce an audio delay system is via digital signal conversion, and both Denon and Sony have shown themselves to be adept enough with digital circuitry to handle that task. Their response to my inquiries about the absence of time-delay units at the show left me with the impression that the costly four-channel bust has made the major Japanese manufacturers more conservative and less sure of their ability to create a market for a new kind of product. (Note that tentative approach that many are taking toward the Elcaset.) Technics had actually developed a time-delay unit, and demonstrated prototypes at an engineering convention last year, but they decided to shelve it until they become convinced that people are ready to buy time delay. (Or maybe they only want to undertake one gamble at a time, and right now they are trying to get the Elcaset off the ground.) So it will be up to American designers (Audio/Pulse, Sound Concepts, and others) to lead the way with time-delay.

This review of the Japan Audio Fair is only a survey of highlights -- and a personal survey at that; another audiophile would doubtless have found different innovations worth noting. But it is clear that we have many pleasures to look forward to as these products begin to appear in our local stores during the coming year. Nor can we, any more, regard the Japanese designers as a race of copycats. If it was ever true that the Japanese manufacturers bought their way into the hi-fi world by making imitative products at budget prices through cheap labor, it is no longer true. The major Japanese manufacturers such as Pioneer, Sony, and Yamaha lead the rest of the world in audio component manufacturing because many of their products are better-designed, better-made, more rigorously quality-controlled, better-sounding, and simply more pleasurable to use than most of the products made elsewhere. And the evidence of the Japan Audio Fair is that they are working to retain their leadership position in the best way possible: by designing new products which are even better than those we see now. -- Peter W. Mitchell

A Publication of the B.A.S.

A 16-CHANNEL PROGRAMMED DELAY NETWORK

Robert Berkovitz and David McIntosh
Teledyne Acoustic Research

1. The Origins of Spatial Sensation

When a sound from a single source is repeated from other sources, displaced in azimuth as well as time, listeners report a characteristic sensation, usually described as an increase in the apparent size of the source or of the room in which listening takes place. A large, enclosed space, such as a concert hall, produces reflections, delayed and displaced with respect to the direct sound, which cause the same sensation. Each concert hall produces its own pattern of reflections, which is in turn heard differently by listeners in different parts of the auditorium. In most acceptable concert halls, within about 100 milliseconds after the onset of a musical tone, the density of the reflections has increased sufficiently to resemble band-limited noise with spectral characteristics similar to those of the program but without distinct time-ordered components. This noise-like reverberation decays at a rate which differs from hall to hall. Aspects of this decay are often regarded as primary acoustic properties of the hall.

2. Research in Spatial Sensation

Studies of concert hall acoustics usually are based on the subjective evaluation of existing architectural examples, rather than on musically desirable reflection or reverberation patterns. Listeners are typically asked to listen to recordings made in various halls and to indicate a preference. Reasons for this preference are then sought by attempts to isolate those factors believed to determine the listeners' choices. These factors, typically identified as intimacy, spaciousness, texture, warmth, blend, etc. , must then be correlated to objective properties of a hall, in order to draw architectural conclusions, so to speak, from the subjective choices of the listeners.

Two serious problems beset such studies. One is the need to depend entirely upon subjective criteria, which differ from one listener to another and from which no clear rank order of importance can be derived. A second problem arises from the difficulties of measuring the characteristics of existing halls--the available microphones usually lack the resolution required to measure the location and amplitude of single discrete reflections and to relate subjective effects to these reflections. Recent studies have frequently been based on the use of digital computers and simulation systems to analyze such relations more precisely than in the past.

3. Music without Architecture

Electronics, especially the development of digital signal processing techniques, enables us to ask a question of interest: "What spatial effects are most desirable during the performance of different types of music?" In addition, it allows us to address ourselves to the question independently of our ability to devise an architectural answer. It is conceivable, in other words, that listeners might prefer certain spatial sensations during the performance of a work of music, but that no real structure could be found or built to satisfy this preference. If we, therefore, take the position that our object is to generate the sensation, and not the architecture, then electronics offers a way to the goal. In addition, electronics offers the possibility of making the desired spatial effect a new variable available to those who create music, for we live in a time when electronically produced and reproduced music represent the primary musical experience of most listeners.

In essence, we wish to explore "ambience," not as merely a property of large rooms, but as another dimension of music independent of its other attributes. We have started such an exploration in two parts:

a. Characterization of the audible spatial and temporal patterns in the discrete early reflection sequences of halls and listening rooms of various dimensions, and

b. Presentation of such patterns to listeners, by use of a programmed delay network, to establish which differences, preferences, and degrees of complexity listeners are able to hear in such patterns.

4. The Computer Program

A number of studies indicate that the subjective effect of early reflections in a large hall is different from that of later reverberation, and that the time period in which the acoustical character of a hall is sensed is on the order of 100 milliseconds. In this time, following the attack transient with which a musical sound starts, the ear and brain form an idea of the size and diffusion of the sound source and of the setting in which source and listener are located. High-resolution measurements of real halls which would adequately represent events during this time period are not yet possible. However, mathematical modeling of simplified rooms, implemented with computers, provides a precise way of determining the basic image locations in time and space. This, in turn, allows the user of the computer program to look for patterns and pattern changes which correspond to differing subjective effects. In several respects, the results of using a simple model are unlike those found in a real hall. However, it is the sensation produced in such a room, and not the effects of architectural detail, which we wish to examine. The program developed at Acoustic Research gives quite detailed graphic outputs representing the way in which the geometry of energy distribution and arrival time change with a number of variables. By using the data from the computer output to set the operating characteristics of a simulator, the subjective effects of different imaginary rooms can be compared.

As in optics, a sound source and its image can be modeled as a pair of sources,

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when analyzing the interaction between direct and reflected radiation. By extending the model, multiple reflections may be taken into account. Just as a room made of mirrors would look like an infinite lattice, a reverberant room of rectangular shape can be modeled as a lattice with rectangular cells. Each cell of the lattice contains a source, which emits its sound at the same time as the real source; however, because the distances from the images in the lattice to the listener are greater than that between the listener and the real source, sound from the images reaches the listener after that from the real source. Techniques for analysis of rooms of arbitrary shape, as well as of rectangular rooms, have been developed.

The basic program requests from the user the dimensions of the room, the location of the source, the location of the listener, the absorption coefficients of each of the six inner surfaces of the room, and the time period for which reflections are to be computed. Numerous subroutines permit information of special interest to be extracted. The program operates in one of the two following ways when used with the delay network.

Method 1. The hemisphere above the listener is divided into sixteen sectors. The delay time, attenuation, elevation, and azimuth of each reflection is computed, and it is assigned to the sector from which it would emanate in a real hall. A graphic and a printed output appear. The graphic output consists of sixteen impulse response charts, representing the complete set of delayed arrivals at the listener's location during the time period under consideration. The patterns which appear offer an indication of the geometry of the image distribution. A printed output provides, for each sector, the time of arrival of the first reflection from that sector and the integrated energy arriving from that sector during a selected time period.

Method 2. Another technique maps the reflections in the forward or rear domain, indicating true elevation and azimuth of each image and its approximate arrival time and amplitude.

5. The Programmed Delay Network

The system used to present listeners with delay patterns is a sixteen-channel digital time-delay system, designed to reproduce the salient features of early reflection patterns in halls and other direct/delay configurations of interest. Music recordings used with the system contain reverberant decay, so that this component of reverberation does not need to be simulated by the system. The presence of so many delays automatically results in considerable incoherence, as well, so that only the early reflection pattern needs to be controlled precisely, to produce a wide range of effects.

The number of channels was chosen on a simple basis. Ten- and twelve-channel analog simulators have been built by others and described as quite effective. The number sixteen is larger than these numbers, comes readily from the digital designer's mind, and is of convenient size to assemble in a reasonable time, so this was the number of channels first chosen for trial.

The basic structure of the system was shaped by the use of random-access-memory

as the signal storage medium, rather than the shift registers normally used. One reason for this was the ease with which multiple outputs could be taken from such a system. Another was the high resolution possible in the setting of time delays—to an accuracy of less than one millisecond. This, in turn, allows experimentation with effects caused by small shifts in delay. Another important advantage of the RAM approach is that all-electronic program storage and switching can be readily implemented. This ability to switch from one configuration to another is an sbsolute requirement if detailed studies of perceptible differences are to be made.

The system is completed by a sixteen-channel power amplifier, built from hybrid modules, each of which provides ten watts output into an AR-7 loudspeaker system. Adjustable low-pass filters allow aerial absorption to be simulated.

Sixteen channels have been found to be adequate for our purposes. Listeners, including researchers, audio enthusiasts and musicians, find the performance of the system quite realistic. A great variety of subjectively different acoustic spaces can be generated quickly and compared.

6. Circuit Description

The programmable signal delay network receives one audio frequency input signal, stores it for up to 256 milliseconds, and develops sixteen independent time-delayed and filtered replicas of the original signal. Time-division multiplexing is used to reduce system cost, by time-sharing one digital-to-analog converter among all sixteen output channels. Each of the output channels is independently adjustable for time delay (one millisecond increments) and gain (0.01 to 1.0 in steps of 0.01). Sixteen complete programs, each listing sixteen delay and gain value pairs, are stored in nonvolatile semiconductor memory, to allow rapid comparison of different simulations.

Figure 1 shows the network in block diagram form. The audio signal proceeds along the top from left to right through input (analog-to-digital) conversion, storage in read/write Signal Memory, output (digital-to-analog) conversion and filtering. Various control signals, described below in more detail, flow upward to operate elements in the signal path.

7. Signal Processing

The input conversion module is shown in Figure 2. The stereophonic music signal source is mixed down to mono, preamplified and pre-emphasized (75 microsecond time constant). Pre-emphasis reduces noise, but it also causes a reduction in overload margin at high frequencies. Since most music sources available to us have already passed through a similar pre-emphasis/de-emphasis operation, they "fit" well within the delay network channel.

The signal is then low-pass filtered by a five-pole elliptic function network (the "anti-aliasing" filter) which limits system bandwidth to approximately 14 kHz, sampled once every 30 microseconds by a sample/hold module (Datel SHM-4), and converted to a twelve-bit, offset-binary-coded digital word by the A/D converter (Datel EH-12B). The twelve-bit parallel output word is then stored in the Signal

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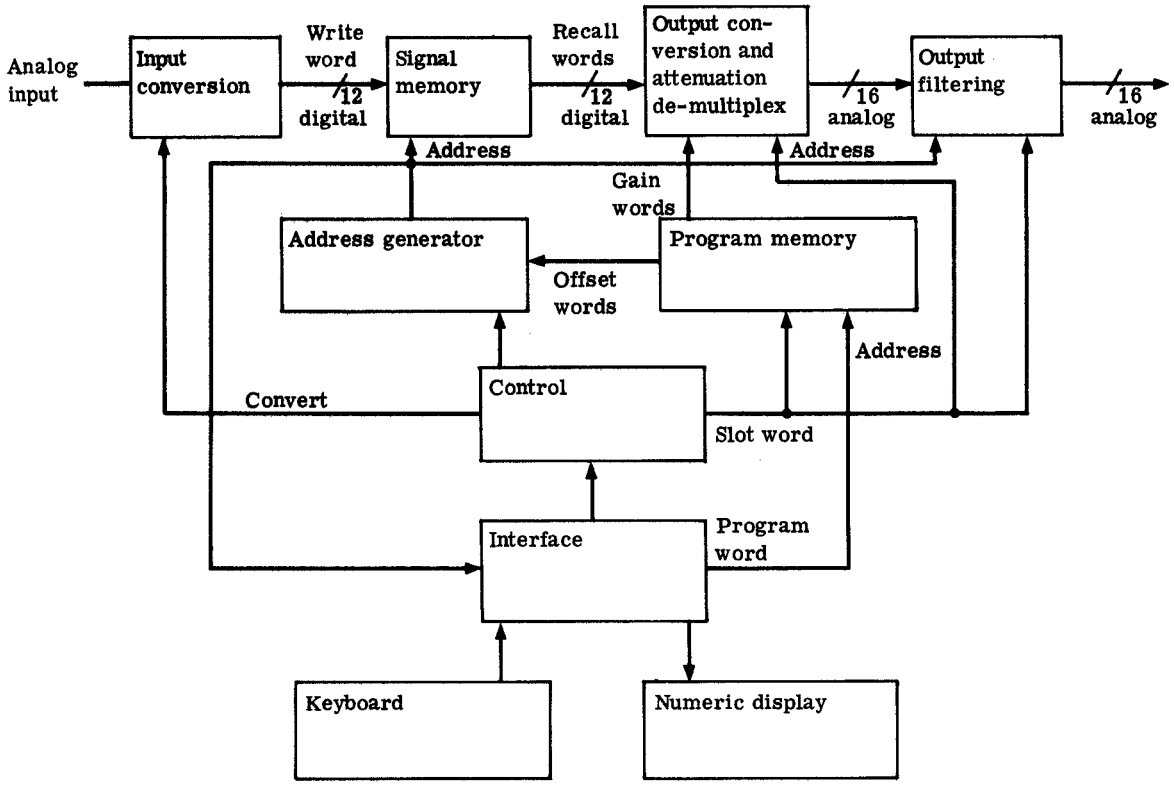

Fig. 1 — Block diagram

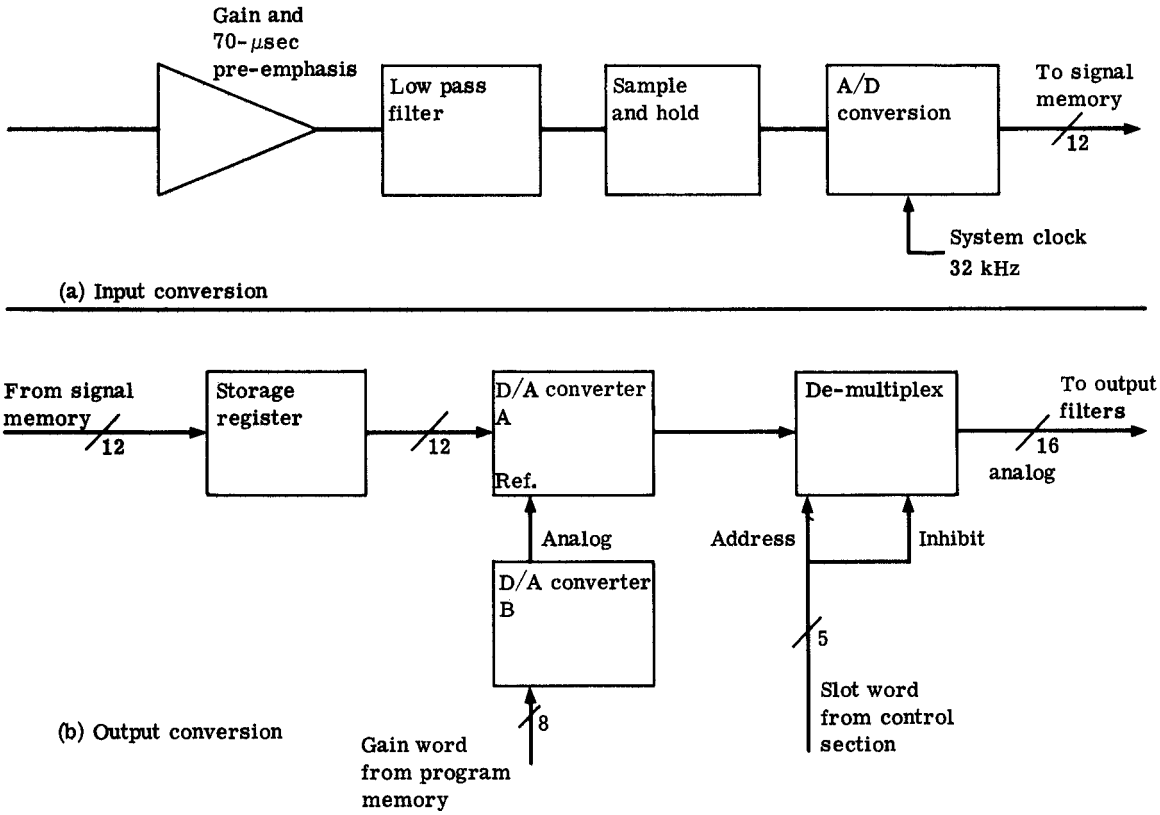

Fig. 2 — Signal path

Memory, and 8192-word by 12-bit array of 96 1024-bit random-access memory ICs. Each of the 8192 word locations in the memory is uniquely specified by a 13-bit, binary-coded Signal Memory Address word received from the control section of the network.

After each input storage (Write) operation, there occur sixteen Recall operations, corresponding to the sixteen outputs. Each of sixteen successive Recall words read out of Signal Memory is reconverted to an analog voltage sample by the main D/A converter (Datel DAC-MI) and, during the conversion process, is effectively multiplied by a stored preset gain coefficient recalled from the control section. The sixteen analog samples appearing in sequence at the D/A converter output are routed via the Demultiplexer (RCA CD4067) to sixteen output de-emphasis networks, buffer/filter stages, and program-controlled low-pass filters. Channel selection in the Demultiplexer is controlled by the five-bit, binary-coded Slot Word, which specifies one of sixteen recall operations and one write operation.

The output filters simulate the high-frequency absorption effects of long air paths, and their response characteristics are set automatically according to the programmed value of time delay.

In practice, the fidelity of the isgnal path is comparable to that of a high quality FM transmission, with a slightly higher level of signal-dependent noise. System performance would be marginal for direct reproduction of music, but it is entirely adequate for use as a simulator of early reflection patterns. It appears that the Haas (precedence) effect and high-frequency rolloff at the output of the delayed channels make the perceived noise and distortion levels of the simulation depend only on the quality of the signal from the front (unprocessed) stereo loudspeakers.

8. Control Section

A crystal-controlled clock signal at 544 kHz is divided by 17 in the Slot Word counter to obtain the audio sampling frequency of 32 kHz. The counter's five-bit output, called the Slot Word, is sent to the output Demultiplexer, and to the Program Memory to recall delay and gain values.

At the beginning of each 17-step Write/Recall cycle, the Write Address counter is advanced by one count. The 13-bit, parallel output of this counter is used directly to address the Signal Memory during the next write operation, and, during the next sixteen recall operations, is summed arithmetically with each of sixteen Recall Offset words sent in sequence from Program Memory.

If the Write Address counter counts upward with time, then a negative number, or offset, added to the counter's output, will address a location lower in memory or earlier in time. The value of this offset is entered into Program Memory through a keyboard, but it could be derived from any analog-to-digital conversion mechanism.

Each of the sixteen Program Memory readout operations also produces a Gain Word, which is sent to the output D/A converter to adjust conversion gain independently for each recall operation.

Program values are stored in CMOS 256 x 4-bit read/write memory ICs with battery

power backup. If the need were to arise for standardized simulation programs, pin compatible pre-programmed read only memories (PROMS) could be substituted.

9. Interface

The Interface section controls entry and display of program parameters and selection of stored programs. Five commands control all operation modes of the delay network. Two of these, Program and Output, represent destination/source addresses for two data input/output commands, Delay and Gain. The fifth command, Enter, causes execution of commands. To set output 13 of program 7 to a delay time of 23 milliseconds with gain of 0.47, the entry sequence is:

PROG, 7, ENT

TAP, 1, 3, ENT

DELAY, 2, 3, ENT

GAIN, 4, 7, ENT

Interrogation of Program Memory to determine stored values of gain and delay is performed in the same sequence, with ENT commands omitted after DELAY and GAIN commands.

The network described is the subject of several patent applications.

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A Publication of the BAS

Reviewing the Reviewers:
A Comparison in Subjective Listening

John J. Puccio

The following is a bit of summer diddling: a chart of how the so-called "subjective" reviewers are reviewing the same products. It says not so much about the products as it does about the reviewers. It may make interesting reading. Reviewers considered were J. Gordon Holt of The Stereophile, Harry Pearson of The Absolute Sound, Patrick H. Donleycott, John W. Cooledge, and Frank Richards of The Absolute Sound (listed as Others"), J. Peter Moncrieff of Sound Advice Issue I, and Edward S. Wodenjak of Sound Advice, Issue II.

Reviews include full reviews, short reports, recommendations, capsules, quickies, further thoughts, comparisons and brief comments in passing. Where the same reviewer has published several reviews of the same product, only the last opinion is considered. Furthermore, products were limited only to those reviewed by two or more reviewers. And, in fairness to Sound Advice and to maintain interest in current products, reviews were limited to those published in the last two to three years and to those products still in current production.

The comparisons themselves are, of course, subjective too, insofar as they are based on my own personal interpretations of a reviewer's comments. (In this regard, trust me, or this whole exercise loses interest already.) Products are listed in descending 'order according to composite average scores.

Now, about the scoring: 5 - an excellent product; highly recommended.
4 - a very good product; recommended.
3 - a fair product; possible, conditional recommendation.
2 - a poor product; not generally recommended.
1 - a really bad product; not recommended at all.

So here is how I see the various reviewers rating each product. An asterisk (*) will indicate a product about which there is a considerable difference of opinion: perhaps being a sign of differing testing methods, different listening techniques or different biases among the reviewers; perhaps, too, being an indication of a variability in sample to sample product quality.

	Stereophile	Absolute Sound	Absolute Sound	Sound Advice	Sound Advice	Average
	Holt	Pearson	Others	Moncrieff	Wodenjak	
Preamps:						
Levinson JC-2		5	5		5	5
ARC SP-3A-1*	5	5	5	4	2	4.2
Soundcraftsmen PE2217	4	4	4		4	4
Citation 11	4	3				3.5
Marantz 3300		3	4			3.5
Marantz 3600		3	4			3.5
Dyna PAT-5*	5	2	4		1	3
Phase Linear 4000	2		3			2.5
Tuners:						
Sequerra 1	5	5				5

	Stereophile	Absolute Sound	Absolute Sound	Sound Advice	Sound Advice	Average
	Holt	Pearson	Others	Moncrieff	Wodenjak	
Tuners, continued:						
Yamaha CT-1000	5	5				5
Yamaha CT-800	4	3				3.5
Citation 15	3	2				2.5
Marantz 10B	3	2				2.5
Amplifiers:						
Phase Linear 400*	3			5	5	4.33
Ampzilla*	5	5	5	2		4.25
ARC D-76A*	5	5	5		2	4.25
Dyna Stereo 400*	5	4	4	3		4
Marantz 500		4	4			4
ARC D-76	4	4		3		3.66
Paoli 60M*	4	2	3	4	4	3.5
Phase Linear 700B		3	4			3.5
Yamaha B-1*	3	3	5	3	3	3.4
Epicure 1*	4	4	2	2		3
Quatre DLH-100*		4		2	3	3
Citation 12	3	3		2		2.66
Crown DC-300A	3			2		2.5
Dyna Mk.III	2	3				2.5
Infinity SWAMP	3		2			2.5
Speakers:						
Infinity SS-IA	5	5	4			4.66
FMI J	5			4		4.5
Magnaplanar T-IIIA	4	5				4.5
Dahlquist DQ-10	4	5	4			4.33
KLH 9 (two pair)	4	4				4
Magnaplanar T-IB	4	4				4
Quad ESL	4	3	4			3.66
IMF Monitor IIIA	4	3				3.5
Dyna A-25	3		3			3
FMI 80*	4	2	3			3
Hegeman I	3	3				3
Yamaha NS-1000	3	3	2			2.6
Audioanalyst A-100X*	1		4			2.5
ESS/Heil AMT-1	2		3			2.5
Ohm F	2	2	2			2
Audionics TL-90		1	2			1.5
Pickups:						
Decca Mk. V*	5	4		3	4	4
Denon 103C	4	4	4	4	4	4
Stax FM*	5			3		4
Fidelity Research FR-1/II		4		3	4	3.66
Supex 900E	4	3	4	3		3.5
ADC XLM*	3	4	4	2		3.25
Denon 103S	3	3	3		3	3
Shure V-15/III	4	2			3	3
Ortofon SL-15/II		3	3	2		2.66
ADC XLM/II*		4		1		2.5
B&O 6000		3		2		2.5

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	Stereophile	Absolute Sound	Absolute Sound	Sound Advice	Sound Advice	Average
	Holt	Pearson	Others	Moncrieff	Wodenjak	
Pickups, continued:						
Micro-Acoustics QDC-1	2	2	2	3		2.25
ADC XLM Super*		3		1		2
Turntables:						
Technics SP-10		4			4	4
Technics SP-110A	4				4	4
Linn Sondek LP-12*	5	2			4	3.66
Tone Arms:						
Decca International	4	4				4
SME 3009/II	4	4			4	4
Transcriptor's Vestigial	3	4	4			3.6
KMAL M9BA /II*	5				2	3.5
Miscellaneous:						
Sony TC-756	4		4			4
Nakamichi 700	4		3			3.5
DBX 119*	4	2	4			3.33
Average score for all products per reviewer:	3.75 Holt	3.43 Pearson	3.56 Others	2.74 Moncrieff	3.37 Wodenjak	