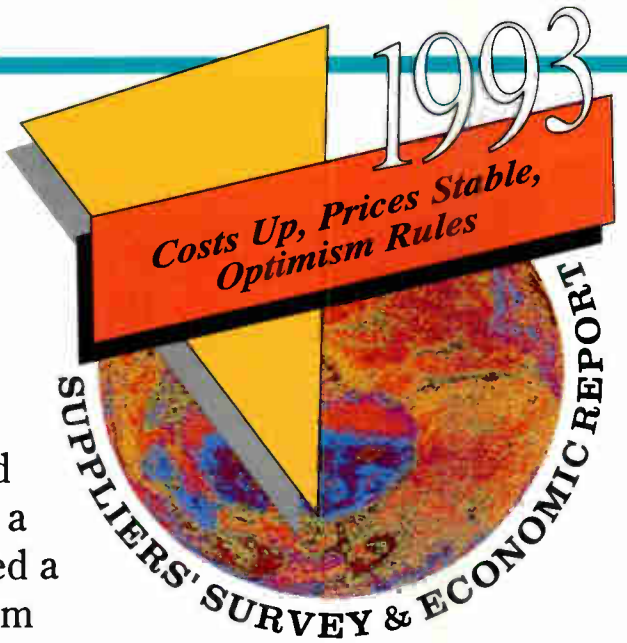
SOUND & COMMUNICATIONS

Volume 39 Number 12 December 29, 1993



CHURCH CHANGES WITH THE TIMES

From four speakers and 200 watts of power — a church sanctuary acquired a full-fledged sound system controlled by software (along with a ventilation system). Preliminary testing, computer ign and ttention ient all of the 26

1993 SUPPLIERS SURVEY

Our eighth annual survey was kept short and to the point so that your suppliers could more easily participate. We get calls every day from people looking for hard data and real numbers. This survey provides them. Our anonymous, verifiable, quantifiable survey was tabulated by an independent firm for your edification. 37

OMATIC IE OPTIMIZATION

l room correction is coming on line for home plications. Who are the players? What are iques? How does it work? We cover Auto- m Optimization in Home Theater installations; an in-depth explanation. 16

IN THIS ISSUE

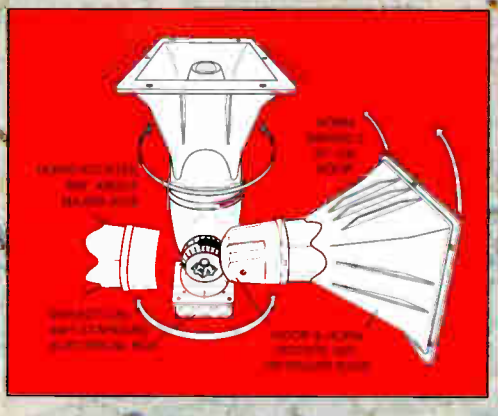
6 Reasons Why The PA430T Will Save You Time And Money

1 Economical

The PA430T's design offers significant savings in installation cost and features a patented mounting system that can be installed to any standard electrical box. Further savings can be realized because of the PA430T's constant directivity pattern, which typically requires 20% fewer horns than the competition to cover the same area.

2 Constant Directivity

The PA430T's 60° x 40° dispersion pattern provides constant directivity control from 2kHz to 10kHz, improving intelligibility while minimizing pattern overlap.



3 Rugged Construction

Constructed of polycarbonate and nylon, the PA430T is rugged like metal horns, however, it is resistant to environmental extremes and will not rust or dent.

4 External Power Tap

Offering selectable taps of 25V, 70.7 V and 100V, the power settings may be changed on an installed unit without disassembling the horn.

5 Versatile Swivel Mount

The PA430T's base rotates 360°, the hoop rotates 90°, and the horn rotates 360°. This enables the horn to be positioned in any direction for maximum use of the horn's dispersion pattern.

6 Customer Support

University offers full-time technical support with a direct line, 800-950-2368. Rigorous quality control standards are also maintained and we promise on time delivery with products shipped from stock. The PA430T also features a five-year warranty against malfunctions due to workmanship and materials.

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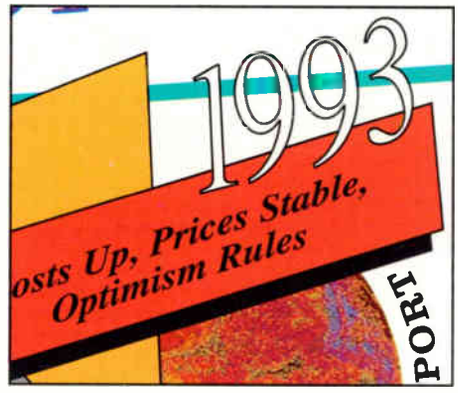

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FEATURES

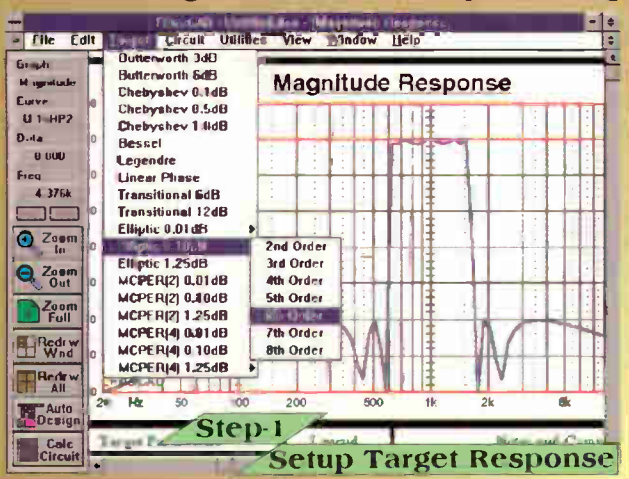
DEPARTMENTS

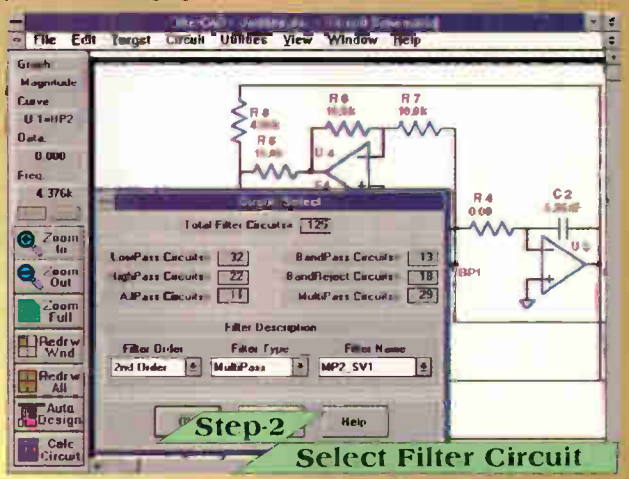
FilterCAD

New

Design Active Filters in 3 Easy Steps !

FilterCAD is a program specifically developed to handle the unique requirements of active filter design. In the past, filter designers had to rely on tables and equations of filter design data, or use trial-and-error analysis with general circuit simulation programs. FilterCAD provides an entirely new approach- *direct design*. FilterCAD contains all of the synthesis equations necessary to actually *design* the component values itself, in addition to providing a full target generation system for accurate comparison. With FilterCAD, designing simple or complex multi-stage filters is an easy and *very fast* 3 step process!





Filter Circuit Topologies

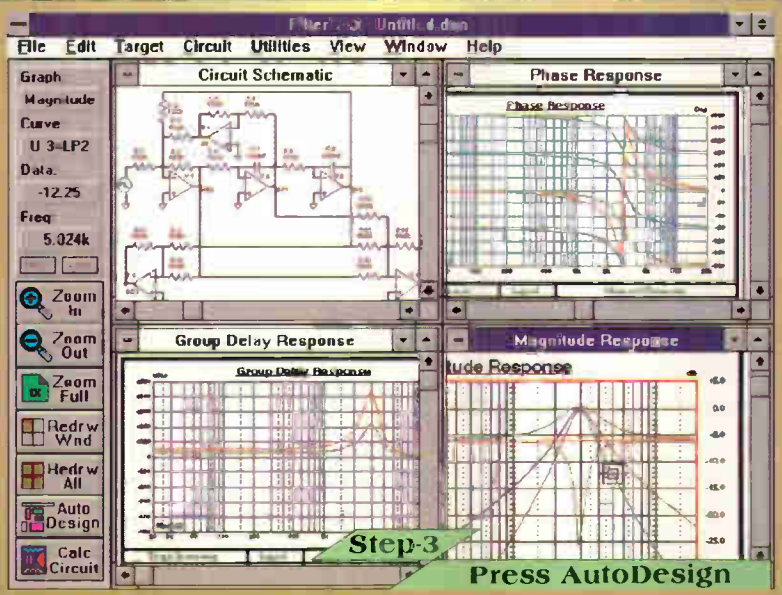
FilterCAD contains a catalog of predefined circuit topologies, from which the user can choose a particular circuit or circuits for a given design. The design equations and filter synthesis information for each of these circuits has been developed and coded into the program, which enables FilterCAD to actually design the circuit itself based on a few key component choices by the user.

Filter Circuits

- 125 different circuit topologies, covering 1st through 8th order filter designs and more.
- User controllable two-pole Op-Amp model.
- Unlimited cascade design.
- Multiple-Feedback-Loop filters to 8th order.
- RLC ladders including Elliptics to 8th order.
- RDC ladders using FDNRs to 8th order.
- Gyrator synthesis for equivalent 'L' and 'D'.
- 1st-4th order state variables and biquads.
- RLC Allpass lattice circuits.
- Twin-Tee Bandpass and Bandreject circuits.
- Wein Bandpass Bandreject circuits.
- Asymmetrical LPN/HPN bandreject circuits.
- 1st-4th order Sallen-Key LP/HP/AP/BP/BR.
- Many other 1st and 2nd order circuits.

System Features

- Standard values: any, 1%, 5%, 10%, 20%.
- Circuit Impedance Scaling.
- Unlimited frequency range.
- User controllable analysis resolution.
- User controllable scale design.
- Custom graphs, fonts, line widths, colors.
- ABS/REL cursor readout system.
- ASCII data import / export.
- Graphics raster and vector export.
- SPICE net list generation.



Target Generation System

FilterCAD contains a full target creation system which enables the user to instantly generate a desired response for a particular filter design. The target response is then displayed on all magnitude, phase, and group delay graphs. Built-in standard classical filter functions are provided with automatic calculations for any transformation and frequency.

Custom Target Controls

- Magnitude, Phase, and Group Delay.
- TF Poly Order: 1-16 poles and zeros.
- Transfer Function Blocks (TFBs): 3 Max.
- TFB Parameters: Ao, Fp, Qp, Fz.
- LP1,HP1,AP1,LP2,HP2,AP2,BP1,BR1.
- TFB Enable/Disable switches.
- Automatic target leveling to circuit data.

Standard Target Functions

- 1st-8th order filter functions.
- Full transformations: LP,HP,AP,BP,BR.
- Butterworth 3 dB /€ dB (Linkwitz/Riley).
- Chebyshev 0.1 dB / 0.5 dB / 1.0 dB ripple.
- Linear Phase family.
- Bessel family.
- Legendre family.
- Transitional 6 dB / 12 dB cutoff.
- Elliptic 0.01 dB / 0.1dB / 1.25 dB ripple.
- MCPER(2) 0.01 dB / 0.1 dB / 1.25 dB.
- MCPER(4) 0.01 dB / 0.1 dB / 1.25 dB.

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MS Windows 3.1, 4MB RAM minimum.
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LINEAR X

Circle 219 on Reader Response Card

Closed Circuit, Suppliers' Survey, and the New Year

This year we did things a little differently. We set aside one day to call several industry leaders and ask them a series of questions (the same questions). This allowed us to get some anecdotal input into our Eighth Annual Economic Report and Suppliers' Survey (which we've taken to calling our Annual Report), and to catch people at the same point in time. Obviously, not everyone was available, but our sample shows a diversity of manufacturers and of opinion.

We added these comments to our statistical report, which resulted from our sending of questionnaires to every manufacturer in the sound and communications business.

Once again, we are patting ourselves on the back for being the only group that is providing the staff, financial backing, and write-up free of charge to the entire industry with no strings attached — the results of an economic survey of that industry.

There are, needless to say, other things to read in this issue. One of the things you won't read about, because I just learned of it today, is the interesting news that Paul Allen, co-founder of Microsoft, has invested in Virtual Vision. Those of you who watch CES-TV News may remember seeing yours truly holding up a brand new prototype of the Virtual Vision "eyeglasses" (which can show real life along with a video picture). Now the product has been produced, and Allen has invested in the company. Allen of course has also invested in Lone Wolf.

We're not sure where all this investing will wind up, but we thought you'd be interested in it — especially since Virtual Vision has joined the CCTMA, the CCTV manufacturers association which comes under the umbrella of the Electronic Industries Association. Other major lights of the CCTV industry are part of this association — ending alphabetically with West Penn Wire, beginning with ADT Security, and including Gyyr, JVC, Sony, and recently, Panasonic (Matsushita has traditionally been a supporter of EIA endeavors), which now numbers somewhere around 50 members. The CCTMA has been sponsoring seminars for trade and end users.

Last week when I was in Washington on other business, I stopped in to see the EIA people who are managing this CCTV group. There is some aggressiveness being shown, as the CCTMA will be sponsoring the CCTV sessions at NSCA, and will be participating in a CCTV exposition this spring. We'll keep you informed as events occur.

Best regards,

Judith Morrison
Editor in Chief

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ADD FULL-FADER & MUTING MIDI AUTOMATION TO OUR CR-1604 MIXER FOR JUST $799.

TOTAL RECORDABLE CONTROL OF YOUR MIX VIA OTTO-1604!

Finally, you can have real-time, free-flowing control of mixer levels, stereo AUX sends and mutes. Create mixesfar more complex than you ever could by hand — and then store, recall and tweak them at any timeAnd as many times as you want.

OTTO-1604 responds instantly to commands without adding noise or in any way degrading the CR-1604's superb specifications. It controls —

- All 16 input faders
- Master faders
- AUX return 1,2,3 & 4 levels
- ALT 3/4 Bus levels (a feature not possible on non-automated CR-1604s)
- Muting of individual input channels, AUX returns, ALT 3/4 & main outputs
- Pre-programmed fades & cross-fades up to 30 seconds long in 1/10 of a second increments.

FREE MACINTOSH SOFTWARE!

OTTO works with any sequencer that includes graphic faders. But if you work on the Mac, you get an added bonus: OTTOmix™ dedicated mixer automation software that runs along side your current sequencer using MIDI Manager or OMS.

ONLY THE CR-1604 CAN BE UPGRADED.

We designed the CR-1604 to re-defineompact 16-channel mixers by packing it with features and endowing it with "big-board" sound quality. Today it's the small mixer of choice for top TV and feature film soundtrack composers, session keyboard and electronic percussion musicians and thousands of home project studio enthusiasts. CR-1604s areed bymembersof theArsenio Hall & TonightShow bands, and have logged millions of miles on superstar tours.*

Not surprisingly, this level of acceptance has inspired a number of "imitation CR-1604s.When comparingthem to the original, remember that only theCR-1604 lets you add full-fader MIDI automation at any timHear the OTTO-1604 and CR-1604 at your Mackie Dealer today.

* See the full list of Mackie endorsees in our color brochure. All company and product names are trademarks or registered trademarks of their respective manufacturers.

The OTTO-1604 retrofit kit consists of an INTERNAL GAIN CELL BOARD which easily installs inside the CR-1604 mixer's chassis below its main circuit board an external, rack-mountableMIDI CONNECTION BOX. Computer-style AD connection cable is include.

FADER UPDATE MODE lets you control OTTO from external fader packs that generate MIDI continuous controllers.

BAR and BEAT counters.

MARK for cue points.

ARCHIVE SECTION can automatically save your work to a different file name after each mix.

OTTO ASSIGN switches the screen between up to 3 OTTO-ed CR-1604s.

TOOL BOX for global editing.

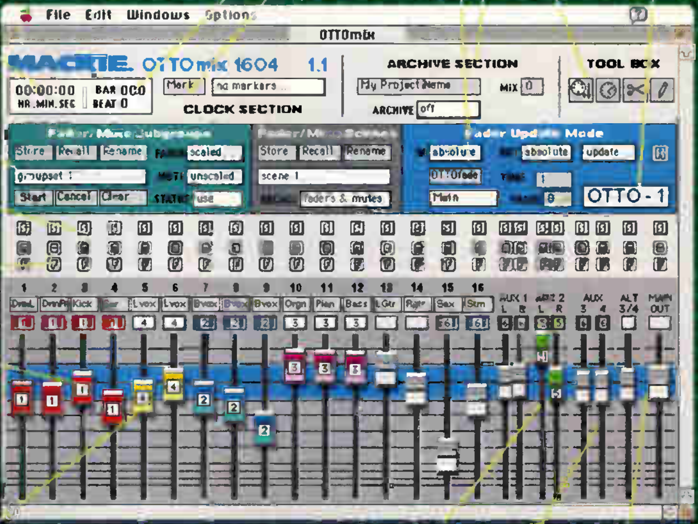
TIME CODE INDICATOR

Assign unlimited fader and mute SUB-GROUPS.

SOLO buttons

FADER & MUTE activity indicators.

FADERS with real time control. Assign unlimited scaled or un-scaled Subgroups across up to three OTTO-ed CR-1604s for 48-ch. automation!



AUX 1 thru 4 LEVELS.

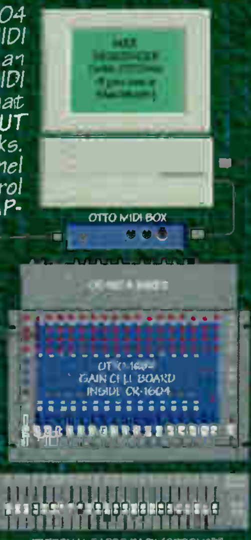
ALT 3/4 LEVEL.

MAIN L/R OUT LEVEL.

OTTO-1604 can be controlled with ANY MIDI sequencer that offers on-screen virtual faders & continuous controller messages. Whether you have a Macintosh, PC, Atari or Amiga you can make full use of the OTTO-1604's power. Mac sequencers offering on screen virtual faders include: Steinberg's Cubase, Mark of the Unicorn's Performer & Digital Performer, Opcode's Vision & Dr.T's Beyond. PC/Windows software that include or will include OTTO-1604 support are Big Noise Software's Max Pak, 12 Tone Systems' Cakewalk, & Master Tracks Pro by Passport Designs.

Shown above: Graphic faders in Cubase for Atari

OTTO-1604 connects to MIDI sequencers via an outboard MIDI connector boxthat includes IN, OUT and THRU jacks. Front panel buttons control LEARN, SNAP-SHOT MUTE and BYPASS functions. You can alsoadd an external fader pack for hands-on control... and daisy-chain up to three OTTOed CR-1604's (via MixerMixer) for 32 or 48-channel automation!



EXTERNAL FADER PACK (OPTIONAL)

CR-1604 Exclusive: Multi-way mechanical configuration switches in minutes.

CR-1604 Exclusive: Discrete mic preamps with -129 dBm E.I.N. and +48V phantom power

CR-1604 Exclusive: Musical equalization at useful points: 12.5K instead of 10K, 2.5K rather than 1K, 80Hz vs. 100Hz.

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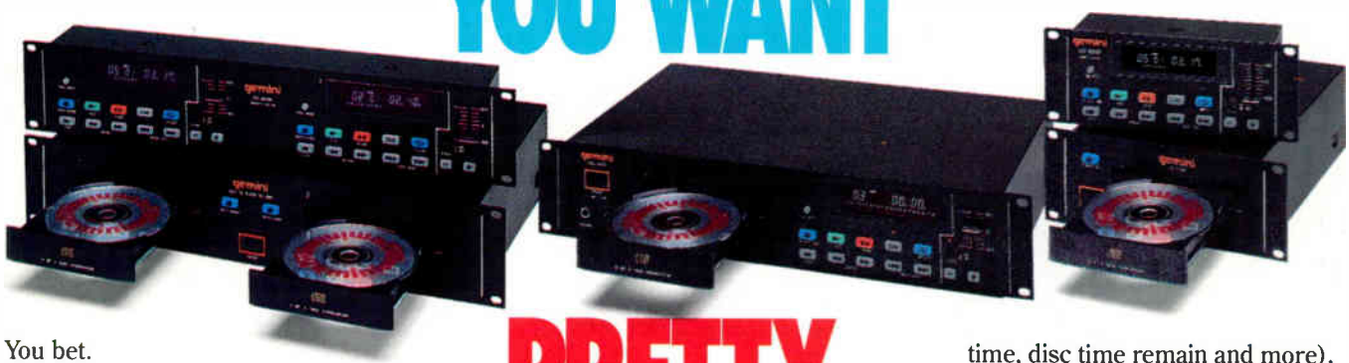

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NEWSLETTER

AZDEN ENTERS MARKET

Azden Corporation, which supplies wireless microphones for consumer and event videography, is introducing a new line of professional wireless systems for the musical instrument and sound contractor markets. The "Performance Series" will be introduced at CES and at NAMM. The series is a separate franchise with its own ad budget and set of sales reps. Wayne Alonso, Azden's national sales manager, heads up the effort. Initially, there will be three receivers, two microphone transmitters, and one instrument transmitter.

ELECTRO-VOICE PRODUCT SERVICE

Electro-Voice says that recent surveys show that the company is exceeding customer expectations with regards to service and repair. The surveys were conducted throughout the company's 1993 fiscal year and focused on total turnaround time and customer satisfaction for product repairs made at E-V's factory service centers in Buchanan, Michigan and Visalia, California. The company repaired nearly 12,000 speakers, microphones, electronic and other products in 1993. All turnaround times are expected to be three days with the exception of electronic products, which have a time of four days. More than 98 percent of the customers using E-V's repair services would do so again.

WINTER CES PLANS

A noise abatement policy will be put into effect at the 1994 International Winter Consumer Electronics Show. Exhibitors demonstrating any type of audio equipment will be required to use a sound chamber or acoustically contained area. Mobile electronics exhibitors must keep all doors and other openings of any kind closed.

CES has added multimedia and desktop video areas to the Winter CES. According to CES, Corel, Intel, Mediavision and Microsoft are four of the latest first time exhibitors supporting the new areas. Exhibitors now include IBM, Compaq, AST, Toshiba, Boca Research, Hewlett-Packard, Creative Labs, and the 3DO Company. The computer and multimedia area will be located in the Las Vegas Convention Center's North 1 and 2 halls. Winter CES takes place Thursday January 6 through Sunday January 9, 1994 in Las Vegas.

FORTI ASSOCIATES DEVELOPING NETWORK

Forti Associates has announced its plans to certify low-voltage contractors for the installation of JBL Residential Music Systems, a line of built-in products configured for use in new home construction. According to Forti, Keith Marshall, group manager of JBL Residential Sound, said, "The low voltage dealer who offers the JBL Music Systems as value added amenities will benefit from the most powerful marketing tool in the homebuilding industry."

ITCA ANNOUNCES DIRECTORS

The International Teleconferencing Association has announced the election of its board of directors. Newly elected board members are: Henry S. Grove, III, Peirce-Phelps, president; Frank Knott, Vital Resources, vice president; Anne Hardwick, VA Dept. of Information, treasurer; Thomas C. Gibson, AMB, secretary. In addition, there are 24 members of the board of directors.

The association has also announced the dates of ITCA '94, which will be held June 19 through 22, 1994 at the Loews Anatole in Dallas.

SPARS ELECTS DIRECTORS

New officers and board of directors of The Society of Professional Audio Recording Services have been elected. Officers are: Dwight Cook, chairman of the board; Howard Schwartz, president; Steve Lawson, first vice president/treasurer; Paul Christenson, secretary. Directors include Lee Murphy, John Fry, Tom Kobayashi, Stewart Sloke, Steve Davis, Gary Ladinsky, Rick Stevens, Ian Terry.

NEWSLETTER

BROADCAST OF LIVE RADIO

Bad Animals in Seattle has announced the "live " broadcast of Heart, fed via T1 fiber optic communication to Los Angeles's LA Studios, where transmission was made to IDB Communications who satellite the program to over 110 radio stations. The show was simultaneously broadcast on local rock radio stations. Bad Animals/Seattle recording facility is co-owned by Steve and Debbie Lawson and Ann Wilson and Nancy Wilson of Heart.

PHILIPS MPEG DECODER

Philips Semiconductors has announced a new chip providing MPEG digital audio decoding functions that reportedly cuts the package size and power requirements for a broad range of consumer and industrial audio system applications. The SAA2500 MPEG Decoder is compatible with Layers 1 and 2 of MPEG standards for digital audio. Sunil Nethisinghe, manager for multimedia audio products, said, "While not the first MPEG decoder, this product clearly offers the advantages of smaller size and lower power over any other currently available solution."

INTERACTIVE MEDIA FESTIVAL

The Interactive Media Festival has launched a search for "definitive examples of interactive media and art today." The Festival Awards Show will take place at the Universal Amphitheater in Los Angeles on June 7, 1994. The Festival Gallery will be open to the public during Seybold's Digital World conference, June 6 through 8 at the Los Angeles Convention Center. The Interactive Media Festival has opened an Internet mailbox.

HOME THEATER ASSOCIATION ELECTIONS

The Home Theater Industry Association has elected the association's first Board of Directors. The HTIA has 48 voting members. Ken Furst remains HTIA's acting executive director. Directors include: Peter Tribeman, Lorri Kelley, Megean Roberts, John Kellogg, and William Matthies.

The next meeting of HTIA is scheduled for the Winter Consumer Electronics Show in Las Vegas in January.

FISHMAN ESTABLISHES AUDIO DIVISION

Formation of the Fishman Audio Division to function as manufacturer and marketer of a line of sound reinforcement equipment is now complete, according to Lawrence Fishman, president of Fishman Transducers, Inc. The new division introduced a prototype if its first product at the 1993 NAMM show. The Acoustic Performer-8 is a two-and-a-half channel speaker/amplifier designed for acoustic guitars, piano or vocals.

HDTV PROGRESS

The Digital HDTV "Grand Alliance" has presented a series of technology decisions to the Technical Subgroup of the FCC's Advisory Committee on Advanced Television Service. The alliance includes AT&T, General Instrument, M.I.T., Philips, Sarnoff Labs, Thomson, and Zenith. The video compression and transport technologies selected are based on proposed international MPEG-2 standards. The scanning formats are focused primarily on progressive scanning. The audio technology is a six-channel "compact-disc quality" digital surround sound system (a Dolby system, according to Dolby). The broadcast and cable transmission subsystem decision is expected in early 1994.

CONFERENCES AT NAB

The 1994 convention of the National Association of Broadcasters will feature 12 standalone conferences during the convention March 20 through 24 in Las Vegas. New conferences include the NAB HDTV World Production Conference; the SMPTE Post Experience; Digital Transmission Tutorial; an Institute of Electrical and Electronics Engineers Broadcast Technology Society half-day seminar.

ARCHITECTURAL ACOUSTICS SOUND SOLUTION

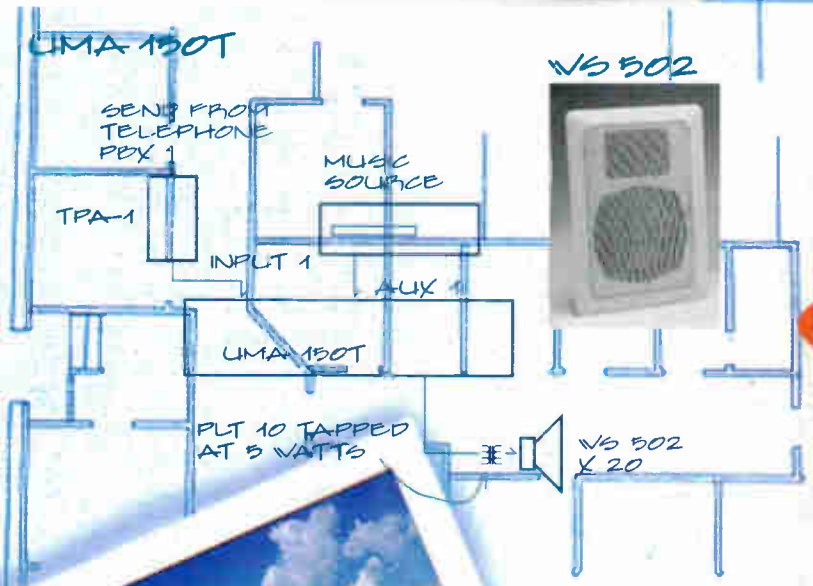
PROJECT: DEPARTMENT STORE RENOVATION

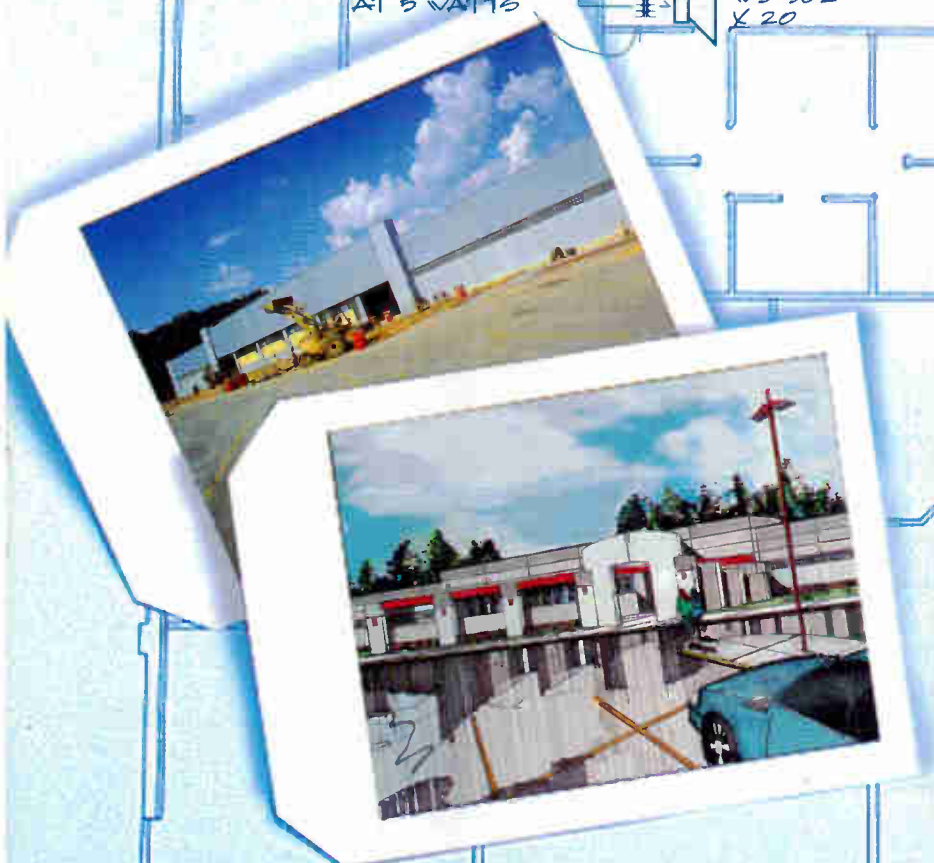
CLIENT'S REQUIREMENTS:

- ✔ TO PAGE (VIA TELEPHONE OR MICROPHONE) THE SALES FLOOR FROM ANY DEPARTMENT
- ✔ BACKGROUND MUSIC (MUSIC ON HOLD)
- ✔ PAGE NEEDS TO MUTE MUSIC

SOLUTION:

- ✔ UMA 150T W/ PEAVEY TPA-1 TELEPHONE PAGING ADAPTOR
- ✔ PEAVEY PLT 10 TRANSFORMERS
- ✔ (20) WS 502 FLUSH MOUNT SPEAKERS





PROFIT

The ***profit*** potential inherent in Architectural Acoustics' extensive line of high-quality, reliable audio equipment is considerable. **Case in point:** the UMA™ 150T. The 150T is a 4-input mixer / amplifier that features 2-band active EQ, contour select, external master volume capability, selectable automatic muting of AUX 1 and / or AUX 2, 600-ohm balanced output, and AC convenience outlet. This unit supplies 150 watts RMS at 4 or 8 ohms, or to a constant line of 25 or 70 volts. An optional rack-mount kit is available. **Case in point:** the WS™ 502. The 502 is a full-range, 2-way speaker system designed for use in wall or ceiling-mount situations. A 5 1/4-inch polypropylene woofer and 1-inch dome tweeter combine to provide sonic clarity in a convenient package. The WS 502 delivers 50 watts continuous power into 8 ohms. Frequency response is from 68 Hz to 17 kHz, with a sensitivity of 88 dB at 1 meter with 1 watt input. ***It's simple arithmetic: UMA 150T plus WS 502 equals profit margin.***

MADE IN THE U.S.A.

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Circle 207 on Reader Response Card

IN THE WORKS FOR '94

By Mike Klasco

One of my favorite and most satisfying projects is the preparation of comparative articles that survey products in the market.

Whether I am doing the writing, such as in CAD Topics, or just the technical editing, as with Rob Baum's popular mic mixer series, I come away with a much more complete perspective than I had at the start of the endeavor.

These series may be initiated by an engineering project, where there simply is just not enough information to be found anywhere (that is what brought on the mic mixer series), or sometimes the purpose is to prod manufacturers into taking actions, which I will get to in a moment. But most often, it is the readers who in some way call attention to what really needs coverage.

The equipment category survey articles always have a few recurring aspects. The specific equipment mentioned in the articles represent examples, rather than an attempt to describe every product ever made or presently on the market. (Nevertheless, manufacturers and designers are a very sensitive lot, and get emotional about not getting what they perceive as their share of coverage.)

Still another result of these survey articles is that as soon as I think we have finished the series, important and unique variations always seem to enter the market. This is exactly what has happened, with Yamaha introducing some sort of add-on automatic mixer subsystem, Peavey offering an inexpensive plug-in module for its rack mount modular mixer (not for the fancy computer controlled system we've talked about, but for a modest "packaged" mixer). Rob Baum briefly mentioned Audio-Technica's inexpensive DSP automatic mic mixer, but the preliminary info from the factory was really sketchy, and certainly not enough for me to feel comfortable about what applications it was intended for (I got clearer info a little later from their ad, which is enough to get anyone worried!). Last week a working unit showed up and we are going to field test this guy. Since it is going to be a few years before we get around to another survey of automatic mic mixers, we have decided to do a final round to the mic mixer series and try to cover all the loose ends.

AS SOON AS I THINK WE HAVE FINISHED THE SERIES, IMPORTANT AND UNIQUE VARIATIONS ALWAYS SEEM TO ENTER THE MARKET.

In the last few CAD Topics articles I lamented the lack of open data bases for different speaker brands in the sound system design programs, and the lack of conversion programs so speaker data from one program could be used for other programs. Jeff Long from JBL has since sent me details on a file conversion utility for CADP2, and soon after the issue hit, Altec/Mark IV clued me into their plans for file conversions and open database for AcoustaCADD. Details to come on this and related stuff.

Today, I returned from Las Vegas (just a business trip, I am not much of a gambler). The Luxor Hotel has just opened up their multimedia theaters. While I read Mark Miller's article in *Sound & Communications* on Doug Trombel's multimedia creations, and was directly involved with the vibration devices that were used in the seating, I was really taken aback at the presentation. During the screening, the structural-borne vibration effect was significantly beyond the capabilities of the device. I ***knew*** that what I was feeling could not be produced by the specific transducer that was being used. While the manufacturer of the transducer does make devices with over a ton of force, these were only rated at 4 lbs. As I turned around (and looked away from the screen) to double check the part number label on the transducer, much of the enormous power and physical impact of the presentation evaporated. Without the vibration device, the visual presentation certainly did not work, but without the high resolution visual component, the tactile effect lost much of its power. I may be strictly an audio guy, but video and multimedia are not going to go away. So expect more coverage of "multimedia" gear this year.

Finally, we at *Sound & Communications* have frequently discussed,among ourselves and with our readers, providing a practical exploration of computer control gear. Certainly I have seen this topic covered endlessly, but not frankly nor candidly enough for a sound contractor to risk specing in this gear into a big job. At this point, Crown and IED have quite a few operational success stories to point to, but all the players have had to overcome really serious field problems. And the actual setup time to program

Mike Klasco is the Technical Editor of Sound & Communications magazine.

the EQ and other settings on some of these systems, along with the user interface, is still not quite right.

Lone Wolf 's MediaLink has gained popularity or at least lip service with the pro audio industry, but these fellows seem to me to have a case of software mind set. A level of support or bugs that are passable in a garage studio product are not going to make it in an airport, life safety, or stadium communications system. I won't go on about this here (at least for the moment), but the type of promises a software publisher can get away with can

SINCE IT IS GOING TO BE A FEW YEARS BEFORE WE GET AROUND TO ANOTHER SURVEY OF AUTOMATIC MIC MIXERS, WE HAVE DECIDED TO DO A FINAL ROUND TO THE MIC MIXER SERIES AND TRY TO COVER ALL THE LOOSE ENDS.

bury a sound contractor.

We are working on a series of articles, including field tests, reality checks, and the like to put a little light on computer controlled sound systems. I think computer control will be an integral part of (and appropriate for) more installations than ever before, and I hope 1994 will be a turning point. It just looks like the manufacturers, software designers, consultants, and contractors all have our work cut out for us.

So let us know what else you would like to see. More in-depth coverage of installations? Comparative lab tests, like Neil Shaw's delay line series? Tutorials on audio components and sound system engineering? Tell us what is important to you, or I will start writing about my travels again! ■

AUDIO MEASUREMENT HANDBOOK, BY BOB METZLER

By Mike Klasco

AudioMeasurement Handbook takes a matter-of-fact, hands-on approach, without too much theory, math, or history to get in the way of the basics that you need to know. This is not to say that the author, Bob Metzler, or his associates at Audio Precision have not been part of the history of test gear.

Most of the staff of Audio Precision had previously developed the Tektronix series of audio test gear over a decade ago, and then left to start Audio Precision, where they introduced one of the first personal computer-based test instruments. Wayne Jones, now at Audio Precision, was previously at Amber (a Canadian test equipment company), which was just merged with Neutrik.

But what about the book? The main focus is on testing electronics; both digital and analog. Topics covered include radio tuners, tape machines, CD players, compressor/expanders, and even a little bit on transducers (although this is not the book for learning about testing speakers or microphones). Audio Measurement Handbook is honestly titled, being both appropriate as your first textbook on making electronic measurements as well as a handy reference book. Published by Audio Precision, the book does not intentionally favor the company's products, although you cannot fault the author for being more familiar and comfortable with products he has helped design.

Audio testing tools and techniques is covered first, discussing the stuff that makes up test gear, measuring noise, measuring signals in the presence of noise, time domain and the frequency domain, non-linear effects and the various types of distortion, implications of connecting to a "device under test," and some advanced techniques, such as Audio Precision's FASTTEST. Other short-interval techniques developed by other manufacturers that are popular in Europe, especially for broadcast, are not discussed.

About half way through, the book explains the differences between lab research applications, QC and production techniques, and maintenance and repair environments.

OTHER SHORT-INTERVAL TECHNIQUES DEVELOPED BY OTHER MANUFACTURERS THAT ARE POPULAR IN EUROPE, ESPECIALLY FOR BROADCAST, ARE NOT DISCUSSED.

The last and most extensive section of the Audio Measurement Handbook is on testing specific devices and what to expect. Although the book was published this August, no mention is given in testing lossy data compression circuitry, such as DCC tape decks and MD minidisc players. Audio Precision's FASTTEST would be effective for this and this topic would be a good addition for the next edition. The book includes both a glossary and index.

Audio Measurement Handbook, by Bob Metzler.

At $12.95, Audio Measurement Handbook is a worthwhile addition to your reference library. It is readable, informative, comprehensive (although not exhaustively so), and although it is published by a test equipment manufacturer, it is an honest and balanced, as well as successful, effort. ■

Mike Klasco is the Technical Editor of Sound & Communications magazine.

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Home Theaters Optimized

Automatic Room Optimization in Home Theater Installations

BY DANIEL SWEENEY

In the January '93 edition of this publication there appeared an overview of the emerging technology of active noise control technology, or what also might be termed *controlled destructive interference.* This article is in a sense a follow up, but takes a much narrower focus, concentrating on one very specific and somewhat idiosyncratic application, namely small room optimization through DSP-based destructive interference techniques.

DEFINING A CONCEPTUAL FRAMEWORK

Very generally, active sound cancellation is the use of "antinoise" to suppress any unwanted sound within a defined air space — antinoise being a phase reversed replica of the sound one wishes to cancel. In a sense the technique is simply making a "suck-out" work for you. Currently the technique has found commercial application in noise cancellation headsets, in cabin quieting systems for airplanes and automobiles, and in duct silencing equipment for factory settings. In the near future we may also expect to see noise cancellation engine muffler systems as well as active vibration cancellation enclosures for noisy machinery. In the longer term, whole room quieting techniques may evolve to the point where active cancellation devices are used to suppress noise in recording studios, performance spaces, and even in private residences. Up to the present time, however, the technology of active noise cancellation has had a very limited impact on the professional sound contractor, and products are only now becoming available with broad applications in the field.

Perhaps the most intriguing of these new products is the category of DSP-based room optimizer, a product which in the most general terms may be said to use destructive interference to cancel reflections at the listening position, and thus to approximate a reflection free zone.

At the time the last article was prepared, only one DSP-based room optimization system was commercially available, that being the SigTech AEC 1000. SigTech has since added the Model TF10D-3 Time Field Acoustic Correction module, while Snell Acoustics, Bowers & Wilkins, and Paradigm (A.I.P.) are expected to have released similar products by the time this article appears in print. Initially all such products will be limited to two channel stereo applications, but all of the above manufacturers are eyeing custom installation/home theater as the biggest potential market, a fact that should be of special interest to sound contractors with a foot in the residential prewire business.

THE NATURE OF ROOM OPTIMIZATION

Although such room optimization systems use the same basic technique of controlled destructive interference as noise canceling systems, they do not operate on extraneous noises but rather, as we indicated, on unwanted reflections and boundary effects produced by the sound reproduction system itself. Thus in a certain sense they tend to make the listening room effectively quasianechoic at the listening position, though none, for reasons we shall explore in a moment, are capable of suppressing all room reflections.

Such room optimization systems also differ from noise cancellation systems in that they are not essentially feedback systems, that is they do not monitor sound in the listening space on a continuous basis and apply correction after the fact. Instead the room

Daniel Sweeney is a freelance writer living in Burbank, California.

is measured on a one time basis with a wide band test signal such as a maximum length sequence or an impulse, and an inverse filter function is then developed by inferring the transfer function of the room-loudspeaker combination at one or more listening positions. The inputs to the loudspeaker are then preconditioned by passing them through the resulting inverse filter at line level such that correction signals will be emitted by the loudspeaker for some period of milliseconds after the primary output of the loudspeaker has occurred. In effect, the speaker system ends up suppressing the early reflections with strategically phase inverted direct sound timed to coincide with the arrival of the reflections at the listening position.

Room optimization systems as a category may be said to alter the way that the listener perceives the decay of sound in the listening room. They may also be said to improve the impulse response of the speaker in the room. In addition such systems may be conceptualized as dynamic equalizers, changing the equalization curve over time to match the spectral curve of the reflected sound over time.

Room optimization systems as presently constituted are basically a species of feedforward, and as such they do not suffer from the transit time problems and unfavorable relationship between gain and instability that afflict all inverse feedback systems. Essentially a single judgment is made as to the appropriate correction at the time the system is modeled for the acoustics of a particular room, and no modification of the error correction signal is made subsequently.

Such being the case, the room optimization system avoids two problems that plague all noise cancellation systems — gross instability and severe bandwidth limitations.

Because the processor is not affected by the output of the total sound system during playback, the processor cannot cause the system to oscillate or run away. And because the processor predicts rather than directly measures the room/speaker response at high frequencies, the transit time through the audio system no longer represents a limitation, and the frequency range over which corrections can be made can be extended in theory to the limits permitted by the digital sampling rate used in the processor itself.

SigTech's AEC 1000 pro audio model.

DESIGN CONSTRAINTS

All such systems, existing or contemplated, are designed to perform most of their work within the first ten milliseconds, the theory being that very early reflections will have the biggest impact on the perceived frequency balance of the system and its imaging characteristics. Obviously the total amount of acoustical energy in the room is going to increase as a result of the correction signals, and in theory the RT-60 should be somewhat lengthened as a result of correction, though Kevin Voecks of Snell Acoustics claims the opposite, while Burke Mathis of SigTech suggests that RT-60 is not significantly changed for better or worse. Interestingly, however, Ian Paisely of A.I.P. takes the position that RT-60 will indeed be increased as a result of generating the cancellation signals. We have not yet had the opportunity to perform measurements with any of these systems in place, so we shall reserve judgment on the matter.

Nevertheless, we can state that one definite and unavoidable liability of all such systems is a basic frequency related position dependence. One can achieve deep, broadband cancellation of early reflections for only a single listening position, whose volume is defined by the wavelength subject to cancellation, and naturally as the frequency rises, the space where complete cancellation takes place keeps shrinking. Outside of this one defined space, a cancellation may become a reinforcement and if the cancellation is deep, so will be the reinforcement. Predictably, where room interiors consist largely of hard, reflective surfaces which return high frequency energy efficiently, cancellations and reinforcements will be deep, and the perceived sound stage and frequency balance of a sound system subsequent to room optimization will vary dramatically over the space of a few inches. In other words, room correction can actually degrade the perceived sound quality of the system for all positions

except a narrow sweet spot.

Designers of these systems address such problems in a number of ways. As frequency rises, SigTech progressively shortens the time period over which correction takes place. On the other hand, Snell Acoustics and B&W average room response over a number of listening positions and opt for a lower degree of cancellation at high frequencies such that several listeners will experience some reduction in the intensity of high frequency reflections but not their complete elimination. And both companies caution against attempting to use the systems as cureall, recommending instead that passive room treatments be implemented first whenever possible.

A.I.P.'s prototype system takes a somewhat different approach in that no cancellation signals at all are produced by the system after the first few milliseconds, and relatively few cancellation signals are used in toto compared to the other systems. The primary purpose of cancellation is to eliminate diffractive effects from the speaker enclosure itself, and, for the most part, the system functions as a very narrow band equalizer with minimal effects in the time domain.

A.I.P. spokesman Ian Paisely gives two reasons for his company's less aggressive processing strategy.

"We make speakers with deliberately wide uniform dispersion and excellent off-axis frequency response. We don't feel sidewall reflections are something to be eliminated, and in our Mirage speakers we deliberately create a broadband front wall reflection as well. We've done a great many listening experiments in conjunction with the NRC, and we find most people prefer the sound of our speakers in a normal listening room. If we were to use the type of processing advocated by our competitors we'd destroy that sound."

Paisely's other objection would appear to have more general validity. "Some of the processing strategies used in these systems look great on paper, but lead to severe sonic anomalies. An accepted way of improving the impulse response of the speaker in the room is to create preringing in the processor's filter. This will seem to correct for the ringing of the system, but if more than about three milliseconds of preringing is generated, the sound quality of the system will be severely degraded. Here the measurements just don't correlate very well with the listening tests."

Such systems suffer from other less obvious limitations as well. All impose appreciable delays on the line level signal as processing is applied, and in a home theater situation the magnitude of the delays is quite sufficient to put the sound out of sync with the picture unless a frame storage system is

B&W's Listening Room Optimizer.

used for the video. Such a system can certainly be made to work, but the cost of high quality frame storage circuits is high. SigTech's answer to the problem has been to speed up the processor, but that in itself adds considerably to the expense of the unit. Either tactic is likely to result in a total price for room correction of well in excess of five thousand dollars for two channels.

Unfortunately, in home theater applications two channels is not enough. SigTech maintains that processing only the three front channels is sufficient to optimize a room for home theater applications, but Snell and B&W take the position that every speaker in the system must processed.

DESIGN EXECUTION

Designing a room correction system for consumer use is a formidable undertaking. The system obviously has to include some kind of sophisticated automated measurement system and a calibration microphone, as well as a powerful central processor to perform the thousands of calculations necessary to generate a suitable inverse filter function. To give some idea of the magnitude of the computational tasks entailed we need only mention that the Snell system, which runs on a 586 processor, requires a full five hours to complete all of the necessary calculations and filter iterations.

To avoid the costs associated with providing the processor itself with the onboard computing power to calculate the filter function, Snell and SigTech specify outboard test measurement equipment which generates the test signal and performs all the heavy numbers crunching. The processor within the system has a fixed filter function burned into memory on the basis of one time measurements, and the use is enjoined to maintain room furnishings and speaker placement as they were at the time of the room analysis, since any significant change in room acoustics would require a complete recalibration of the system.

SigTech provides its authorized retailers with a complete test setup and

instructions as to how to perform the testing procedures. Each speaker is tested separately at one listening position. Snell, on the other hand, will provide only a calibration microphone, a signal generator, and a DAT deck to record the test signals. As with the SigTech system, each speaker is to be tested individually, but the tests are performed at a number of different listening positions. The recording will then be analyzed at Snell headquarters, and a chip containing the appropriate filter function will be burned for the individual processor.

The Snell and SigTech systems differ in other particulars as well. SigTech is designed to work with any loudspeaker system and is not really intended to compensate for the speaker's shortcomings in terms of phase linearity, directivity characteristics, or tonal balance. It only addresses room effects. The Snell system, on the other hand, will be capable of time aligning the speaker and will be optimized for individual speaker models.

The other major distinction between the two systems is the way in which they propose to handle multi-channel video sound as opposed to ordinary stereo. SigTech designers feel that fundamentally different processing strategies may be required, and that a dedicated three channel unit will be required for video. Snell's position is that room optimization can be achieved for video simply by using three stereo processors.

SigTech's system currently sells for over $4,000. The Snell system is projected to be considerably less expensive though final pricing has not been announced.

The B&W and A.I.P room optimization systems appear to be further from completion than the Snell and certainly than the SigTech, and fewer details of implementation have been released by the respective companies. The B&W system, called the Listening Room Optimizer, analyzes and processes both speakers together, thus dealing with crosstalk components, and also phase corrects the loudspeakers themselves. The whole system is self contained and does not require the services of a technician or ancillary test equipment. The system permits optimization for a single listening position or averaging over a wider area. Multichannel home theater applications are definitely contemplated, but

the initial system will be stereo. Retail pricing is projected to be in the 8k range in the U.S.

A.I.P. has committed to few details in the ultimate configuration of its system, but the company appears to be leaning toward a stand alone system with built-in measurement equipment like the B&W. Room correction will almost certainly be much less aggressive than that offered by competing systems. A.I.P. management consider the category to be price sensitive, and feel that systems priced in the thousands of dollars simply will not sell even in the context of five figure home theater installations.

OPTIMIZATION ROLLOUT

B&W, Snell, and A.I.P. have all promised their systems by early '94. Snell has made many premature announcements in the past, however, which may be indicative of fundamental difficulties in bringing a system to market at an attractive price point. Meanwhile Harman International and International Jensen are at work on experimental systems.

Certainly the notion behind DSP-based room optimization is extremely attractive in the context of a custom installed home theater system. Customers for such systems are known to have a general aversion to passive room treatment and at the same time a willingness to view the home theater as a major home improvement rather than an assemblage of hi-fi equipment where each component is subject to close scrutiny in terms of price. The feeling at Snell and B&W is that the home theater buyer is the ideal candidate for these systems.

Perhaps, but Burke Mathis of SigTech and Ian Paisley of A.I.P. both feel that the benefits of room correction are apt to be more audible on music programming than on the dialogue and effects-heavy soundtracks of video movies. If that is the case, one wonders if the added cost of these devices will go entirely unquestioned.

It is probably safe to say that DSP-based room correction of one sort or another is almost inevitable in the home theater realm, even if it is only microprocessor controlled equalization used in conjunction with some simplified automatic measurement system. The price of processing power is continually dropping, and the advantages of automating system setup and calibration are immediately apparent. But in the short term a major selling effort will be required to introduce the category and to educate the public as to its benefits. DSP-based room correction is a fascinating technology but communicating its benefits to the layman is difficult. As the folks at Lucasfilm like to say, the audience is listening. ■

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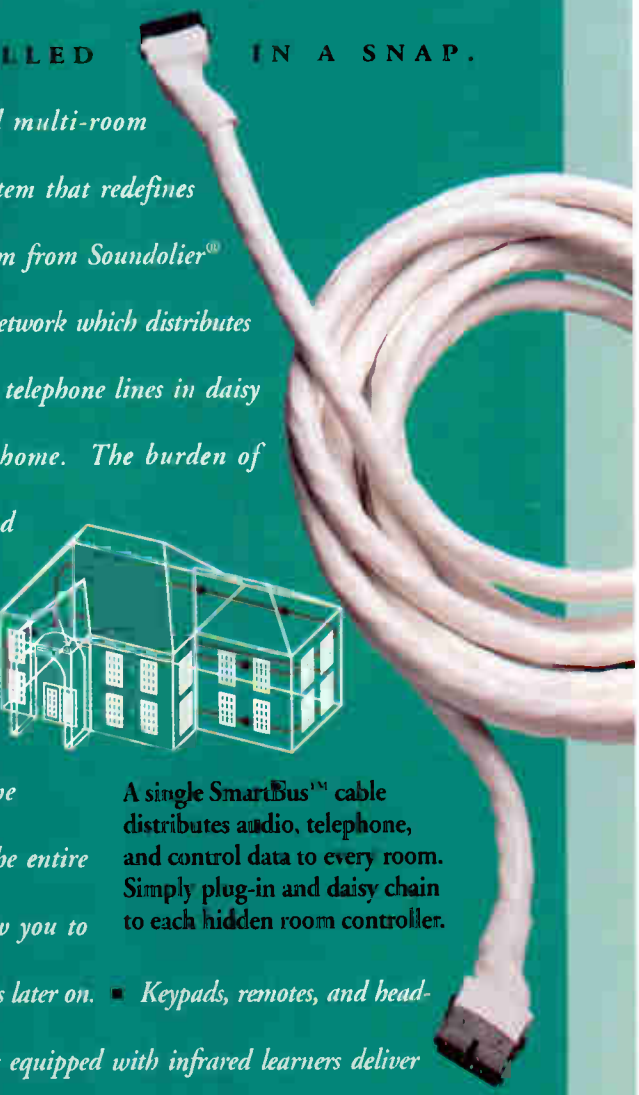

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Computer Controlled Church

Modern System Helps Church Change With The Times

BY KEITH CLARK

When the First Baptist Church of Eugene, Oregon, was built in 1926, the modern audio system it now features wasn't even a glimmer in even the most futuristic eyes.

Times have certainly changed, with the 770-capacity sanctuary benefitting from a recently installed system designed to reinforce a wide range of worship service elements. The project highlights a growing emphasis on the latest professional audio technology being employed to enhance services at houses of worship of all sizes and types.

The system was designed and installed by Gary Hardesty of the Hardesty Technology Group, Eugene. (Hardesty is now director of the JBL Systems Group.) Consultation and assistance were provided by First Baptist's Chief Audio Engineer Ty Young and Minister of Worship & Music Steve Maricle.

The sanctuary, plagued by very live acoustics, presented many challenges to the design/installation team. High plaster ceilings, wood walls, oak-backed pews and only partial carpeting help create this very live atmosphere.

The First Baptist Church of Eugene's sanctuary.

The previous system, installed in 1970, had included four speakers receiving a total of only 200 watts of power. Speakers in this stereo system were placed in crevices etched into the front sanctuary walls.

Two of the speakers were located high on the wall, left and right, and supplied sound to the balcony. The other two speakers were located low, left and right, and supplied reinforcement to the balance of the room.

"The old system presented a number of drawbacks. Not only was it underpowered and aesthetically detracting, but the plaster walls surrounding the speakers greatly limited their natural resonance," Young explains. "On top of all of these problems, the configuration of the speakers caused feedback problems on a regular basis."

So when funds became available for a major sanctuary renovation, church officials decided that a new sound system, offering loads of capability and flexibility, would be a big part of the renovation effort.

"We were seeking to include a more contemporary style of music in our services," says Young. "In addition to our traditional worship services which feature full choir, pipe organ and piano in a large-group setting, our "New Dimension" services using drums,

Keith Clark is President of Priority Communications in Niles, Michigan.

CROWN IQ TURBO 1.0 SOFTWARE

By Ty Young

Crown's IQ System computer control hardware and software was introduced to me during the installation of our new sound system at the First Baptist Church of Eugene, Oregon.

With IQ, we were able to install our power amplifiers in the attic, certainly a remote location and also very near to the central cluster. We could turn the amps on and off, via IQ, at the main console site and could also monitor important amplifier functions including input and output levels, distortion, signal polarity and reserve amp power.

Having such an elaborate system in our relatively small church (770 seat capacity) was very exciting, and we've been more than pleased with the system's performance.

Recently Crown introduced a new version of IQ software — Turbo 1.0. Turbo features faster response speed, graphic representation of every system component, user-friendliness, and, ultimately, ease of use.

One caution: Turbo may increase your hardware requirements. It's designed to run on a 386SX or faster machine with a VGA color monitor, mouse and two megabytes of RAM; hard drive requirements are about 1.5 megs for the complete software package.

That said, Turbo is a fantastic program to use. After you get past the title page, it does a "roll call" of all of the amplifiers and displays a message informing you of what it's found. In the event that the serial cable between computer and amps gets unplugged or cut somehow, the program tells you that, too.

Turbo then takes you to an "Amplifier Frame" filled with information about each amplifier, including power status for each channel, polarity status, amp output mode (dual, bridged, or parallel mono), output attenuation for each channel and reserve power status.

Using the space bar, arrow keys and page up/down keys, you can navigate around the page (which resembles a spreadsheet program) and type in pertinent information such as model numbers and channel assignments (*i.e.*, lows, monitors, etc.). Turbo saves that information as a "data frame" to hard disk so it can be recalled later.

A computer screen shot of the IQ Turbo graphics screen.

Once the initial information about each piece of equipment is entered into the computer and saved to disk, you switch to the "graphics" mode. Turbo displays a pre-configured "GDM" (Graphic Display Module) for each amp initially entered into the system. The module includes:

- Bargraph-style input levels and output levels (in decibels, with peak indicators);
- A bargraph depicting amp power usage;
- A graphic "LED" for each channel which lights up in bright red if the channel distorts more than .05 percent;
- "Buttons" which can be pushed, or "clicked," on and off by mouse to control individual channel power, channel mute, an "auxiliary" control circuit and cleverly, a channel polarity button for correcting strangely-wired cables.

GDMs can be created for more than just amplifiers — they can also be created to monitor and control other IQ-compatible devices. For example, Rane, an IQ System licensee, has introduced the NEQ-56 1/6-octave graphic equalizer whose fader settings can be stored in Turbo and recalled instantly.

The bottom line is that Turbo is designed to let you create your own graphic "plate" and configure it to suit your needs: simply choose "controls" from a menu, assign those controls a task and identity, and save the design.

Available controls include faders, meters, LEDs, buttons, "containers" (colored squares you draw on the screen to add a "background" for your controls) and text — all in your choice of 15 scalable fonts.

Design can be as detailed or as simple as you wish it to be — especially useful in designing the "perfect" system for clients.

How does all this graphic stuff make for practicality? I can power-down all of my amps with one mouse click to a button on the screen labeled "HOUSE AMPS POWER." Another click, and they're all back on. It's also very easy to individually "solo" each amp's channel input and output by muting other channels.

In addition, Turbo's "MultiLink" allows devices to be linked together (for power, muting, attenuation, etc.) in a number of different ways.

IQ-P.I.P. cards, providing the link between software and the amps, include a three-pin mini-XLR jack on the back of the card, with the pins delivering +15 Vdc. Connect a solid-state relay to the jack and you can selectively turn on or off (at the computer) a separate 120 Vac device.

With this capability, I chose to locate a heavy-duty cooling fan near my amp rack because it's located in the attic of the church, which gets very warm during summer months. On the computer screen, right beside my "HOUSE AMPS POWER" button, is my "HOUSE AMPS COOLING FAN" button, which is next to my "MONITOR AMPS COOLING FAN" button.

The manual is written for audio techs, not computer nerds. There are plenty of examples using "real-world situations" and a tutorial guide to setting up Turbo.

IQ Turbo 1.0 software is best described as an ultra-powerful remote control and diagnostic tool for IQ-compatible pro audio equipment. It's incredibly easy to use: within fifteen minutes of installing the software on the computer I had a full-color screen showing me diagnostics and the states of over 100 functions related to our system.

Ty Young is a professional cellist and also serves as Music Assistant and Head Audio Engineer at First Baptist Church of Eugene.

The central cluster was made up of JBL systems.

bass, guitar, piano, synthesizer and a small vocal ensemble required a sound system capable of exceptional high-fidelity and intelligibility. Our new system more than amply meets those needs."

The first step was the addition of a new Soundcraft 200 Delta mixing console. Young notes that the upgraded console supplied an immediate improvement in sound quality, even with the old system still in place.

Subsequently, bids were solicited for design and installation of the new system. "Looking through all of the bids, we really liked what the Hardesty Technology Group had to offer. They were very knowledgeable and offered a very thorough proposal," Young explains.

Even before being awarded the job, the company did their homework. Gary Hardesty attended several worship services, did some preliminary RT-60 testing, and talked with Young, pastors and church staff about their goals for a new system.

After getting the go ahead, Hardesty utilized a CAD program in determining optimum speaker type and placement within the sanctuary. He also reviewed church blueprints for further data.

A two-way central speaker cluster, made up of JBL systems, was mounted above the pulpit area. The cluster includes three JBL SR 4732 speakers, each with a JBL 2385A horn and JBL 2446H driver mounted on top, firing left, center and right.

Also included in the cluster are two JBL SR 4722 speakers that serve as choir monitors, firing back toward the choir loft. One of the speakers is aimed outward and provides "fill," while the other is aimed directly at

House mix position showing the Soundcraft Delta 200 main console along with the monitor console and the computer used for the IQ system.

Why does Crest Century SP/TC give you more for your money?

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Crest reliability is legendary — ask any Crest amplifier or Crest Gamble console user. The Century consoles are built to the same high standards. We've used the latest technology and only top quality components in the Century series — you'll find no TL072 or 5532 chips and no electrolytic capacitors in the signal path. The console is fully modular. And the power people at Crest have given Century SP and TC a power supply that's practically indestructible...think of the service calls that could save!

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Made in America, Crest Century consoles are quickly gaining a worldwide reputation as the contractor's choice for features, performance reliability and above all, value. For the full story on the entire Crest Century series, which includes the full-featured GT and live monitor LM console models as well as the SP and TC, call Crest Consoles at 201-909-8700.

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Circle 206 on Reader Response Card

the choir seating.

The entire cluster, mounted above the pulpit area, is flown in a specially-designed steel grid cage concealed by a wood and cloth covering that matches the sanctuary's aesthetics.

The speaker cluster is powered by five Crown Com-Tech CT-400 and CT-800 amplifiers. Three CT-400s power the mid and high frequency sections, while one CT-800 as well as half of another power the low frequency sections. The remaining CT-800 channel powers the two choir monitors.

A Rane GQ-30 provides 30-band equalization to the main system. The system crossover point is 1.1 kHz, with a Rane FAC-28 active crossover offering 48-dB-per-octave crossover control.

The amplifiers, mounted in a new rack located in the church attic to keep cable runs to a minimum, are equipped with P.I.P.-IQ cards linking them to a Crown IQ System. IQ software supplies computer control from a 386 PC located at the house mix position.

"During the design phase, Gary introduced us to the IQ System and showed us what it would do," says Young. "After seeing all of the advantages it presents, we were convinced that IQ was right for our needs."

Young recently switched to the just-released IQ Turbo package offering increased capability (see sidebar). Pri-

"The old system presented a number of drawbacks. Not only was it underpowered and aesthetically detracting, but the plaster walls surrounding the speakers greatly limited their natural resonance."

or to that, IQ System version .45 software for PC had been used to provide convenient access to the remotely located amps.

The IQ System allows house audio technicians to control power on/off of the amplifiers, as well as to perform system diagnostics. Another feature of the IQ System allows for the remote control of other devices, such as cooling fans.

In an effort to combat heat build-up in the church's attic during summer months, Young installed an IQ-controllable ventilation system which may be selectively turned on or off at the computer by hitting the space bar.

Prior to initial IQ System implementation, Hardesty modified the PC keyboard, disconnecting any keys that weren't necessary for utilization of IQ. In addition to simplifying operation, this modification prevents accidental system alteration.

An underbalcony speaker system, comprised of eight JBL 8306 in-ceiling speakers, is time aligned with an Audio Digital ADD-3 delay device. This small system is powered by two CT-200 amplifiers, as well as an amp from the prior system, located at the main mix position.

Underbalcony levels are kept relatively constant, and it's not linked to IQ at this time. "There are times when the main system is running at tremendous levels, and we simply turn off the underbalcony speakers," Young says.

A floor monitor system was recently added, designed and installed by Young and powered by a CT-400 amplifier housed in a room accessing the pulpit. It is also linked separately to the IQ System, which provides remote and individual control apart from the main cluster.

In an effort to combat heat build-up in the church's attic during summer months, Young installed an IQ-controllable ventilation system.

Cable runs for the entire system were performed by Young and his staff. Five cables were run: one each for main system highs, lows, choir monitors, computer control, as well as a spare.

Young believes that the system meets the diverse demands of the First Baptist Church. "One of the biggest challenges to doing church audio is that you're faced with something new each week," he says.

"Services are often presented in a different order, there are always new soloists and performers, the number of microphones being employed can vary dramatically — there's always something new happening. This new system helps us provide a professional level of audio that our congregation really enjoys." ■

Compression Drivers

The Good, The Bad, The Ugly

BY MIKE KLASCO

First of all, what is a compression driver? Essentially a compression driver is a dome tweeter which faces into a partial obstruction, which then passes through a horn. The partial obstruction is comprised of a number of openings that form miniature horns and is known as the phase plug. The area of the tweeter dome is larger than the openings in this phase plug, and some air compression takes place. Since the tweeter drives the horn, and the tweeter diaphragm is "compression loaded," hence the name compression driver. This month, our occasional series on Everything You Wanted To Know About Speakers will take a look at various compression driver design philosophies, and is intended for those of you who use and spec compression drivers. If you are not too familiar with what is inside, you may want to read on anyway. At least I have avoided any math, and will discuss what are the elements that cause distortion and failure rather than what makes compression drivers and horns tick (which will be dealt with in future articles in this series).

Theoretically, the common compression driver is capable of extremely high acoustic output levels. With efficiencies approaching 50 percent in their mid-band response, and "rated" power handling of 50-200 watts, these devices ought to be able to attain acoustic outputs of 25-100 acoustic watts, if the data sheets and the math were to be believed. By way of reference, at the conductor's position, at full tilt, an orchestra may reach about 1 acoustic watt of power.

In actual practice, the compression driver becomes unusable prematurely, at sound levels an order of magnitude lower than the predicted values. The dominant factors that interfere with attaining the full potential output of the compression driver are:

- Distortion, caused by diaphragm breakup at elevated levels and air distortion.
- Thermal limitations — maximum operating temperatures of the moving mass system and the compression driver's capacity to dissipate the heat as fast as it builds up.
- Excursion limitations — the ability of the moving mass system to have linear excursion without unstable characteristics or collisions with stationary components (phase plug, coil scrapes, etc.).

Let's take a closer look at each of these problem areas.

DISTORTION

Diaphragm

Even if reliable (thermal-mechanical) operation of the compression driver could be attained at elevated sound levels, if the "quality" of the sound was poor at high levels, then the benefit of increased output capacity would not be significant.

The contributors to the high distortion levels at elevated output are diaphragm breakup (analogous to "cone cry" in a woofer) and air distortion.

High compression ratios in the phase plug require that the diaphragm have adequate rigidity to drive the sound through the high mechanical impedance of the phase plug. Certainly the large motor structures commonly used in professional drivers provide the push needed, but the lightweight diaphragm begins to distort (elastically deform) at higher acoustic outputs. Distortion increases significantly as the input power rises beyond just a few watts. Diaphragm breakup is not just nodal deformations, but other elastic distortions due to the intensity of vibration.

Therefore, if the diaphragm could be more rigid and maintain low distortion at higher acoustic output levels, one of the most critical limitations to achieving the output capacities would be overcome.

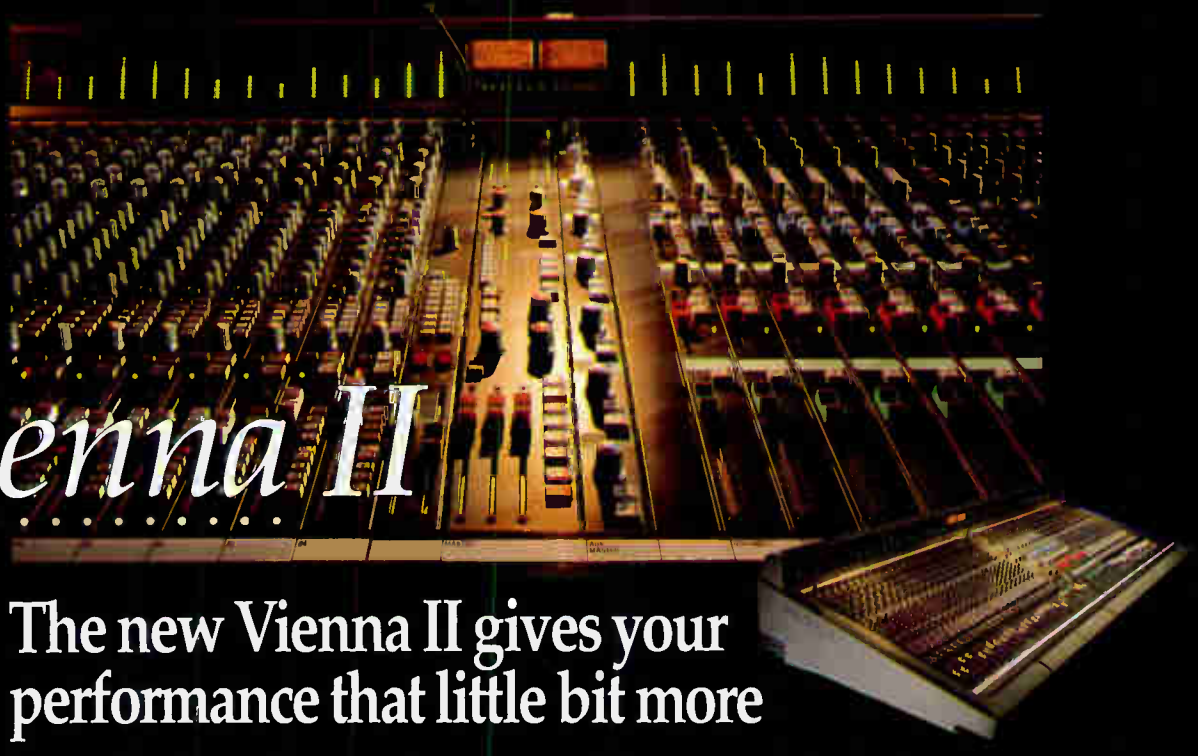
This increased strength must not come at the expense of higher mass of the diaphragm assembly, although if the surround, bobbin, and/or voice coil assembly could be reduced in mass, then a slightly greater mass in the diaphragm assembly could be accommodated.

Diaphragms with lower distortion can be developed by:

- enhancing the characteristics of the diaphragm substrate — Beryllium, titanium, composites or other techniques and materials.
- embossing the dome to break surface tension and suppress breakup modes.
- deeper dome geometry.

Mike Klasco is the Technical Editor of Sound & Communications magazine.

Encore!



Vienna II

The new Vienna II gives your performance that little bit more

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- Improved EQ for tighter control over LF in both bell and shelving mode
- Fully featured stereo module giving higher input density
- Individual pre-post switching on all auxiliary sends
- New input stage giving wider range and allowing mic and line level signals to be connected via the XLR input
- Insert points on auxiliary outputs
- VCA Grand Master module for extended control of 8 VCA groups

Whether you are on the road or have a permanent venue to fill, the Vienna II offers unrivalled performance together with Soundcraft's impeccable pedigree at a price which may surprise you.

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• thicker diaphragm (at the expense of top-end response).

Related to the above is the desirability of achieving a higher dome resonance frequency. The dome response frequency helps define the top-end response of the driver. Dome resonance can be pushed upward in frequency by a smaller diameter dome, a deeper dome (such as used in TAD and Altec products), or by diaphragm materials with a higher Young's Modulus, such as used by JBL and TAD. JBL additionally uses embossing techniques to raise dome resonances, and still another solution was tried by Cerwin-Vega by attaching the voice coil midway up the dome (which also suppressed the first diaphragm breakup mode).

Air Distortion

Another significant contributor to distortion at elevated acoustic outputs is air distortion caused by modulation of the air between the diaphragm and the phase plug, within the phase plug itself, and in the horn throat.

If sound levels at the mouth of the horn are about 130 dB, then the levels in the phase plug can approach 170 dB, which is near atmospheric pressure. Under these conditions, the air distortion is high. When the early developers of horns and compression drivers designed the original transducers, amplifier power was only 10 watts. Ninety dB at full tilt was considered more than loud, with any additional capability reserved for headroom. Over the years, compression driver materials, adhesives, and other elements have allowed ever increasing input power levels without burnout. It is not uncommon for levels to reach 130 dB at the horn mouth, yet, with only a few exceptions, the design of phase plug has not been re-engineered to accommodate for this sound intensity.

Reduction of air modulation distortion can be achieved by slightly increasing the dome/phase plug spacing (although this will result in lowering the cutoff of the top end response). Additionally, the compression ratio of the phase plug might be decreased down to 85 percent. The compression ratio is the area of the diaphragm compared to the opening in the phase plug facing the diaphragm. Typically, compression ratios are 90 percent or higher, although there are exceptions, such as Community's M4 and M200 mid-range compression drivers, which are about 50 percent, and more recently, JBL's new mid-range compression driver, and the compression drivers in Tannoy's midrange/high frequency coaxial speakers. By opening up the phase plug, the density of energy for a given acoustic output is reduced and the mechanical impedance of the phase plug is also reduced, lessening the forces that would deform the diaphragm, for a given diaphragm buckling strength.

Over the years, compression driver materials, adhesives, and other elements have allowed ever increasing input power levels without burnout.

If you are familiar with microphone transformer design, then the analogy of turns ratios in the primary and secondary windings might be helpful. An audio transformer with a low turns ratio will have small "gain" or transformer effect, but will have low distortion. A transformer with a high turns ratio will have high voltage gain, but also have high distortion. If the compression ratio is less than 90 percent (the diaphragm faces into an area that is only 10 percent open) then it is hard for it to peak up the top-end response. This "tuning" of the response is similar to peaking up of the top-end response of a tape recorder with a peaking coil. If the Q of the coil was not high enough (or the compression ratio not high enough), then you could not get a sharp enough rise at the top-end. Interestingly, many speaker designers use electrical circuit analogies to model compression drivers.

The most common technique to avoid air distortion at high sound levels is simply to use a larger diaphragm. A four-inch diaphragm, given the same compression ratio as a three-inch diaphragm, can reach higher sound levels before reaching air distortion. But bigger drivers are heavier, cost more money, and have a tougher time getting clean top end response, compared to their smaller siblings. It is much easier to find a good sounding 1.75-inch compression driver from many manufacturers than it is to find a decent four-inch compression driver. On the other hand, don't expect the 1.75-inch driver to generate anywhere near the output of the bigger drivers. Somewhere in between these compromises are the three-inch dome drivers, such as the popular E-V DH1 and Altec 299, with more output than the small drivers, and (usually) less power handling than the bigger guys.

Getting smooth response from a compression driver, even a small diaphragm design, is not automatic. One of the most commonly used small format compression drivers in the M.I. industry, which sells to manufacturers for about $20, has enough dips and peaks so as to be just about un-equalizable. Problems arise from plastic parts resonating, from the diaphragm and phase plug face unintentionally not having matching contours (because of the different shrink rates due to plastic injection molding for the phase plug and metal forming techniques for the dome), discontinuities between the phase plug flare rate and the compression driver's throat, and a half dozen other gremlins. More than any other transducer, compression driver design is filled with gremlins, and these must be fought endlessly, and mostly empirically by trial

and error (after the problem is solved, the designer can go back and develop fancy theories).

But back to air distortion. There are still other techniques to fight air distortion; for instance, the length of the phase plug can be increased, extending into the throat, such as implemented in Tannoy's new coaxial. This longer phase plug will encourage laminar air flow even at higher acoustic outputs and maintain a lower Reynolds number. The Reynolds number is the transition from laminar to turbulent air flow. Tannoy has successfully used the extended length/low compression ratio phase plug in their latest coaxials.

While the compression driver engineer must struggle with the design trade-offs discussed here, most of the time these factors take a back seat to just getting the required frequency response. Not enough top-end response is the most common problem. Driver engineers are tempted to use magnet wire that is too thin (which can be mechanically weak, and not have enough current carrying capacity), place the phase plug too close to the diaphragm (to peak up the top-end, but this also can result in diaphragm collisions with the phase plug), and too thin a diaphragm material (which will have a better response at low levels, but high distortion at high levels).

Other compromises include diaphragms that are not deep enough for optimum rigidity, but result in better production yield. Conversely, if the diaphragm is too deep, then it tends to rock; remember, the dome suspension is not in the plane of the center of gravity, and is relatively unstable compared to the two point suspension of a cone speaker.

THERMAL LIMITATIONS

Increasing the low distortion/high acoustic output capabilities of the compression driver would not yield a useable benefit if the driver could not sustain the newly attained elevated levels without voice coil burnout or power compression effects.

Kapton MTB bobbin material has been recently introduced. It is a filled Kapton that is thermally conductive. The material is not electrically conductive and has insignificant eddy current effects when used as a bobbin. Eddy current effects result in the impedance of a speaker rising at higher frequencies, so the speaker cannot absorbs

(Continued on page 70)

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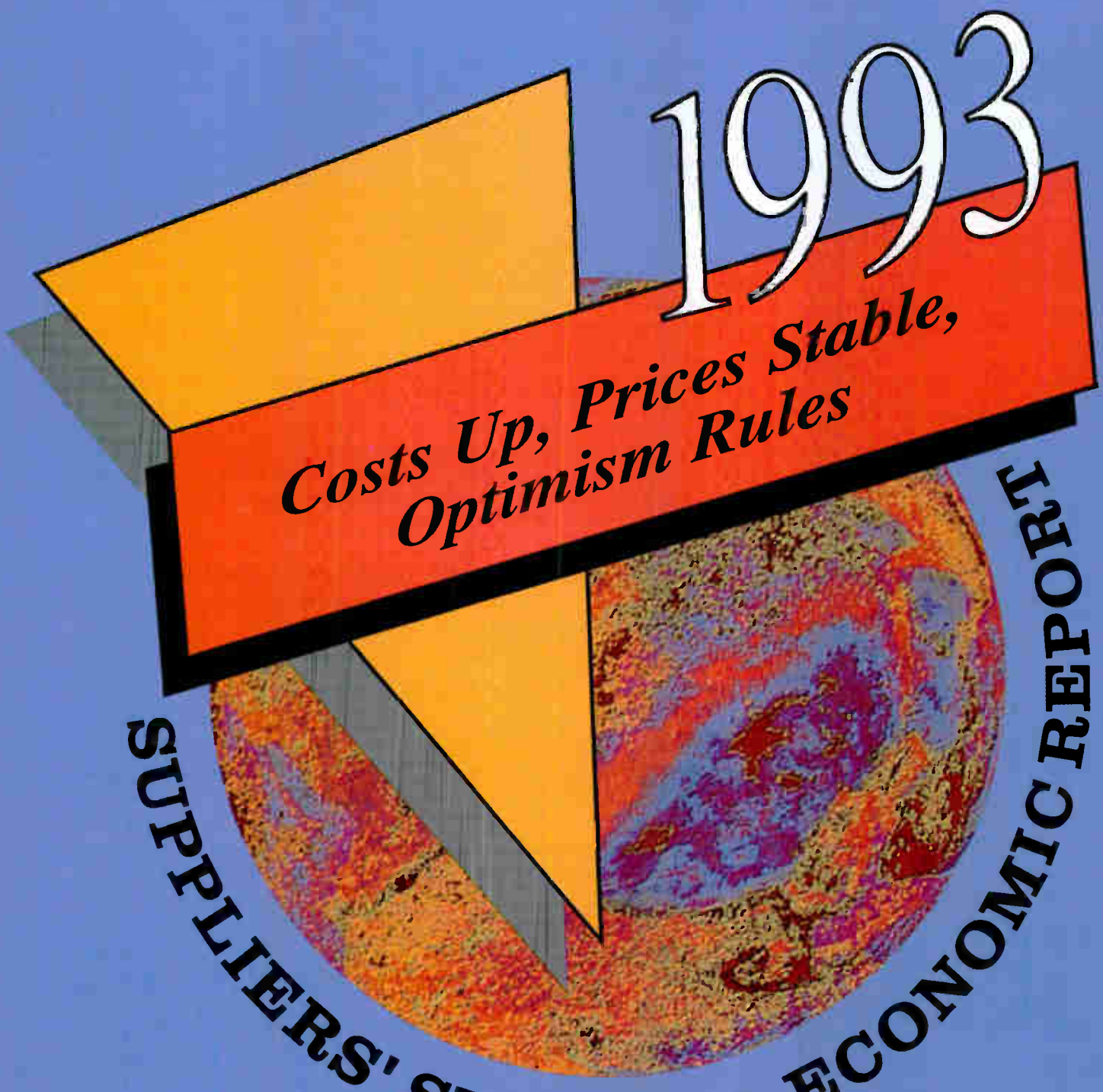
Circle 218 on Reader Response Card

SOUND & COMMUNICATIONS



The Eighth Annual Sound & Communications Suppliers' Survey and Economic Report

By Judith Morrison

Doug McCallum
Director of Management Systems, University Sound

How would you sum up the business climate of 1993?
Steady and growing slightly.

What are your expectations of the business climate for 1994?
From here it looks good. I think we'll be at least steady if not on the increase industry-wide.

What changes, if any, do you see in the professional and commercial sound and communications industry?
I think the biggest thing in commercial sound would be that there is more integration of some of the high-tech things, computer-controlled audio networking systems, that kind of thing.

Do you see the sound and communications market expanding into new areas? If yes, which areas?
I haven't personally noticed any new areas, no.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?
(laughing) Depends on what JBL does. I wouldn't be surprised if there's a little bit more contraction, yes. I've heard a couple of rumors, but you know how rumors go. Yes, I think there's a good possibility.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?
There may be some slight increase, nothing major. We didn't raise any prices this year but our costs did go up, for sure.

What do you think of the general health of contractors?
Based on our accounts receivable, I'd say they're maintaining. I don't think their health is getting any worse. It seems their business is staying fairly even.

Have your operating margins changed in 1993?
Yes, the margins have decreased considerably, primarily because of the yen-dollar fluctuation.

Do you have any advice to contractors? Consultants?
Keep reading. Stay up with what's going on.

Any further comments on the state of the industry?
We're bullish on the market. These days if you don't see a big decline coming, things are very good. I don't see any decline coming, so things are good.

This year we decided to be different. Having established, over the past few years, a historical base that allows comparisons to past years, we have now deemed it appropriate to take some liberties with some of the questions and answers. We deleted some of the questions that weren't eliciting a lot of response. And we added an anecdotal interview with industry leaders.

Our statistical survey is still intact. You'll note the quantified results in these pages. Once again we sent a questionnaire to every company listed in the Sound & Communications Blue Book (which is free and open to all industry suppliers). Responses were sent directly to Survey Analysis, a research organization in Florida, who sent us the total numbers. (This year we gave our respondents the option of returning the questionnaire directly to our office. Some people did this. But the questionnaires remain anonymous.)

We picked a day in late fall. This was the day of the phone call. We called heads (or near-heads) of a diversified group of manufacturers (and some contractors). Many of them were out of the office or in meetings (that's why they're industry leaders; they're busy). We asked everyone we contacted the same questions on the same day. While these answers can't be gathered and reproduced statistically, we think they give valid insights into the business. So we're printing the questions — and the answers — within these

Do You Use Independent Reps? —

	1990	1991	1992	1993
Yes	74.6%	70.4%	81.3%	73.7%
No	25.4	29.6	18.8	25.0

How Pleased Are You with Your Reps Performance? —

	1990	1991	1992	1993
Very Pleased	13.2%	13.2%	11.5%	7.1%
Pleased	49.1	57.9	53.8	60.7
Not Pleased	35.8	28.9	30.8	25.0

Most Important in Making Buying Decisions	1993	1992	1991	1990
Consultant	13.2%	15.6%	22.2%	25.4%
Contractor/Management	9.2	18.8	20.4	21.1
Contractor/Installer	19.7	12.5	31.5	22.5
Contractor/Engineer	19.7	18.8	16.7	23.9
Architect	5.3	6.3	3.7	5.6
End User	22.4	3.1	44.4	25.4

Contractors Doing an Unusually Good Job

- Professional Sound Industries, Sterling, VA
- Acoustech, Arvada, CO
- Stagefront, Savannah, GA
- Chainstore Security, Huntington, NY
- Seriously Sound, Atlanta, GA
- SPL, Columbia, MD
- Haddon Theatre Supply, Louisville, KY
- Atlantic Audio Systems, Raleigh, NC
- A & C Systems, Netherlands
- Dicolore, Holland
- Clair Brothers, Lititz, PA

survey pages. And to all those who weren't in or who we didn't contact: We'll be getting to you. We're planning more surveys, and a return to our Question of the Month. (Anything you'd like to talk about?)

At any rate, this year's Eighth Annual Survey of Suppliers found more stabilization, less fear, and a little more optimism for the industry. That's not to say that everything is wonderful, but, for instance, the refusal of credit has stabilized as far as the numbers of customers who have been refused credit. The spread between invoice and payment has, however, increased from last year. And yet, people are feeling "positive."

Some things are consistent. Each year as we survey the suppliers to the sound and communications industry, we find that the level of positive feeling moves up and down within a narrow range, but no one, absolutely no one, ever checks off the "very negative" box.

Actually, over 35 percent of our respondents feel "very positive" toward sales for 1994, for their companies. And over half feel "positive." That's a total of nearly 87 percent who feel more than neutral (only 2.6 percent feel negatively). When we get to the attitude toward the "industry as a whole," we find fewer people feeling "very positive" (3.9 percent, versus 6.3 percent last year). However, the "positive" people are up (57.9 percent from 53.1 percent last year) and neutral is down. As one might expect, larger companies are more apt to be "very positive" or "positive" for both the industry and themselves.

Three quarters of our respondents use independent reps, but only 7.1 percent of them are "very pleased" (although over 60 percent of them are

Dick Ravitch

President, AKG Acoustics

How would you sum up the business climate of 1993?

For us the climate was positive but cautious. We're doing, I'm pleased to report, very well this year. We've introduced new products and addressed some real market concerns and issues. We feel good about '93. It was a good year for us.

What are your expectations of the business climate for 1994?

We look for continued growth next year through the introduction of new products and through increased market share. We feel that the economy will not necessarily turn down; it certainly won't get any worse than it has. The potential for us to increase our penetration into the market is a good one for '94.

What changes, if any, do you see in the professional and commercial sound and communications industry?

The fixed-install sound business is a growing one. I think the level of sophistication is getting higher. People are looking for higher quality systems and more integrated systems. With fixed-install sound there is a lot of movement and a lot of potential. We also see developing markets outside of the United States for commercial sound. Those markets were heavily dominated by major companies like Siemens and Philips and so on that did turn-key installations. We're starting to see independent sound contractor emerge in Europe as they have here.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

I think as people become more information aware and more technology aware, you will see an increase in communications requirements. The phone company and Sony and Compaq and Apple are starting to push these PC-based conferencing systems in a big way. I think there's going to be a lot of growth. There's going to be a lot of misunderstanding of what these things are and what they can and can't do. I just read a review of one of the PC-based voice systems and the article was complaining about the quality of the microphone. So there will be a need there. I think the computer industry will help create new areas for the audio market.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

I think it'll be a lot slower than it was. There will always be some consolidation taking place by the larger manufacturers or the larger suppliers just because of the nature of where the industry is going. As in any business, the pendulum always swings from one side to the other; as large companies get larger, it opens opportunities for smaller companies in the marketplace.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

Yes, there will be a definite cost increase for us next year. We import a lot of the equipment we sell. A lot of the fluctuation will have to do with foreign exchange rates. It could result in some price increases. Hopefully the dollar is not going to do materially worse than it has been doing. It's been taking a hit over the last seven or eight years. It's all a question of what interest rates do and things like that. We saw minimal inflationary increases this year with labor and materials cost.

What do you think of the general health of contractors?

They're as healthy as the economy is. If school budgets are not cut back too far and they can put sound systems in, if churches spend money to renew their sound systems, which is a big business in the southeastern part of the country, contractors should be o.k. If corporations continue to be as profitable as they seem to be in the last 6-12 months and do more boardroom expansion and get into this teleconferencing, I think the contractors will be very healthy.

Have your operating margins changed in 1993?

Well, they always change. On balance they tend to level out. Some things are up, some are down. This past year didn't have a major fluctuation.

Do you have any advice to contractors? Consultants?

(laughing) Get out of the business. No, I think the thing is to stay focused, look for opportunities. There is business out there. The economy is still generating billions of dollars of capital every year and that money has to go somewhere. I think they need to be alert and be aggressive and go out and get the business that is there to be had.

"pleased"). Small companies and big companies are just as apt to use reps, but big companies are far more likely to be "very pleased" with the reps' performance.

Over 68 percent see worship houses as an expanding area, and nearly 62 percent see expansion for schools. But over 11 percent see a *contracting* market for worship houses. And over a third expect contraction in the concert hall market (but another third expects that to expand). (We didn't break down the answers for geographical location, and maybe that would explain some of the differences.) This year we added "interactive facilities" as a classification. Nearly 60 percent of our respondents see that market as expanding. Nine-point-two percent sees it as contracting (but none of the larger companies agrees with that).

More people are reporting that more

John Lee

President, Crest Audio Inc.

How would you sum up the business climate of 1993?

The business climate for 1993 was very healthy.

What are your expectations of the business climate for 1994?

The expectations for 1994 are very positive.

What changes, if any, do you see in the professional and commercial sound and communications industry?

We plan to broaden our product base and expand into additional markets.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

The sound and communications market is expanding. We see increased interest coming from the home theater, church and hospital markets.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

Industry acquisitions seem to be only natural during times where smaller businesses may begin to struggle and large corporations have the need to expand and consolidate some of the business entities. Growth through acquisition is not only practical, but a reality.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

We do not anticipate overall cost increases in 1994. Prices for 1993 did increase, but only slightly.

What do you think of the general health of contractors?

The health of the audio contractors remains stable!

Have your operating margins changed in 1993?

Operating margins have not changed for Crest.

Do you have any advice to contractors? Consultants?

Advice to contractors? Buy Crest products.

Joe Hardt

Chief Financial Officer, AMX Corporation

How would you sum up the business climate of 1993?

It's been up, good. The first half of the year was less vibrant than the second half. Things seem to be picking up. For us, the international business continues to expand much faster than our domestic business.

What are your expectations of the business climate for 1994?

We expect a better year next year. We think a lot of things we are into are going to be expanding at a faster rate next year.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

I think there will always be movement. I would also say that there will also be the need for the innovators on the bottom end of the market, especially with the continued growth of computers within the market. More software and consolidation will create opportunities for start-up organizations.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

We don't see any price increases next year since the market won't accept it. We didn't really see any this year either.

Have your operating margins changed in 1993?

No, not really.

Do you have any advice to contractors? Consultants?

Be ready for change.

Softening Sources for Company Business (in descending order)

Concert halls
Factories and offices
Hospitals
Residential
Boardrooms
Schools
Theme Parks
Worship Centers
Interactive Facilities

Expanding Sources for Company Business (in descending order)

Worship Houses
Schools
Interactive Facilities
Theme Parks
Boardrooms
Residential
Factories and offices
Hospitals
Concert Halls

Refused Credit to More or Fewer Customers?			
	1993	1992	1991
More	23.7%	37.5%	35.2%
Fewer	7.9	3.1	5.6
Same	68.4	53.1	59.3

Change in Time Between Invoice and Receipt of Payment	1993	1992	1991	1990
More	47.4%	34.4%	59.3%	47.9%
Less	3.9	12.5	5.6	1.4
Same	48.7	50.0	33.3	43.7

time is being taken between invoicing and receipt of payment. Only 3.9 percent report "less time" being taken. But on the up side, nearly half the people are saying the time is the same as last year. On the down side, nearly a quarter of our respondents say that they have refused credit to more customers this year. But 68 percent say it's the same as last year. These figures are relatively consistent no matter what the size of the company.

Who wants to spend time with whom? Over 47 percent of our respondents would like to spend more time with consultants. Only 9.2 percent want to spend less time. More large companies want to spend more time with consultants.

The cost of doing business has risen for a full three- quarters of our suppliers (9.2 percent report "much higher"; 65.8 percent report "higher") Over a fifth report the cost as the same as last

Tom Roseberry

Vice President, Marketing & Sales, IED

How would you sum up the business climate of 1993?

Good.

What are your expectations of the business climate for 1994?

Better.

What changes, if any, do you see in the professional and commercial sound and communications industry?

I think the actions of the SC-10 subcommittee of the standards group for the Audio Engineering Society, the protocol they brought forth, is going to move this industry within this next twelve month window into a totally different structure of sound system.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

The increases next year will be minimal. Everyone has some changing costs as time goes on but I don't think any drastic cost changes. That will probably be reflected in some increases in the market at certain levels. There was minimal increase this year.

What do you think of the general health of contractors?

There's a family of really good, strong, technical, financially safe contractors and then there is the peripheral. Some of those grow into that certain class. Some technical people will get together and start a company but not have a business mind and that's where a contractor gets into trouble.

Have your operating margins changed in 1993?

No.

Do you have any advice to contractors? Consultants?

Everybody needs to stay as educated as possible on the radical kinds of changes that are taking place in our industry.

Any further comments on the state of the industry?

I think it's very healthy. It has matured a lot in the last five or ten years. We have definitely made a space in the overall economy that's going to continue to grow.

Terry Pennington

MIS Director, Rane

How would you sum up the business climate of 1993?

Well, it's been noticeably improved over 1992. While it hasn't been dramatic, it certainly has been positive in most parts of the United States. The world market is expanding rapidly, with a few exceptions.

What are your expectations of the business climate for 1994?

We expect a slightly better market in the United States and we have a very strong outlook for the international market.

What changes, if any, do you see in the professional and commercial sound and communications industry?

I see, especially in the commercial industry, that a product's performance advantages are becoming more and more important for contractors than ever before.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

There seems to be more of a interlinking between other aspects of communications. We're seeing more of the video and other types of communications equipment and jobs being done by the traditional sound contractor. It's certainly been moving in that direction for some time.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

I certainly think there will be more of that on the top end of the scale. For example, I expect some of the more notable major manufacturers to continue in acquisition mode but I don't think the number of suppliers will change so much because there is always a place for the entrepreneurial spirit.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

Our prices were held pretty stably. We did see a lot of pricing increases coming out of foreign suppliers, particularly Japanese. That's primarily due to the money market and our relationship with the yen. We don't expect to see any dramatic changes for next year, maybe marginal increases.

What do you think of the general health of contractors?

I think there's a lot more competition for contractors out of the music stores. I also see that there are more small independent contractors that are becoming proficient at doing full-fledged design and installations. There is a healthy competition developing for the major contractors who have dominated the higher-up and medium areas of the market in the past.

Have your operating margins changed in 1993?

Slightly. Primarily, we've been able to have a cooperative effort to both share in our goals of quality improvement and efficiency improvement.

Do you have any advice to contractors? Consultants?

Primarily for contractors, I would advise that they would take a long hard look at the medium to low-cost jobs that they might have started out doing but have abandoned through the years and to work hard at streamlining their operations.

Jun Matsumoto

President, Aiphone

How would you sum up the business climate of 1993?

It's been pretty fair. We're ahead of last year. We've seen, as a result of our efforts and the slight rise in the economy, a reasonably good year.

What are your expectations of the business climate for 1994?

Continued growth and improvement.

What changes, if any, do you see in the professional and commercial sound and communications industry?

Overall, I see a tremendous change. For us, we see a lot of customers and contractors who are very much in residential applications and security. We are experiencing the residential intercom market as growing, as is the home entertainment market. There is tremendous potential here.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

Yes, definitely.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

Yes, our business is heavy in imports and we expect a 3 to 5 point cost increase which could result in some price increases.

What do you think of the general health of contractors?

There is a lot of potential for them. They just have to look hard for the jobs.

Have your operating margins changed in 1993?

Yes, our margin went down drastically because of our costs going up.

Do you have any advice to contractors? Consultants?

I would say that they need to be open to all ideas because there is great potential out there for work in new markets.

Expectations of Unit Sales —1989	1990	1991	1992	1993
Increase in unit sales	93.3%	81.7%	79.6%	87.5%	84.2%
Decrease	4.4	2.8	0	3.1	3.9
Same	0	14.1	16.7	9.4	10.5

Attitude toward industry as a whole — 1990	1991	1992	1993
Very Positive	8.5%	5.6%	6.3%	3.9
Positive	43.7	48.1	53.1	57.9
Neutral	38.0	40.7	37.5	31.6
Negative	9.9	5.6	3.1	3.9
Very Negative	0	0	0	0

Brian Benn

General Manager, IRP

How would you sum up the business climate of 1993?

Flat.

What are your expectations of the business climate for 1994?

About 5% growth.

What changes, if any, do you see in the professional and commercial sound and communications industry?

Computerization of sound equipment whether we want it or not.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

Yes, but it would be better to put it another way. I see the video market expanding into audio. A/V is now V/A. Audio is now being driven by video.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

No, I can see that most of our competitors are surviving. There has been some consolidation but I don't see that changing too dramatically.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

There will probably be about a 2% increase in price. We saw cost increases of about 3.5% this year but we didn't put any prices up because it's not a wise thing to do in today's market.

What do you think of the general health of contractors?

It's not good because they lack the video capability. Video contractors are becoming audio contractors. There is a trend in that direction and it's very noticeable in many areas. Audio contractors are not willing to make the investment that is required to buy into video. Video contractors have already made the investment into audio equipment.

Have your operating margins changed in 1993?

They shrunk a little bit, naturally. Costs go up, you don't put the prices up. It happens.

Do you have any advice to contractors? Consultants?

Consultants, I would recommend they work a little harder to get it right. That's to maintain their credibility. I do see their credibility falling now. It's because money is tight. In the old days, when money was no object, a consultant was something we could easily afford, whatever the job. Today, we have to justify that consultant and in many cases the consultant is not justified. We find the contractors are doing more and more design work.

Contractors need to expand their horizons a little bit and start looking at other things they could offer such as fire alarms, security. A lot of them do that, I know, but I think they need to expand because pure audio is hard for anyone to make money off of these days.

Any further comments on the state of the industry?

I think its in a state of change at the moment, both economically and technically. Our industry is going to change quite dramatically over the next five years. It will include a great deal of fiber optics, DSP and computer control. You'll see some of this developing with telephone companies and so on.

Change in Operating Margin	1993	1992
Higher	27.6%	28.1%
Lower	27.6	50.0
Same	42.1	18.8

Change in Average Cost Per Sale	1993	1992
Higher	42.1%	50.0%
Lower	13.2	21.9
Same	34.2	18.8

year. And 3.9 percent report the cost as "less." Larger companies are more apt to answer "much higher." Smaller companies were more likely to answer "higher."

But those costs will be met by a presumed increase in sales. At least 84.2 percent of our suppliers expect an increase in unit sales. Over 10 percent expect sales to remain the same. And 3.9 percent expect a decrease. These results are relatively consistent with previous years. Optimism rules; most people expect to have increased sales.

This year, we asked for an individual's approximate gross revenue in 1993 for sound and communications products. While not everyone chose to answer this question, of those who did, the mean was a four million dollar company, although nearly 13 percent reported gross revenue of over six million dollars.

Last year we began asking about changes in operating margins. While roughly the same percentage has seen their operating margin go up this year as did last year, far fewer have seen their operating margin get lower (27.6 percent this year versus 50 percent last year). But 42 percent has seen the operating margin remain the same.

While 42 percent has seen the average cost per sale go up, that figure was 50 percent last year. Only 13 percent has seen the cost per sale go down. But over 34 percent has seen it remain the same.

Our sound and communications suppliers let us know what they're thinking. Write-in questions included new applications and markets to be addressed; and contractors who are do-

Ken Berger

President, EAW

How would you sum up the business climate of 1993?

For us it was much improved and it seems to be generally better than last year.

What are your expectations of the business climate for 1994?

We expect continued growth both domestically and internationally. The U.S. for EAW this year was not as active as it has been. It will probably start to catch up again.

What changes, if any, do you see in the professional and commercial sound and communications industry?

The most obvious change is the pending adoption of the SC-10 networking standards. I would say that over the next five years that has the potential to change the way the industry operates at least as much as the adoption of the MIDI standard.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

Yes and no. There are a lot of markets that are really waking up to the importance of audio in a big way, such as theater, cinema, sports facilities. That's an example where you would expect some sort of minimal sound system that just allows people to hear an announcer over a microphone, and facilities are now going for things that are more expensive and sound much better – where you can play music and that kind of thing. We see that happening more and more. The people that are putting up these large public venues are looking at the importance of the sound system. Also, large screen video and video walls are becoming more popular. They're becoming things that audiences expect. What we're seeing is that in areas where audio used to be of minimal importance, it is becoming much more important and more of the budget is being allocated for audio.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

Yes. I certainly think so. I continue to be amazed at the number of manufacturers in this industry.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

Yes, we have some prices that will be slightly higher next year and we didn't see any price increases in 1993.

What do you think of the general health of contractors?

There are some people that are very well established and understand that they are running a business. They keep going from strength to strength. There are other people, for whatever reason, who seem to go up and down. It's mixed, I would say. There are some very healthy companies and there are some that will need to get their act together in a business sense.

Have your operating margins changed in 1993?

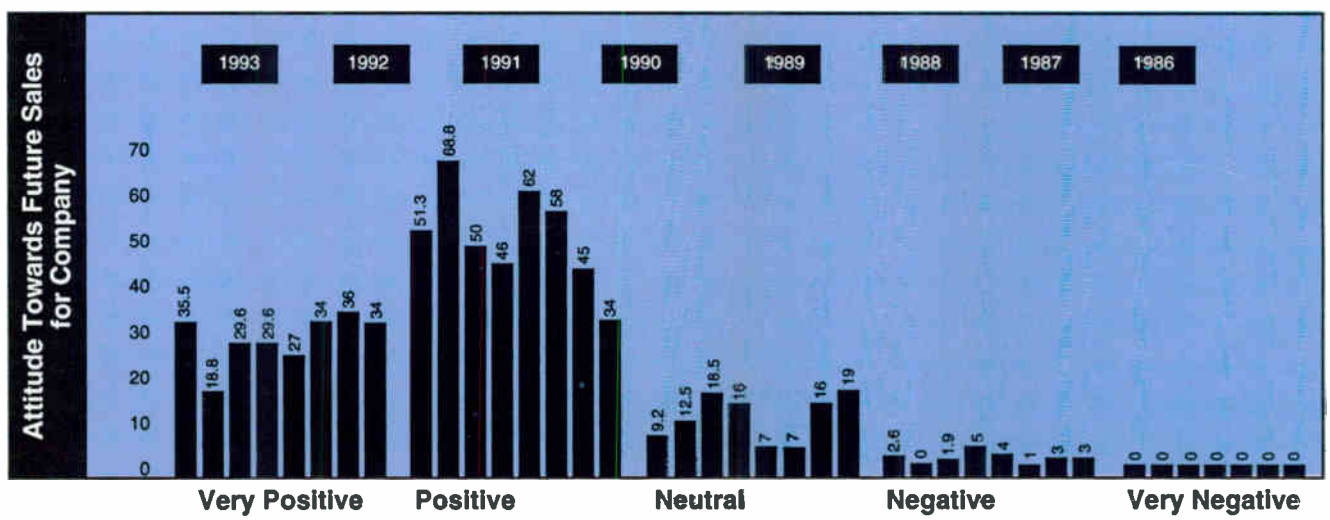
I don't think so.

Do you have any advice to contractors? Consultants?

My advice is that we should, as an industry, continue to strengthen our momentum by helping people to appreciate the value of a good sound and video communications system. There's still a long way to go to solve the category of sound and communications equipment to a lot of customers. There is always pressure to compete on price but if that is the only level that you compete on, then in the long run, it's bad for you and everyone else. If you cannot establish the value of professional equipment and the services that you provide (design, installation and service), you're not going to be here five years from now. So my advice is that in the hurly-burly of competing for jobs, try and maintain your focus on the long term goal of establishing the value of what you do in your customer's lives.

Any further comments on the state of the industry?

From our point of view, we have a well-established base of acoustical consultants domestically and the level of knowledge among contractors is also pretty high. Elsewhere in the world, that's not the case. This is an area where America clearly continues to lead the world in technology. It's an opportunity for us and for other American manufacturers to export that knowledge and raise the level of professionalism in other countries.



New Markets and Applications

- Stereo phase scope monitors
- Stands
- Studio
- Home theater
- Home stereo
- Car audio
- Musical instruments
- Video assist systems
- Special sub-systems
- Teleconferencing
- Vehicular video systems
- ID Badging systems
- Serial digital video
- Theater
- Religious
- Professional wireless mics
- Flexible sound and video cables
- New P.A. and industrial communications
- CCTV
- In-wall
- Water-proof
- Foreground and commercials audio
- Manufacturing more products in Canada
- Portable P.A. system speakers
- Metal products
- Wire and cable
- Touring sound
- Audio for video and film
- Surround sound
- High power amplification
- Digital/computer control networking
- Intercommunications
- Digital audio
- International sales
- Adaptive computer controls
- Video accessories
- Vintage guitar sound-switching
- Lecture systems
- Instructional systems
- Post-production
- Health Care
- Project studio market
- Editing and animation

Ken DeLoria

President, Apogee Sound

How would you sum up the business climate of 1993?

I can tell you from Apogee's perspective. In the speaker and amplifier business, we've experienced growth at about 22%. That is a lot less growth than what we've experienced in the past eight years that we've been in business. The first few years we were in business, of course, we were so small, the growth factor was really high, but since then we've maintained a very consistent growth. This would be the lowest growth year that we've had since we started the company. It still is growth so we don't feel like there is any impending doom or anything.

Of course we'd like to see it a little bit higher. Definitely more than half, maybe two-thirds of the growth is foreign sales. Domestic has a pretty small growth factor, so we'd like to see some improvement there.

What are your expectations of the business climate for 1994?

I don't really know. It feels like things are going to improve. It feels like it's not going to get any worse, but then, people were saying that last year. There was that seemingly false recovery right after the Clinton election. There was a lot of confidence going into this year. Last December was the biggest December we've ever had. It was the third biggest month of the year.

What changes, if any, do you see in the professional and commercial sound and communications industry?

Well, clearly, virtually everything is going into the digital domain. Also, we are beginning to look at individual items as they fit into networks. The computerization of the world at large has led to the desire to computerize everything in audio. There is a need to move forward technically.

Do you see the sound and communications market expanding into new areas? If yes, which areas?

Yes, I don't know what those areas are specifically, but we're just seeing the tip of the iceberg of networking electronic devices. It will bring design changes in virtually all products that are now taken for granted.

Do you expect to see more contraction of suppliers through acquisitions, mergers, attrition, etc.?

Yes, I do. I think there are still some smaller independent companies which will be bought. The market is definitely more competitive today than it was seven or eight years ago. I can imagine that 6-12 $5 million American audio companies will be bought over the next couple of years.

Do you expect to see any cost increases in 1994? Price increases? Did you see any in 1993?

We did see cost increases; I don't know if they'll be balanced by the decreases. Because of the competitive nature of the marketplace and the poor economy, a lot of suppliers are shaving their margins but at the same time a lot of things are going up. I don't know if they'll balance each other out. We'll try to hold and remain steady but I see price increases on the horizon. We did not raise our prices this year and probably won't do anything before February or March. That will make it over a year since our last price increase, and this one would only be slight.

What do you think of the general health of contractors?

Most of them are small. The ones that are either fresh or very highly motivated always seem to be well and the ones that are not highly motivated always seem to be hanging on by a thread. I don't think it's a very healthy industry. It'll always be there. It seems to burn a lot of people out.

Do you have any advice to contractors? Consultants?

Stay highly motivated, stay really excited about the products and the market potential in your area. There are jobs out there. Don't just wait for the phone to ring. There is work. You just have to go after it.

Any further comments on the state of the industry?

It's in a great state of flux right now due to the massive move to digital. Everything will be digital in some way. There will be great ripples as everything goes digital and becomes part of a network. There will be casualties along the way in terms of companies going under or people in companies losing jobs, as well as products completely changing.

ing unusually good jobs.

Once again, the contractors mentioned deserve special note, because this was after all a non-prompted full write-in question. Anyone mentioned in those circumstances should be commended. Among the contractors mentioned most are:

Clair Brothers, A&C Systems, Dicolore, Atlantic Audio Systems, Seriously Sound, SPL, Haddon Theatre Supply, Chainstore Security, Stagefront.

And among the anonymous comments made by the suppliers:

- There will be more changes in features and functions in the next five years than there were in the last 30! One product will do the functions of the current two, three, four, or five.
- There is a slow recovery underway.
- Quality, contractor/supplier performance is becoming a driving force in the market.
- Computer control looks good on paper, but we need to justify the learning and the expense.

And this year, for the first time, we asked contractors themselves for comments on the past year. Here's some of what they said:

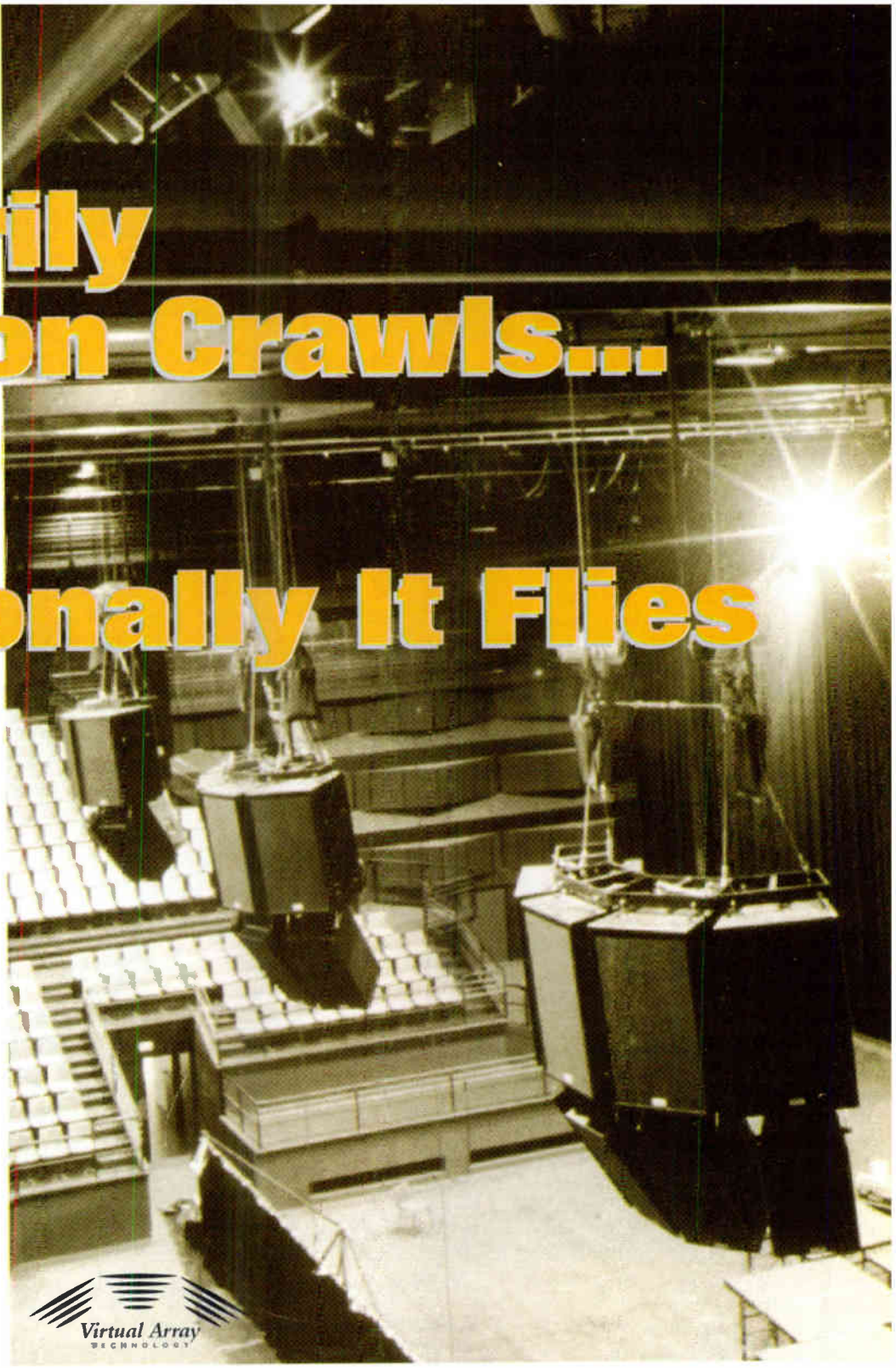
"I expect business to be up at least 10 to 15 percent." . . . "We've just about doubled our business from 1992." . . . "We're pretty optimistic about next year." . . . "There's a lot of bids out and we are hoping to get them." . . . "Businesses are popping up everywhere, and it looks good for us."

Happy New Year.■

[Research assistance by Mark Miller and Sacha Landreneau.]

Ordinarily Evolution Crawls...

Occasionally It Flies



To Succeed, Evolve

Progress emerges in many forms: one of them is a cultural center in the south of France. The Zénith de Pau actually adapts its internal architecture to the presentation. Inside dual acoustically isolated space frames, the stage, seating, ceiling and rear wall can be reconfigured for classical music, pop, theater or meetings. Integrated acoustic treatment and digital electronics maximize flexibility.

The acoustical consultant demanded an equally evolved loudspeaker system: lightweight to hang without massive support, compact to leave sightlines open, accurate and natural for acoustic music and speech, powerful to deliver the energy of rock performances. Conventional thinking had no answers. So Jean-Pierre Mas turned to EAW's Virtual Array™ Technology for practical solutions.

To Evolve, Adapt

With a range of enclosure sizes, dispersion angles and output capacities, VA™ Technology adapts to almost any application. The new KF650i used in the Zénith de Pau, like all VA™ systems, is a true three-way design: The entire vocal range is covered by a 10" cone loaded with Kenton G. Forsythe's midbass horn and displacement plug. This astonishingly compact system is capable of 133 dB SPL and ±2.5 dB response from 70 Hz to 20 kHz.

To Adapt, Listen

For a decade and a half, we've been listening critically and carefully to loudspeaker components and systems. To rooms of all sizes and shapes, to music of all kinds. To the voices of our customers, audiences and end users. If you're interested in what we've learned—and how it can help your next project evolve beyond the ordinary—contact us today for more information and a demonstration of Virtual Array™ Technology.

The KF650i evolved in demanding environments like the Zénith "Salle de Spectacle," Pau, France. Christian Malcurt, APIA, acoustician. Jean Pierre Mas, Mas Conseil, designer. Tech Audio, installer.

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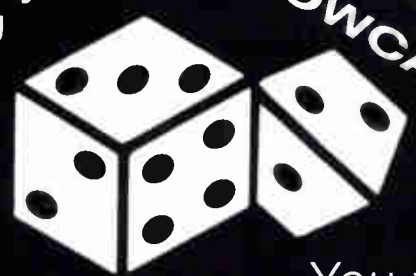

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- ❑ Lighting Instailer/Designer
- ❑ Club Owner/Manager
- ❑ Architect/Designer
- ❑ Audio Equipment Dealer/Distributor
- ❑ Lighting Equipment Dealer/Distributor
- ❑ Record Tape, CD Retailer/Distributor
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- ❑ Other

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SET UP THE CLIENT BASE

By Dr. Wilhelm Wokka III

1. Determine your suitability to the task

1.1 Move to Philadelphia, see if you fit in here, go to a 76ers game, enroll in the PMCMK and the AES. If you pass the tests,

2. Get their confidence

2.1 Hang out your shingle.

2.2 Purchase and wear a suit.

2.3 Purchase a real-time analyzer and instrumentation microphone.

2.4 Attend trade shows, show your face, advertise in Sound & Communications.

2.5 Read many audio books and improve your vocabulary. Find as many big new words as you can and practice using them in your daily conversations.

2.6 Practice speaking in somber, confidential tones, especially on the telephone.

3. Get their trust

3.1 Do one job for free, like the Japanese. Get your foot in the door. You have money, you can afford to do this.

3.2 Be friendly. Smile and speak with great sweeps of the arms, in resonant tones, with your great and expanding vocabulary.

3.3 Do a great job. Establish a huge volume of data and measurements to document the job. Force the sound contractor to comply with your specifications to the letter. Get an attorney to help you do this. Have him show up at the job site to enforce this, not you. Don't let him know where you live. Establish an escape route from your office. This is important.

3.4 Establish yourself with manufacturers. They will trust you and give you work. Send out large confusing forms requesting product data. Invent new kinds of acoustical tests and make them mandatory for product inclusion on the "acceptable equals" list in your spec. The manufacturers will comply, driven by the engineering departments who will love to spend endless hours purchasing, using and trying to interpret all these new data. These new tests, by the way, can make excellent papers for publication. Some good tests to invent new measurements for are: Intelligibility, good sound, purity of sound, transmission of musical signals, real-time audio quality, and so forth. The best thing to do is involve a powerful modern computer and some software that is very time-sensitive. Hire some graduate student to make some up for you. They will work for $6.00 an hour and will work endlessly, and often lose track of time anyway. You'll know what to do.

3.5 Establish yourselves with architects. Join the AIAA. They'll let anyone in who pays the fee. Advertise in Architectural Digest. Hang out with them at the IAAM show. Convince them you like them. They will trust you and give you work.

4. Get their money

4.1 Never agree to a fixed price. Always have an outlet for expanded billing.

4.2 Billable time is money. Bill them a lot. They will feel good about this and will pay you out of respect for your knowledge.

4.3 Enjoy your wealth. It is your destiny. Enjoy your life as a Great Man of Audio Science. Think about the formation of the Audio Edification Society. ■

Welcome to the Pond

The Mighty Ducks New Home takes Wing

BY MARK MILLER

A quacking duck blares over the speakers. Thousands of duck calls answer back. Welcome to The Pond, since October the home of the National Hockey League's newest franchise, The Mighty Ducks of Anaheim, owned by the Walt Disney Company.

Construction of The Pond, located in Anaheim, California, two miles from Disneyland, was completed in June and an extensive last-minute sound upgrade took place in September. Originally the Anaheim Arena, The Pond was built by the city of Anaheim to attract a professional basketball or hockey team to the area. The sound system was designed in the fall of 1990 and installed between June 1991 and June 1993 with no specific plan for the future of the arena.

While the arena was under construction, Michael Eisner, chairman of the Walt Disney Company, would drive by and wonder who would inhabit the space. In the fall of 1992, the Mighty Ducks (named after a Disney film) were born.

"In the beginning," says Ron Baker, of Wrightson, Johnson, Haddon & Williams in Dallas, Texas, audio consultant and designer for The Pond, "the future tenants of the building were uncertain so there were aspects that we postponed in implementation and, therefore, a fairly general purpose sound system was developed without having it focused or slanted or emphasizing any one particular sporting need."

A press conference at the Anaheim Arena.

Disney leased the building from Ogden Entertainment in the middle of its construction and decided to have everything completed that had already been commissioned. "Disney wanted to finish all contracts," says Baker, "and see what they got and upgrade from there."

Disney got a general-purpose sound system designed by Baker with the possibility of either hockey or basketball, put together with strict budget limitations from the city of Anaheim. "There are subtle differences between basketball and hockey that I had to overlook to be more general in the initial design with this system," says Baker. "Basketball is more intimate and needs more focus; hockey is much more of an open and louder sport.

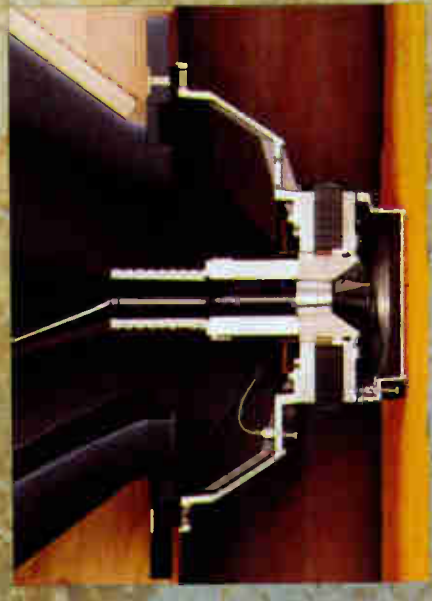
Mark Miller is a freelance writer based in New York City.

ALTEC 9864-8A
THE ACOUSTIC ENGINE WITH A SPLIT PERSONALITY

Altec Lansing has literally redefined the approach of full-range loudspeaker design with the introduction of the revolutionary 9864-8A vented bass duplex horn system. The 9864-8A is the first and only full-range, point source, constant directivity, loudspeaker system in a single enclosure.

The heart of this innovative system is it's "engine"; a true coaxial or Duplex® design. The low-frequency and high-frequency components feature a single integrated driver which is capable of handling 550 watts of continuous power while providing 130db SPL from 50Hz to 18kHz with directivity control down to 200Hz. The unique cabinet not only acts as a housing for the "engine" but also as an acoustic propagation guide for the lower frequencies.

- ❖ Compact Enclosure
- ❖ Single Point Source
- ❖ High-Output
- ❖ Excellent Directivity Control
- ❖ Cabinet Allows Refinishing
- ❖ Cost Effective
- ❖ Ease Of Installation



Primary Specifications

System Type:	Vented bass horn type, full range loudspeaker
Pressure Sensitivity:	HF: 109 dB SPL (1 w, 1 m) LF: 104 dB SPL (1 w, 1 m)
Frequency Response:	50 Hz - 18 kHz (equalized)
Power Handling:	HF: 75 w. AES; 150 w. continuous program; 300 w. peak power LF: 200 w. AES; 400 w. continuous program; 800 w. peak power
Maximum System Output:	127 dB SPL. AES method: 130 dB SPL. continuous power; 133 dB SPL. peak power
Dimensions:	31.5 in. (80.0 cm) high, 25.3 in. (64.3 cm) wide, 25.5 in. (64.8 cm) deep
Net Weight:	124.0 lbs. (56.2 kg)

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Circle 213 on Reader Response Card

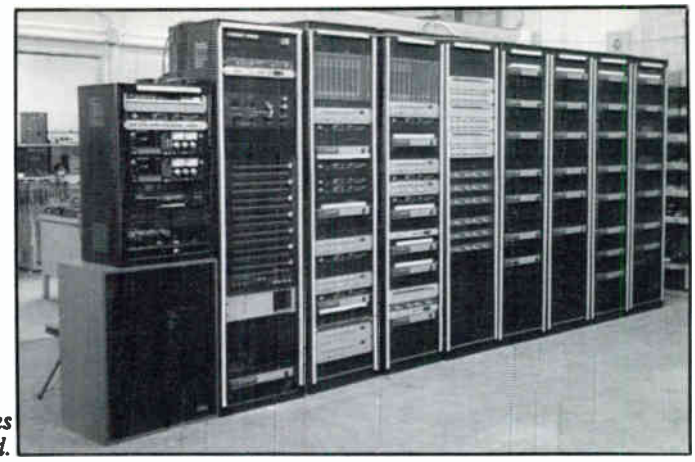
Some newer arenas have basketball-only speakers that are focused for baseline and sideline seating."

The original arena contracts specified an exploding cluster, which consists of a cluster broken into four pieces. "This configuration," says Baker, "gave them a little more opera-tional flexibility in being able to utilize one or two clusters in a half-house mode."

When Disney officials, including Bill Platt, the Project Coordinator and Audio Director of Walt Disney World, listened to the existing system in August, they opted for upgrades before the team's October 8 debut.

"The enhancements were needed primarily in mid-range type coverage," says Baker, "and more volume output." EAW was chosen to assist in boosting the mid-range coverage. "This decision was made," says Baker, "primarily because of size and quality." Two large clusters, rather than four, are now on either side of the scoreboard paralleling the length of the ice. Sixteen EAW KF852 cabinets hang there for long throw along with eight MH662Cs with CAD drivers hung next to the scoreboard. These are situated with 180 degree arrays. A quantity of MH660s are in the fill cluster on either side of the scoreboard. "The Disney Technical Services people took the existing four clusters down and kept the JBL front-load 15 cabinets, and the CAD drivers were installed in the EAW boxes," says Greg Hockman, EAW West Coast Representative. "Basically everything else was torn out."

Additional Crown amplifiers put the volume at the desired higher level. "Dan Olilla (of Valley Audio, contrac-



The racks at the Pond.

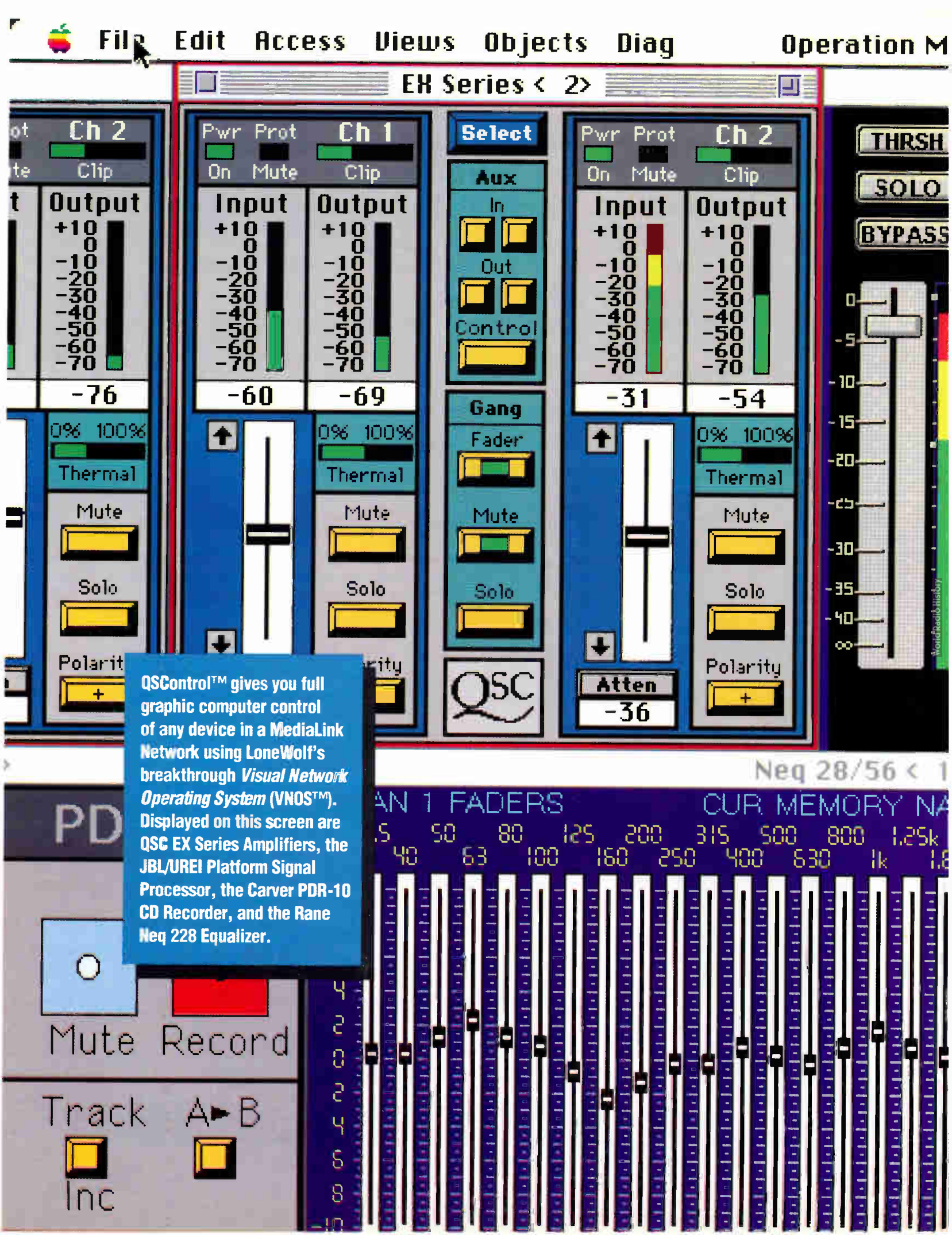
tors for the project) re-wired the racks and put in seven Crown MA 5000s and two MA 3600s," says Hockman. This was in addition to the ten Crown CG1600s, nine CG800s, two Compact 400s, and eight Compact 200s. "Just a little rearranging and a few additions put the power level up where we needed it," said Olilla.

The excess equipment taken from the original system will be re-used by the Walt Disney World Technical Services Staff, possibly as a monitor system for anthem singers or other talent, for pre-game or between period activities.

The entire changeover took less than three weeks. "I know we got the order on the 19th of September," says Hockman, "and the boxes were delivered on the 27th to Anaheim. The whole system had to be ready for the season opener." Platt led a team of Disney Technical Services workers and Olilla joined him on all-night break-downs and installations. "I worked with Bill on one of these shifts and he had been awake for 40 hours straight," says Baker. "There was simply not time to install the system." Between hockey practices, pre-season games and other final construction work, accessibility to the clusters was minimal.

The Pond, also home to a local professional roller hockey team not owned by Disney, is now completely outfitted for hockey including a press area designed specifically for the sport. "Small generalized paging is in this area," says Baker, "which accommodates press, broadcasting, sound control, and scoreboard control. The paging system involves someone from the Duck P.R. Department providing statistical and anecdotal information to the press."

The press and public of Anaheim are now enjoying the antics of hockey's latest expansion team and when the action on the ice is at its worst (as it usually is for an expansion team) you can always count on the quacking duck coming over the speakers to liven things up . . . and you can always count on hearing it. ■



QSControl™ gives you full graphic computer control of any device in a MediaLink Network using LoneWolf's breakthrough *Visual Network Operating System* (VNOS™). Displayed on this screen are QSC EX Series Amplifiers, the JBL/UREI Platform Signal Processor, the Carver PDR-10 CD Recorder, and the Rane Neq 228 Equalizer.

QSControl™

The New Tool Of The Trade.

On October 1, 1992 at AES/San Francisco, QSC invited the industry to "Hear the light."

It was time to unveil a breakthrough that QSC was convinced could become the long-awaited standard for pro-sound computer control and network integration — *Lone Wolf's MediaLink*™ and the *Visual Network Operating System* (VNOS™).

MediaLink offers complete, non-proprietary, open system interconnection with any audio device via a common networking language (VNOS) and simple hardware interface.

The QBridge™ is the hardware interface for various communication formats in a MediaLink network and the QHub™ connects up to eight full-duplex fiber optic devices.

QSC was the first power amp manufacturer to recognize MediaLink's potential and develop QSControl™ (pronounced "Q's Control").

QSControl connects QSC EX Series Amplifiers to the MediaLink network. It gives you total computer control and monitoring of all amplifiers and any other MediaLink device in your system. (Even non-MediaLink devices may be bridged to the network.)

You can customize control panels, view and change network configurations (LanScapes™), and design an endless variety of venue applications with Virtual Venue™. All graphically. All with mouse-driven, drag-and-drop simplicity and efficiency. And, you can instantly switch between views in multiple open windows.

In other words, QSControl takes complete advantage of the full-function power and ease-of-use of the two most popular GUI's. Versions are available for both Macintosh® and Windows®. *In fact, with MediaLink your network can include both of these platforms at the same time.*

The QSControl software is available in Macintosh and Windows versions.

One of the most revolutionary features of a MediaLink/QSControl network is its use of Fiber Optic Cable for connection between devices. Fiber Optic Cable is immune to interference and it prevents ground loops. It offers a very high bandwidth. And, this Fiber Optic Network will allow you to upgrade to digital audio or whatever else the future may bring.

The plug-in QLink card is the EX amplifier interface, via fiber optic cable, to the MediaLink network. It allows for several optional I/O modules, including MIDI, PA-242, RS-485, and either glass or plastic fiber optics.

Speaking of the future, what about MediaLink's potential to become the industry's widely accepted standard?

It may still be too early to tell, but the list of leading manufacturers who have "heard the light" is growing rapidly. At the time this ad was produced the list included JBL, Soundcraft, UREI, Rane, TOA, Carver, Altec Lansing, Vega and Klark-Teknik. But, if you want to keep up to speed, you'd better contact us. It's likely the list will keep getting longer.

With QSControl and MediaLink, your network may include both "Mac" and PC systems.

If you're considering computer control, don't get locked in to a closed network. *Join the MediaLink revolution.* And call QSC Audio Products at **(714) 754-6175** to learn more about QSControl and EX Series Amplifiers.

Hear the light.

QSC® AUDIO

Interactive Bars

NTN Brings the NFL to Patrons

BY MARK MILLER

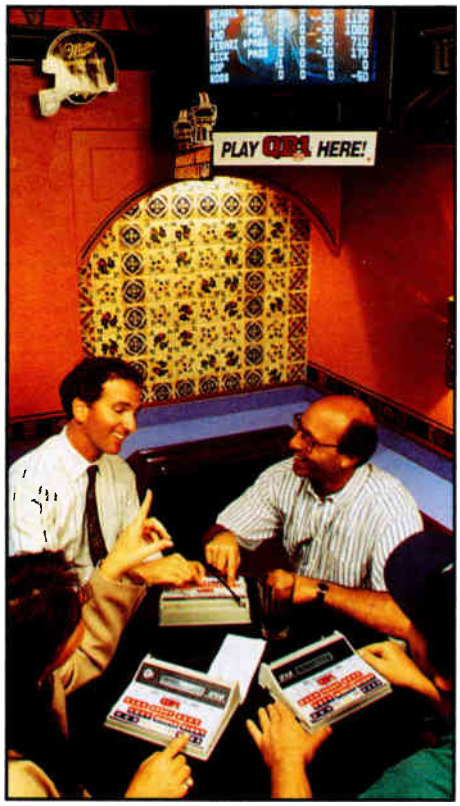
NTN Communications of Carlsbad, California, the first 24-hour "interactive television network," is changing the world of TV.

Starting in 1983 as the brainchild of the brothers Patrick J. and Daniel C. Downs as well as Donald C. Klosterman, the idea was intended to add more fun to the game of professional football.

The interactive football game (QB1) is played while a live football game is taking place, and score is kept on a separate television screen. Each game player has a small wireless keypad that allows the player to predict each play in the real game. Buttons are marked Left, Right, Middle, Pass, and Run. The more specific a player gets, the more points are awarded. Each game on NTN is played for prizes: TVs, VCRs and the like.

Klosterman, general manager for the National Football League's Houston Oilers in the early seventies, originally wanted to install an electronic keypad on every seat of the Houston Astrodome for people to play the interactive game against other stadium-goers. Score would be kept on the stadium's huge Jumbotron television screen. The system was never installed but the idea has grown into an international industry of interactive competition.

QB1 spawned other sports games and then, to create more programming, NTN turned to interactive trivia. Trivia fills the bulk of the schedule. The games usually see the same players every week. "Yeah, we get the trivia regulars in here," says Ted Lanzi, bartender at New York City's Down the Hatch, a Greenwich Village bar which has carried the network for a year. "They're a pretty laid-back bunch but the football people can really get into it."



QB1: An interactive football game from NTN Communications that takes place during a live football game.

NTN is run just like a television station, with several hours of live news programming a day. Producers, directors, graphic artists and computer programmers all work within the Carlsbad, California station. Thirty freelance trivia writers around the country modem in their questions.

"A lot of these people have worked with game shows before and have a good feel for it," says Jerry Petrie, Senior VP and Marketing Director for NTN. For NFL games there are three people in each of the station's nine studios: the producer, the keypad operator and the referee.

"When there is a play," says Petrie, "the referee will yell 'Snap' when the ball is snapped and the technician will hit a button that will freeze all of the keypads across America and Canada and Great Britain in less than a quarter of a second. Anything you've input into your wireless keypad at that point is your play. The referee then calls what the play was. 'Run, Left ' or 'Pass, Middle' and the technician puts that into the computer. The computer then calculates how everybody is doing across the country. It's a ball to be in the studio, just a complete ball."

While continuing to expand in its bar programming, adding 50 units in Australia and 150 in Great Britain, NTN is also steadily building its consumer network in North America. It is currently seen on some cable channels such as Continental Cablevision in Massachusetts and Daniels Cablevision in San Diego, California.

"What I like about having it on local cable," says San Diego County resident Petrie, "is that I can turn on the

Mark Miller is a freelance writer based in New York City.

On-screen rankings are shown.

TV and play poker against my buddies around town without leaving the house. So, I can take care of stuff around the house and have something to talk about around the coffee machine the next day."

NTN is also seen on the GTE Mainstreet cable network as well as two on-line services: General Electric's GEnie and the Imagination Network (formerly Sierra). The network has also been working nationally with E-on (formerly TV Answer) on its Interactive Video and Data Services. LodgeNet, a service for hotels across North America, carries 24 hours of interactive trivia games from NTN.

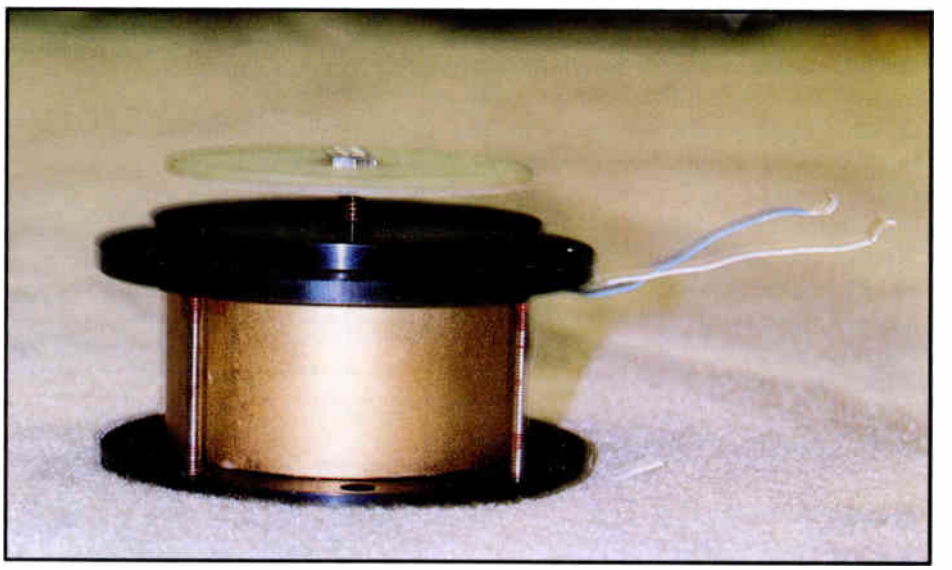
Score would be kept on the stadium's huge Jumbotron television screen. The system was never installed but the idea has grown.

In addition, the network also broadcasts special programming such as games of prediction for the Academy Awards and others. "The possibilities are endless," says Petrie. "We premiered three interactive shows this fall and we keep on developing more. This is a market on the upswing." ■

A NEW ENTERTAINMENT TECHNOLOGY FOR COMMERCIAL INSTALLATIONS

By Mike Klasco

In clubs, movie theaters, theme parks, and multimedia presentations, the special effects can never get off the video screen nor out of the speakers. The sound designer just does not have a way to reach out and touch the audience.



Aura's VibraSonics transducer for theaters, theme parks, home and auto.

Sound is experienced in two ways: by soundwaves through the air, which are heard by your ears, and by bass vibrations, which are felt by your entire body. In concert sound, the bass energy reaches you through the building structure as well as the air. In commercial sound systems, when this "feeling" portion of the audio is missing, something powerful and important is lost.

In the September issue of *Sound & Communications,* Mark Miller wrote about the Luxor Hotel's special effects theaters. In this article, a technique to enhance the realism of audio/visual presentations called AuraSonics was mentioned and this month we are going to take a closer look at what this is about.

For many years various companies have attempted to build vibration devices that would supplement woofers and subwoofers to provide the "feeling" of deep bass. Some efforts simply used woofers to try to couple to and shake the building structure, others used small "momentum shaker" elements that mounted directly to seats, walls or the floor. The shaker gizmo consists of a speaker's magnetic structure that moves back and forth within a metal casing. In a speaker, the magnetic structure is normally fixed to the basket, while the voice coil and cone move back and forth. But in a shaker, it is the magnet that moves and the coil that is stationary. As the magnet moves, the casing wants to go in the opposite direction. Since the casing is fastened to a seat or floor, you feel this opposing force, driven by the music signal. None of these have been really successful, either because they were ineffective, could not handle enough power, or were too costly.

Deep bass vibration devices in commercial sound systems may be in for some changes. Aura Systems, a west coast aerospace technology company, has re-engineered an electromagnetic linear actuator for bass vibration reproduction. Aura's main business is industrial and military linear actuators which develop over a half ton of force with strokes almost a meter long. These transducers are used for proportional valve controls and precision positioning in industrial, scientific, and aerospace applications. The actuators offer a combination of low distortion, long stroke, extended response into the infrasonic range, and cost effectiveness that are the product of a clev-

Mike Klasco is the Technical Editor of Sound & Communications magazine.

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Crown introduces another first with real-world artificial intelligence for amplifiers. With our new SmartAmp™ upgrade, sophisticated control and diagnostics are now on-board the amplifier for the highest levels of performance and safety possible. (Crown IQ System® control is *not* required for operation.)

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For more information on how you can add artificial intelligence to your amplifiers, call us toll-free: 1-800-535-6289.

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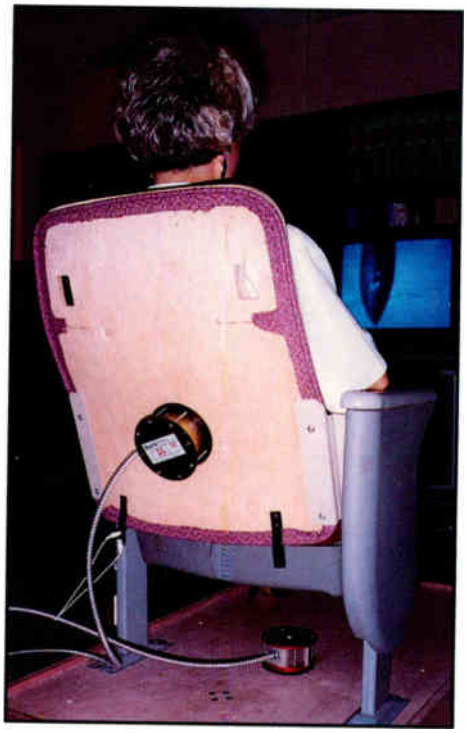
er and unique magnetic circuit. What does this have to do with deep bass for clubs, karaoke, movie theaters, and theme parks? Aura is now making their actuator deep bass devices available for commercial sound installations.

The AuraSonic actuators can be installed into the back and seat cushions of chairs or seating units, or floor modules can be supplied. Perhaps most exciting is the concept of deep bass from the floor. Most experienced sound installers know that when there is heavy bass at ear level, listeners find it fatiguing and objectionable. But bouncy dance floors vibrating with the bass line of the music make people want to dance, as well as helping them dance better. Karaoke singers also get



The transducer as demonstrated.

emotionally caught up with the "power" of their singing as the bass flows through their bodies. Not to mention that the bouncy floor cushions their fall when they trip over drunk. The actuators within the floor generate the musical vibrations which are then transmitted as sensations directly, through bone conduction. The actuators are driven by separate power amps, just as you would drive a subwoofer. In movie theaters, the Dolby "Boom" channel outputs work just fine. With the feeling portion of the music restored, the musical experience becomes more sensual and exciting. The sensation of profuse deep bass is truly powerful, beyond what can be attained just with subwoofers.

DEEP BASS VIBRATION DEVICES IN COMMERCIAL SOUND SYSTEMS MAY BE IN FOR SOME CHANGES.

The mixing engineer or DJ will want to keep the bass vibration present, but

at a low intensity, throughout the presentation. To add drama, the intensity can be increased. The bass actuators connect to a power amplifier, which is driven by a signal processor. Within the signal processor the mids and highs are rolled off and a limiter prevents the vibration devices from being overloaded. In club systems, unless one of these actuators is installed in the sound booth, the DJ will not have a feel for how intense the effect is. If you have the budget, installing these devices into the floor of the

WITH THE FEELING PORTION OF THE MUSIC RESTORED, THE MUSICAL EXPERIENCE BECOMES MORE SENSUAL AND EXCITING.

control booth makes the job of beat-matching easier.

Another application is eliminating bass leakage in recording studios since the bass beat can be sent through the floor. A friend of mine put one of these devices into his drum throne for when he practices his electronic drums late at night. I think there are going to be a lot of unusual places where these get put to use.

A side benefit, or in some cases, the main reason for using this approach is that bass transmission is minimal. When you step off the floor (or seat), the effect is gone — and so are complaints from neighbors! Since much of the bass is provided by direct bone conduction from bass vibration, the woofers can be backed off somewhat. In the clubs in which I have used these devices, not only is the vibrating floor popular, but the ability to get away from the heavy bass once the dancers decide to leave the dance floor is another attribute.

Aside from reducing bass leakage into nearby spaces, another acoustical effect is crisper and tighter bass. At first I could not figure this out, but after taking some measurements, I realized that the reverberation and bass flutter echo effects are greatly minimized since much of the bass is through the floor and seating structure, not through the air — therefore, the room resonances in the space are not set off.

Too bad roller disco has faded, as skating on one of these floors is really an experience! Other neat possibilities are bar stools and bench seating near the dance floor. How about aerobic studios with a low impact bass vibration floor? Right now the first installations have been in special movie theaters (like the new Luxor theater in Las Vegas) and amusement park rides, but expect to see a lot more of this technique. ■

Tannoy Monitors Image; NAMM Leadership

Tannoy Monitors at Clinic

Image Marketing's first annual "Product Clinic" recently took place at Third Encore Studio in Los Angeles. One product discussed at the two-day clinic was Tannoy's new CPA-10S loudspeaker system.

The CPA-10S comprises one ten-inch dual concentric driver in which the mid-frequency and high-frequency sources are aligned to a point source, resulting in near uniform frequency response over a wide area of dispersion. Possible areas of application include concert reinforcement, movie theaters, upscale A/V installations, and high-quality public address systems.

NAMM's '93 Management Institute

This year's Management Institute, held in August at the Harrison Conference Center in Lake Bluff, IL, featured a keynote speech by Danny Cox, author of the book, "Leadership When the Heat Is On." Other lectures included "Why Customers Buy and How to Get Them to Buy More," "The Decision Making Concept," "Creating and Keeping Customers For Life," and "Converting Management to Leadership." In addition, two four-hour sessions on financial management covered such topics as "The Only Four Ways to Grow a Business and Their Risks," "Retail Self-Assessment Kit For Owners/CEO's," and "Prospering in the New Normal."

The NAMM Management Institute is designed to teach attendees how to become more effective leaders, discover decision-making concepts that work, and uncover ways to create and keep customers for life.

Bose Rides the Wave

The Wave radio from Bose is compact, measuring 4.5-inches x 14-inches x 8-inches, and weighs seven pounds. The unit has a 34-inch single ended waveguide inside it, intended to provide full sound for most home listening rooms. The Wave radio features AM and FM stereo radio and a dual alarm clock. In addition, it offers 12 radio presets, mute, scan and automatic sleep features, as well as a battery back-up in case of a power failure. All functions can be regulated by a credit card sized remote control included with the unit.

A compact disc player or a cassette recorder can be directly plugged into the Wave radio to provide alternative sources of music. Also, television sets can be plugged into the Wave radio. Finally, the Wave radio can be connected to any Bose powered loudspeakers, thus becoming the heart of a hi-fi system.

Allen & Heath at the Avalon

Allen & Heath's GL3 console was recently installed in three venues, stretching from Chicago to California. The unit currently provides a front of house mix for the Avalon Nite Club in Chicago, a bar featuring live music. The GL3 was also the choice of The Little Waldorf, in Reno, NE, to mix live bands on the club's stage. Finally, the console was installed in the Eclipse, a live music, DJ and karaoke club located in Cabo San Lucas, Baja California. The GL3 provides stereo main out and up to six independent monitor mixes. Other features include balanced XLR input and outputs, four stereo returns, and an input strip which includes phantom power, phase reverse, four band EQ with two sweepable midranges and six auxiliary sends with pre post switching.

In addition, the Saber Plus PA console was the choice of the Living Word Christian Center on the northwest side of Baltimore, MD. The console is housed in the sound booth and controls the house sound as well as four monitor mixes.

A-T Mics Find Universal Acceptance

The Universal Amphitheatre in Los Angeles recently installed Audio-Technica microphones for use in all house shows. The chosen mics were the AT4051 and the AT4033. The former is being used under the snare, on high hat, overheads, and percussion, while the latter is being applied to the piano.

Audio-Technica also made inroads in Texas, as over three-hundred AT857QMLa gooseneck microphones with AT8416 shock mounts were installed in the Texas Capital Extension in Austin. Primarily used for sound reinforcement, the AT857QMLa's are fed through an automatic microphone mixer as well as into both a tape-feed system for reporters and a house-tape recording system to record various meetings. Each microphone is additionally paired with a manual switch that mutes an overhead speaker and lights up when the microphone is active.

The ATM35 microphone has caught the eye of stand-up bass player Rufus Reid, who has been using the mic in both live and studio applications. Reid, along with drummer Akira Tana, is the leader of the jazz ensemble, TanaReid.

Finally, AT4051's were used to film what is being called the "hip-hop exterior scene, San Francisco," in the upcoming film, "Sister Act II. The three 4051s were suspended above the filming camera's view on a large bar spanning 24 feet, and were mounted in a traditional left, center, and right spacing. The AT4051 is a transformerless, externally polarized capacitor studio microphone featuring a frequency response of 20 Hz to 20 kHz.

Panasonic & Government Team Up

The U.S. General Services Administration has authorized Panasonic to sell the Panasonic VisionSeries 200 roll-about video conferencing system to Federal Government Agencies under GSA contract. The contract runs from October 1, 1993, to September 30, 1994, for the VisionSeries 200 system and video conferencing components, such as the WG-V510 audio/video codec, WG-

A410 acoustic echo canceller, and WG-V400 color video camera.

In other news from Panasonic, two computer drivers that support the company's multi-laserdisc players are now available through CompuServe. To download the computer drivers for the Windows 3.1 and Macintosh Hypercard computer platforms from CompuServe, a user needs to: access to CompuServe; select "Go" menus under the "Service" menu; type in "MULTIVEN" to go into the multimedia vendor forum; select "BROWSE" command under the "Library" menu; select "General Information" section.

The two files are listed as follows: PANMCI.ZIP Windows 3.1 MCI Driver for Panasonic's AG-LD30 and LX-150 multi-laserdisc players. Use PKUNZIP.EXE Program for exploding: PANA_L.SEA Macintosh Hypercard APDA driver for the AG-LD30 and LX-150. It is a self-exploding file; double click the icon.

New Prototype From Sharp

Sharp has developed a prototype of an ultra-compact, superlightweight HDTV LCD projector thanks to a newly developed poly-silicon TFT LCD panel. In this new panel, the amorphous (non-crystalline) silicon transistors used up to now for switching the transistors which control the liquid crystal molecules have been replaced with polycrystalline silicon transistors, allowing the new panels to made smaller.

The development of this two-inch poly-silicon TFT LCD panel with over 1.31 million pixels not only boosts the pixel count of the LCD panels, but also makes it possible to shrink the size of the projector's optical system. The prototype uses three of these new panels to reproduce the three primary colors — red, green, and blue.

SMPTE Gets Emmy

The SMPTE was presented with an Engineering Award for Outstanding Achievement in Technological Development by the National Academy of Television Arts and Sciences. The Emmy is the third that the Society has received, and it honors the development of the "In Plant Digital Serial Interconnection for Television," which is a series of standards and recommended practices that describe the serial connection of digital television signals within the plant.

The award-winning procedure was originally implemented by the Committee on Television Technology, chaired by S. Merrill Weiss, Consultant, and the Working Group on Studio Video Systems, chaired by Peter Symes, Grass Valley Group. The Working Group has now been reorganized into the Committee on Television Signal Technology.

The Society previously received Emmys in 1983 for the development of the 4:2:2 digital component video standards and in 1986 for the development of the D-1 recording system standards.

Drawmer Purchases SoundField From AMS Neve

Drawmer recently purchased the SoundField and ST250 microphone business from AMS Neve plc. All responsibility for product development, manufacturing, marketing and service of the SoundField and ST250 microphones has been transferred to SoundField Research Ltd, a sister company of Drawmer Distribution Ltd. However, SoundField Research will operate completely autonomously, utilizing its own technical and marketing personnel.

The sale of the microphone business resulted from the merger of AMS and Neve. The unified AMS Neve will focus wholly on its range of editing and mixing equipment.

ISC West In Las Vegas

The International Security Conference & Exposition West will be held at the Sands Expo and Convention Center in Las Vegas, February 1-3, 1994. Eight workshops, forty-six professional sessions, and two plenaries are on the agenda. Workshops include "CCTV Installation and Field Service," "Integration and Application of Access Control," and "Preparation for the NICET Exams." The sessions will feature such topics as "Security Litigation — Avoidance and Cost Control," "CCTV Fiber Optics," and "The World of Outdoor Space Protection." One plenary will deal with the ongoing challenge of false alarms, while the other will focus on the "hot" technology issues at showtime.

KEF's Executive Changes

Robert Heiblim, president of KH America (formerly Kinergetics US), announced the appointment of Jim Sullivan as vice president and general manager of KEF Electronics of America. Ray Lepper has moved to KH America as vice president, international projects. Sullivan's office will be located near Boston, MA, where the new location of KEF America's sales and marketing staff will be established. It is hoped that the changes will increase KEF's efficiency and competitive position.

XingSound Now Available

Xing Technology has announced the release of its MPEG audio compression software, XingSound. XingSound offers real-time, CD-quality compression and playback to users of 16-bit 44 kHz sound cards with on-board Analog Devices Personal Sound System DSP chip sets. The product also works with any 16-bit Windows-

compatible sound card and is capable of synchronizing audio with real-time video capture using Xing's MPEG-compliant video encoder board, XingIt!.

XingSound provides a user interface for record and playback and offers user-selectable capture rates from 4 kilobytes to 56 kilobytes per second. XingSound includes a software-only player enabling MPEG audio files to be played back on any Windows-compatible sound device. The software requires a 386/486 PC with at least 4MB RAM and any Windows-compatible sound card.

Gat Decor Chooses Jade

"Gat Decor," a leader in UK dance music, recently chose a

Soundtracs Jade for his Surrey, England, Studio. Following a career in the DJ business, Gat Decor began the process of equipping his studio which now includes the 48-channel Jade console complete with patch bay.

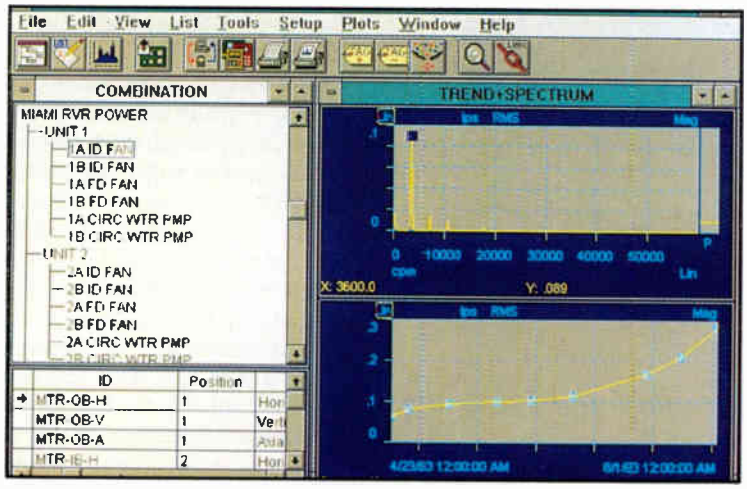
Decor's style lies largely in the progressive/dance field and since releasing "Passion," he has remixed several top ten dance tracks. He is currently mixing Jean Michel Jarre's "Chronologie Part 6" as well as recording his own album due for release next year.

Gentner's First Quarter Results

Gentner Communications Corporation recently announced their first quarter fiscal 1994 results. For the quarter ended September 30, 1993, the company reported net income of $195,043 or $0.03 per share on sales of $2.3 million compared to net income of $131,245 or $0.02 per share on sales of $2.2 million for the same period a year ago. This first full quarter of sales of the company's new teleconferencing products resulted in an 85 percent increase in revenues attributable to the teleconferencing division versus the company's previous (fourth) quarter.

Dynair Bridges the Gap

Dynair Electronics has an-



nounced a new line of modular digital interfacing and conversion equipment designed to bring the analog and digital worlds closer together. The Genesis product line consists of a complete line of 8 and 10 bit A to D and D to A converters and associated products, and will convert the full range of component and encoded analog signals to and from the several digital formats in current use.

The Genesis line features a full complement of audio conversion equipment, including a serial digital audio multiplexer which combines asynchronous AES/EBU digital audio with serial digital video signals. Fiber optic transmitters and receivers allow full bandwidth signals to be transmitted distances of over fifty kilometers. The equipment is housed in 1, 3, and 4 rack unit frames. The Genesis equipment was demonstrated at the recent SMPTE Show in Los Angeles.

Tannoy Helps Montel Williams

Tannoy Contractor Series CPA-5 speakers an CPA subbass systems are utilized for "The Montel Williams Show," which is taped at Times Square Studios in Manhattan. Fourteen CPA-5s are hung throughout the studio's ceiling, while four subbass systems are on the floor. The talk show, which involves a high degree of audience participation, is currently in syndication.

New Software From Entek

Entek recently released EMONITOR for Windows, a Predictive Maintenance software program that fully implements Windows technology within a Predictive Maintenance package. Features of the package include a single display panel that automates all routine daily operations, advanced alarm techniques, and use of Gupta, the accepted standard database for Windows. The system is also SQL-based for easy integration with other systems. The software is designed to allow users to gain extended insight into machine conditions by using the functions that Windows technology offers, such as multiple views of data simultaneously and easy access to reports.

Avid Edits Documentary

Avid Technology's Film Composer digital nonlinear editing system was used to edit "It's All True," a feature documentary about Orson Welles' lost 1942 South American film by the same name. Film editors were forced to deal with six different types of film and tape formats in the making of this documentary. All the material was digitized into a Media Composer running Avid's 24-fps film software. They were then able to customize the interface and sort the footage into categorical bins.

In addition, the Film Composer was used to organize material based on Welles' own notes, as he worked at times without a script. Because the documentary is bilingual, the four tracks of audio on the Media Composer proved useful. Editors cut the film with four active tracks at all times: Portuguese and English dialogue, music, and sound effects.

Welles began filming "It's All True" in 1942 for RKO and Nelson Rockefeller. However, the project was never completed, and the footage was believed to have been lost until 1985, when the original negative was discovered in an old RKO nitrate vault on the Paramount Pictures lot.

ShowBiz Expo East Info

The Third Annual ShowBiz Expo East, set for January 6-8, 1994, at the New York Hilton and Towers in Manhattan, expects to host 225 exhibitors, over 45 industry-driven conference panels, and a variety of special events sponsored by premiere industry trade groups and organizations. This year's theme, "Go East — It's a Whole New Direction," refers to the renewed vitality of the East Coast Production Community. Over 10,000 people are anticipated to attend the three day event. Panels will discuss current trends in new technology, including virtual reality, interactive, CD-ROM, digital composing, special effects, and 16mm photography.

SSL Chosen By Snaptrax

Solid State Logic's ScreenSound has been chosen by Snaptrax, a new audio post production company based at Denham film studios, outside London. Two ScreenSounds are currently in use at the facility, along with a SoundNet digital audio network. Current projects involving Snaptrax include a new drama series starring Hugh Laurie entitled "All Or Nothing At All."

In addition, G Plus Consoles have found their way to the far East at Sountec Studios and TaeSung Records, with both installing SL 4000 G Plus desks. Sountec Studios — also called Shinnara — chose the SL 4064 G Plus. The console will be used for a wide variety of musical styles, including Korean folk songs, pop songs, and heavy metal. The owner of TaeSung Records is employing the SL 4048 G Plus to

Distortion Free.

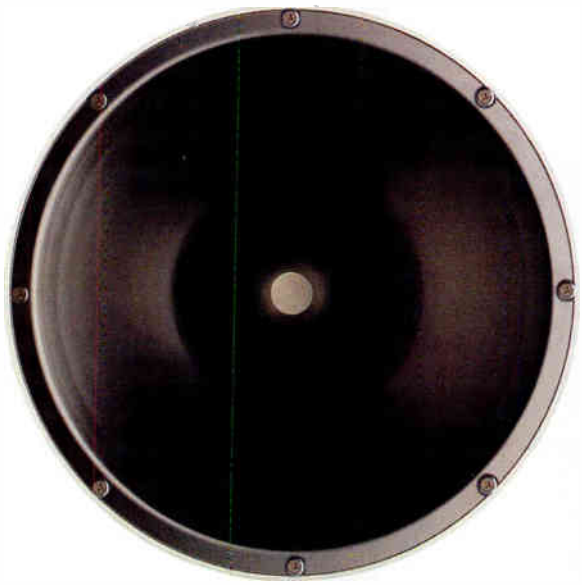
SOUND REINFORCEMENT LOUDSPEAKER TECHNOLOGY

TEC AWARD NOMINEE 1993

OUTSTANDING TECHNICAL ACHIEVEMENT

It's funny, but sometimes the worst things in life are free! Take distortion for example. For too many years, if you wanted the high sound pressure levels that horn/driver combinations deliver, they were the only game in town. Period. There were trade offs of course. Inferior coverage that was never the same at any two frequencies and with this, poor power response that made for inconsistent performance from room to room. And worst of all, poor sound quality and very high levels of distortion. All of this Free!

Distortion Free.



But Ramsa has an alternative to those old compromising horns. Our engineers have come up with a technology they call the Spherical Waveguide and it's in our new T-Series trapezoidal speakers. With these wide-range, compact speaker systems, you get all of the good stuff of horns and none of the compromises.

Good stuff like the power handling and efficiency needed for the tough demands of professional sound reinforcement, but with the sound quality of audiophile and high-end studio monitors.

Those Spherical Waveguides are the reason. Alone or in arrays, the T-Series deliver superior sound quality, with extremely low distortion, consistently in all applications. Whether rock & roll or in a house of worship and all points in between.

We haven't got space here to tell you all of the exciting performance gains in the new T- Series systems and particularly the Spherical Waveguide, so if you would like to know more, please contact us here at Ramsa at (714) 373-7277 and we'll send you more information. But be warned! You're going to rethink all you have come to accept about horns!

RAMSA

Panasonic

Broadcast & Television Systems Company

Circle 217 on Reader Response Card

make a record in commemoration of his 20th Anniversary as a singer. He then plans to use the console for recording traditional Korean folk songs, as well as continuing to record his own songs.

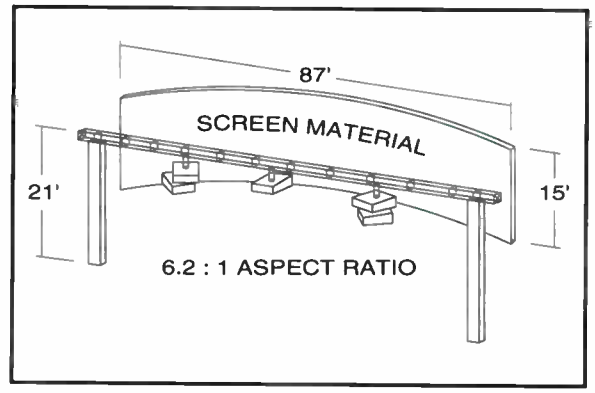
RE America Intros New Musicam

RE America has introduced the RE 660 and RE 661 Musicam Digital Audio Codec. The RE Musicam 660/661 was developed to enhance existing Musicam technology with broadcast specific features. The new unit provides up to 20 kHz of audio bandwidth and features mono, dual mono, stereo, and joint stereo operation with selectable bit rates from 56 to 384 kbit/s. Standard features include AES/EBU and SPDIF digital interface, two-times V.35, X.21 or RS 422 interface and a front panel digital headphone jack for monitoring of digital or analog inputs.

Also new from RE America is its RE 663 ISDN Musicam Decoder and RE 662 ISDN Musicam Encoder. Capable of multiplexing up to three Basic Rate Interface ISDN lines, the RE 662/663 can dial bandwidth on demand between 56 and 384 kbit/s and supports both EurolSDN and American NI-1. The RE 662/663 features three network terminal adaptors which are tied to an inverse multiplexer and has a front panel mount standard telephone interface that allows for telephone talkback using single-line telephone handsets or ISDN-ready telephone handsets.

Package From Dawber

Dawber & Company is making its wide-screen presentation technology available to exhibit builders and their clients. It is a complete theater system, featuring HDTV-spec images measuring 15 feet high by 87 feet wide, for audiences of 50 to 400 persons. The equipment package includes laserdisc players, scan converters, video projectors, audio mixers, amplifiers, speakers, lighting instruments, lighting controllers, computers, screens and support trusses for the screens, projectors and speakers. Dawber's AV technicians coordinate directly with exhibit builders or expo services to ensure proper I&D and show run.



Dawber specializes in corporate films, sponsored entertainment and product promotion for Fortune 500 clients. The company has had its work installed at EPCOT, The Smithsonian, and the Chicago Museum of Science & Industry.

Ziegfeld Revamps With Crest

Crest's NexSys Computer Controlled Audio System was recently installed in the 2000-seat Ziegfeld Theatre at the Reno Hilton and Casino. The NexSys' snapshot and MIDI capabilities were important factors in its selection. NexSys is designed to bring the

operating status of the whole system to one's computer monitor, with screens that show input and output, VUs, heatsink temperatures, gain settings, and all other parameters. The installation of the system was part of a half-million dollar renovation of the Ziegfeld Theatre, which houses a production stage over one acre in size.

Mark IV Prepares For Network Standard

With the AES SC-10 subcommittee continuing its mission of finalizing industry-wide network and protocol standards, Mark IV Audio is aiming to become the first pro audio entity to offer a complete line of network-compatible products. Recently, Mark IV entered into a licensing agreement with Lone Wolf to utilize its MediaLink network technology. In addition, they have given Lone Wolf a contract for development of hardware interfaces and software applications layer software for several Mark IV products.

Altec Lansing is currently in the final development stages of interface technology that will provide compatibility within the MediaLink network. Likewise, Vega is approaching introduction of a low-cost interface to work with MediaLink that will also feature an open architecture port to accommodate other networks. Electro-Voice and Klark-Teknik have announced that many of their electronic products will now feature this same open architecture design to ensure network compatibility. Klark-Teknik is also developing specific interface hardware and software for its DN3600 programmable equalizer.

Axemaster Uses Digitech

Brad Gillis, former guitarist in the successful '80s band, "Night Ranger," recently employed a GSP-21 Legend in the recording of his new solo project, "Gilrock Ranch." The processor was used on several tracks, including "Mr. Lollipop." In addition, while on the road with the new three-piece lineup of Night Ranger, Gillis has been using the DigiTech Whammy Pedal.

Another musician (and producer), Thomas Dolby, recently has been using a DigiTech VHM-5 Vocalist in his personal studio. Dolby is currently producing an album for Dr. Fiorella Terenzi, a professor of astrophysics at Milan University who has set her sights on pop stardom in addition to planning to host a "hip" science-oriented television show this fall. This apparently is an example of life imitating art, as Dolby hit the pop charts big in the mid-80s with the song, "She Blinded Me With Science."

Finally, PineTrax studios, located in Holyoke, MA, have been using a number of DigiTech MEQ-14 MIDI-programmable graphic equalizers for various recording applications. Currently in the process of expanding the facility to twice its original size, PineTrax handles a variety of local artists encompassing jazz, rock, metal and rap, as well as commercial production.

DRIVERS

(Continued from page 35)

less signal from the power amp, and therefore has less top-end output.

Kapton has not been universally accepted for bobbins in compression drivers for two reasons: the attachment to the dome has been awkward and the "sound quality" of the material is not as good as Nomex. Some Wisdom and Witchcraft on this are as follows.

Attachment to the dome has been awkward, as Kapton is a flat film sheet. Three dimensional forming of Kapton has only recently become predictable and practical. Using these techniques, a bobbin can be formed that attaches to the dome, identically to some of the techniques used with Nomex.

The sound quality differences between Kapton and Nomex are due to the Q of the material and effects related to bobbin torsional resonances. If Kapton is to be used, then ferrofluids can help damp out these effects as well as increase the thermal conductivity of the gap. If Nomex is used, then one supplier of DuPont's Nomex bobbin material, Hisco, offers an epoxy saturated material with enhanced characteristics. You can spot the epoxy treatment; instead of the yellowish color of Nomex, the appearance is blue.

EXCURSION LIMITATIONS — A NEED TO BE APPLICATION SPECIFIC

There are always tradeoffs with output, bandwidth, sensitivity, distortion, etc. If the designer is trying to achieve (for example) increased output in a compression driver, it would not be realistic to expect to achieve substantial gains in both acoustic output capability at the low end of the response as well as the mid-band.

Finally, lets briefly look at one example, such as a high output midrange/high frequency compression driver. If the engineer, the marketing department, and the end-user accepts the premise of a compression driver targeted to achieve higher output levels, but with a crossover point moved upward from 500 Hz to 1000 Hz, then physics will cooperate. The application would be in either 2-way systems with an extended range woofer or 3-way speaker systems using cone driven midranges or very large format compression drivers. Most of the new processor speakers use the woofer up to 1000 Hz or higher.

By moving up the crossover point from 500 Hz, which was originated in the early days of movie theater sound, to perhaps 1000 Hz, the compression driver will no longer be quite so vulnerable to mechanical failure modes. Specifically, these are diaphragm/phase plug collisions, suspension fatigue and shattering, leadout wire failures, and coil/top plate scrapes due to dome rocking on large excursions.

Of course, just moving the crossover point up an octave does not address why the crossover point used to be set lower! Attention must be paid to the design of the woofer's on-axis and off-axis response, to ensure that quality and intelligibility will not unduly suffer from changes in system design. Cone material, cone body profile, selection of surround type, not to mention voice coil selection are all critical factors, but that is another story. ■

Auto Mixer; Rackmount Console

A-T Gets Smart

Audio-Technica has introduced the AT-MX341 Automatic Microphone Mixer. Also known as the SmartMixer, the unit is a microprocessor-controlled, automatic-switching, four-channel microphone mixer.

The SmartMixer features two modes of operation to which each microphone can be independently switched via front panel priority pre-select switches. With the priority switches down, only one microphone at a time is allowed to be on. With the switches up, the microphones are disconnected from the control bus. This tells each microphone to come on independently when its input sound level tells it to turn on and allows all of the microphone to be heard at once. Microphone attenuation is factory-set at eight dB but can be internally adjusted between six and 20 dB.

AT-MX341's can be cascaded with a link cable and special connectors on the rear panel, allowing numerous microphones to be controlled by one mic at the end of a string of mixers. Other features include a seven-light LED output level meter on the front panel, a master threshold control, and female XLR balanced inputs and a line-level output through a male XLR connector.

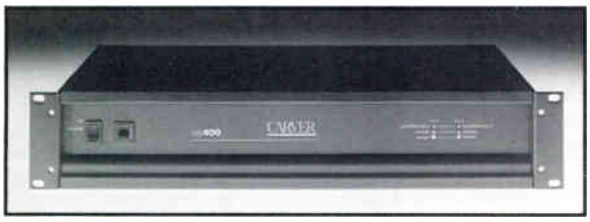
Also new from Audio-Technica is the ATW-1235 and ATW-1236 professional wireless microphone systems. Fully functional within an operating range of up to 1500 feet, the systems provide a broad audio frequency response with a RF stability within ±0.005 percent. Each system features a choice of 20 operating frequencies.

Circle 1 on Reader Response Card

Allen & Heath's New Console

The GL2 is a four-subgroup, rackmount live mixing console designed to function as a front-of-house monitor and multitrack-recording mixer. The 14-channel unit features balanced XLR inputs and outputs as well as four auxiliary returns. The input strip includes phantom power, four-band EQ with two sweepable mids and EQ I/O switch, as well as six auxiliary sends with pre/post switching. The board can be stored either horizontally or vertically in a standard equipment rack.

The GL2 can be expanded with an optional SYS-LINK module. The system allows two or more boards to be linked together with a connection at buss level. In addition, an optional connector



panel allows other manufacturer's consoles to be bussed into the GL2, including auxiliaries and subgroups.

Also new from Allen & Heath is their SMPTE module for the GS3V mixing console. The module will allow the GS3V to sync, via SMPTE, to all timecode sources. The module simultaneously sends MIDI timecode via the MIDI-out jack on the GS3V, and is capable of reading and writing SMPTE in all of the standard timecode formats.

Circle 2 on Reader Response Card

Amplification From Carver

The CA-400 is the latest addition to Carver's new line of stereo power amplifiers for fixed sound installation. Controls and connectors on the rear panel include 11-detent input level potentiometers, two parallel sets of balanced inputs (barrier strip and XLR-F), barrier strip outputs, and mode switch for selection of stereo, bridged mono, or dual mono operation. Internal jumpers are provided for level potentiometer defeat, ground lift, input sensitivity select, and true parallel mono operation.

Circuit protection features in the C-400 include DC fault, thermal overload, and output short. In addition, all connected speakers are protected by a clipping eliminator circuit and output muting relays for on/off transient suppression. On the front panel, three status LED's indicate signal present, clip/protect, and ready/fault.

Circle 3 on Reader Response Card

Yorkville Providing Power

The Audiopro 3400 power amplifier delivers 1200 watts per channel at 4 ohms. The 40 lb. 2 rack space unit utilizes the same 2-tier design as Yorkville's AP-3000, but is designed for 4 ohm speaker loads. Features include an Energy Management System which monitors and regulates AC current to maintain high performance from 120V 12 amp circuits, and toroidal power supply. The AP-3400 is designed for sound reinforcement applications involving larger speaker systems.

Circle 4 on Reader Response Card

Go Retro With Electrohome

Electrohome limited has introduced the Retro III, a self-contained, rear screen projection enclosure. The 67-inch diagonal wide-angle screen produces an image suitable for areas subject to high-ambient light conditions, such as boardrooms, control rooms, trade shows, and training facilities.

The Retro III is configurable with virtually all Electrohome projectors, including the ECP 2100, 3000, and 4000 series, as well as the Marquee 8000 projector. In addition, the unit can be fitted with an optional black matrix screen for creating high contrast images in situations with extremely bright light conditions. The Retro III is mounted on heavy-duty concealed casters, and the screen unit is finished in charcoal gray and wood grain arborite.

The support section is finished

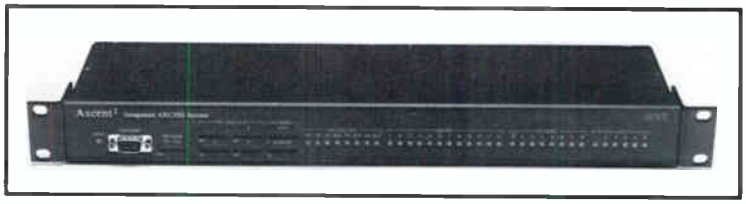
in corded polypropylene with black anodized aluminum base supports. A rear access door in the base permits slide out projector access or removal. The unit includes space inside for the addition of audio speakers.

Circle 5 on Reader Response Card

AMX Goes Remote

AMX's Axcent² control system incorporates many features of the full-sized Axcess system, but was designed exclusively for small to mid-sized installations. The range of equipment control options includes two RS-232/422 data ports, two RS-232 data ports, eight IR/serial ports, 12 relays, and six input/output ports. Axcent² is compatible with the complete line of AMX control panels and comes within a single-height rack frame.

Circle 6 on Reader Response Card



Audio Logic Delays

The D20 digital room delay is a permanent-installation digital delay unit designed for acoustic alignment of under-balcony or multiple speaker arrays. The D20 features two electronically balanced inputs and a choice of two, four, or six servo-balanced outputs. Input signals are 64 times oversampled by an 18 bit A/D converter while the outputs are eight times oversampled. The unit provides a standard minimum delay increment of 20 microseconds, which may be further divided into 325 nanosecond increments for each stereo output pair. The maximum delay time is 1.365 seconds in stereo and 2.73 seconds in mono. The delay memory may be expanded with an optional module. Delay units are selectable in milliseconds, microseconds, seconds, inches, feet, yards, centimeters, and meters, while the delay increment may also be specified by the user. Computer control of the D20 is accomplished via an optional plug-in MIDI module.

Circle 7 on Reader Response Card

Niles Now On-Site

The On-Site System, from Niles Audio Corporation, is designed to offer custom installers increased on-site flexibility by allowing the user to create custom configured connector plates, or change the color of wall-mounted volume controls, wall-mounted switches and infrared sensors, on site. The bulk-packaged blank connector plates are available in various hold patterns: one, two, three, four, six and eight holes on a single gang wall plate. The plates are available in both Decora and standard styles in Almond, Black, Bone and White.

The bulk-packaged connectors will fit any hole in any plate, and all of the connectors can be mounted with a supplied hex nut. Five varieties of connectors are available: solderless 5-way binding post; solderless banana jack; solderless RCA connector; RCA connector with solder-tabs; and F-

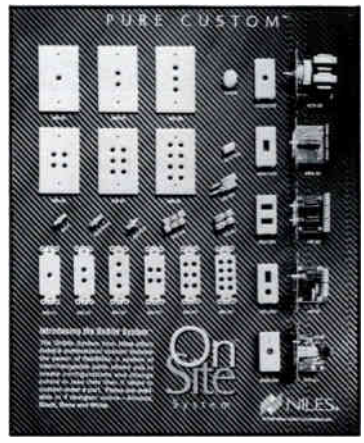
Connector. Custom designed, gold-plated banana plugs are also available.

Three types of wall-mount selectors and IR sensors are also supplied in bulk: a Speaker/Amplifier Selector, Speaker A/B Selector and Speaker/Headphone Selector and a Decora-Style IR Sensor. The corresponding snap-in color plates and buttons are supplied in bulk in Almond, Black, Bone and White.

Circle 8 on Reader Response Card

Processing With Ramsa

The Ramsa WZ-DE40 digital multiprocessor functions as an all parameter variable, stereo or two-channel compressor limiter, graphic equalizer, parametric equalizer and spectrum analyzer. The unit features an auto notch

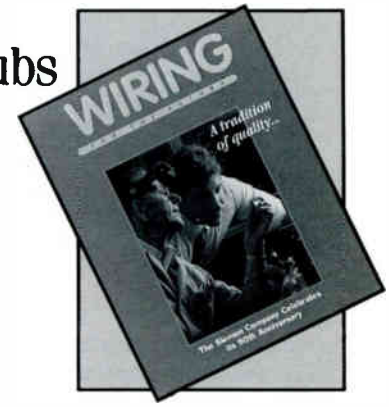


filter for automatic feedback detection and elimination, a MIDI connection for uploading, downloading or linking multiple units and has a dynamic range of 107 dB. The system has 20 bit resolution and can be locked or unlocked as a stereo unit. All 99 controllable parameters can be memorized to 99 locations with immediate recall

Circle 9 on Reader Response Card

LITERATURE

Siemon and P-H Pubs



Siemon Looking to Future

"Wiring for the Future," a Siemon Company publication, provides information about cable and connection hardware for telecommunications networks. The most recent edition features an article entitled "How to Evaluate & Upgrade Imbedded Cabling Systems" and an engineering report entitled "An Overview of Telecommunications Outlet Connectors for Unshielded Twisted-Pair Cabling." Also included is new product information on the Company's Category 5 M1-50 block.

Circle 10 on Reader Response Card

P-H Connector Data Sheets Available

Two new data sheets on 16 gauge electrical connectors from Packard-Hughes Interconnect are now available free of charge to design engineers. The MRS connectors offer crimp removable, solder tail, shielded, wire wrap and fiber optic contacts. Considered one of the most dense 16 gauge contact system packages in the industry, this series can accommodate up to 212 contacts in one connector, with the MIL-C-28748 or equivalent commercial specifications.

Circle 11 on Reader Response Card

PEOPLE

Knudsen at Kurzweil

Kurzweil Appointment

Kurzweil has appointed Craig Knudsen as director of marketing for Kurzweil digital home products. Knudsen will be responsible for new product development and marketing functions related to Kurzweil's home line. Knudsen has worked previously for IBM as a marketing representative and was an advisor/instructor for its corporate training program.

Knudsen

EIA/CEG Promotion

The Electronic Industries Association's Consumer Electronics Group announced the promotion of Jeanne Chircop to the position Staff Director of Membership Communications. Chircop will coordinate and oversee all activities of EIA/CEG's Assistive Devices Division and Product Education Committee, including publication of the "CE Product Terminology Dictionary" and Diskette. Her other responsibilities will include managing and editing "CE Network News," the association's membership magazine. Chircop joined the EIA/CEG Communications department in December of 1988 as manager, and moved to the Membership & Industry Relations department in October of 1991.

CALENDAR

Upcoming Events

JANUARY 1994

ShowBiz Expo East and East Coast Theatre Conference: New York, New York. Contact: (213) 668-1811. January 6-8.

Consumer Electronics Show: Las Vegas, Nevada. Contact: (202) 457-4900. January 6-9.

NSCA Owners and Managers Conference: Amelia Island Plantation, Florida. Contact: (800) 446-NSCA. January 20-23.

National Association of Music Merchants: Anaheim, California. Contact (800) 767-6266. January 21-24.

The New Product Showcase (ICIA): Atlanta, Georgia. Contact: (703) 273-7200. January 21-22.

FEBRUARY

International Security Conference: Las Vegas, Nevada. Contact: (708) 299-9311. February 1-3.

Association for Research in Otolaryngology: St. Petersburg Beach, Florida. Contact: (515) 243-1558. February 6-10.

National Hearing Conservation Association: Atlanta, Georgia. Contact: (515) 243-1558. February 17-19.

MARCH

intermedia: San Jose, California. Contact: (203) 352-8240. March 1-3.

National Association of Broadcasters (NAB): Las Vegas, Nevada. Contact: (202) 429-5300. March 21-24.

APRIL

National Sound and Communications Association (NSCA): Las Vegas, Nevada. Contact: (800) 446-NSCA. April 7-9.

USITT: Nashville, Tennessee: Contact: (317) 494-8150. April 12-16.

Electronics Distribution Show (EDS): Las Vegas, Nevada. Contact: (312) 648-1140. April 26-28.

MAY

ICA Expo: Dallas, Texas: May 22-26.

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Electroacoustic Development Co.	77	234
Exchange National Funding	77	230
Gem Sound	47	275
Gemini Sound	8	216
Gold Line	73	270
JBL Professional/Soundcraft	33	
Klipsch Professional	7	258
LinearX Systems	5	219
Mackie Designs	7	211
Marantz Professional	35	262
Menlo Scientific Acoustics	74	263
Meridian Communications	77	231
Music Supply Company	77	236
NCAC	64	280
OAP Audio	24	261
Omnicraft	73	286
Opamp Labs	77	235
Peavey Architectural Acoustics	11	207
Peerless Industries	18	255
QSC Audio	52/53	208
RCI Systems	70	265
Racom	68	279
Ramsa/Panasonic	67	217
Rane	69	257
Raxxess Metalsmiths	50	287
Renkus-Heinz	30	251
Roadie Products	77	237
Rolls	72	271
Sabine Musical Manufacturing	63	250
Sam Ash	72	288
Sennheiser Electronics	36	218
Shure Brothers	3	205
Sonic Systems/Soundsphere	17	248
Sonic Systems/Soundsphere	65	249
SoundTech	50	260
SoundTech	13	268
Tascam	31	259
Tektone Sound & Signal	55	274
Telex Communications	58,59	252
University Sound	CII	203
Whirlwind	28	273
White Instruments	13	272
Winsted	68	281
Yamaha Pro Audio	22/23	254

FREE INFORMATION
Use the Reader Service Card opposite page 18. Just circle the RS# of products that interest you. Detach, and Mail!

"While every care is taken to ensure that these listings are accurate and complete, Sound & Communications does not accept responsibility for omissions or errors."

MARKETPLACE

HELP WANTED

STENTOFON®
Communications, Inc.

- Base salary, commission, bonuses
- 401K retirement
- Car allowance
- Full expense reimbursement
- Paid life, health, dental insurance for employee
- Two positions: Dallas, TX & Chicago, IL

Regional Sales Manager
Here is an opportunity to join the finest sales and marketing organization in the field of specialized voice communications. Responsibilities include managing a regional distribution network of reselling dealers and reps, making product demos and presentations to users and specifying engineers, 40-50% travel throughout 10-12 state area. The successful candidate will possess at least 5 years industry experience, preferably w/ manufacturers, excellent communication and organization skills, an aptitude to work with technical products, and a proven winning track record.

Send resume in confidence to: Stentofon Communications, Inc.
Attn: Fred Hall, VP Sales • 6119 Connecticut Ave. • Kansas City, MO 64120
No phone calls, please

biamp®

New technology ventures and sales growth create a need for innovative and enthusiatic people to fill the following positions at Biamp Systems.

Electronic Design Engineer

Electronic engineer for the design of analog and digital audio and digital control circuits for professional audio devices. Candidates should possess at least a BSEE with experience in analog and digital audio circuitry design.

Regional Sales Manager

Sales professional to work with manufacturers' reps, Biamp dealers and end-users in the promotion of Biamp products in the eastern US. Position requires a self-motivated and ambitious professional with excellent people skills. Residence in eastern US is required.

Please send your qualifications to:

BIAMP SYSTEMS
14270 N.W. Science Park Drive
Portland, OR 97229
Attn: Ralph Lockhart

Biamp Systems is an equal opportunity employer.

A-V/Sound Systems Engineer/Installer
Well-established South Florida sound, video, & A-V systems contractors and pro-audio dealers looking for top-notch individual to lead installations and field engineer high-caliber projects such as convention centers; meeting facilities; hotel & boardroom systems; churches; schools; airport projects; hospitals and government facilities. Individual to be able to read plans, manage installation personnel team(s), and solve technical problems. Salary and benefits commensurate with abilities.

Contact: Rod Sintow at
PROFESSIONAL SOUND SERVICES, INC.
Tel: 305-891-2206

SALES
Sales Engineer for Pro audio & related systems. Able to call on Architects & Engineers in NYC area. Self-Starter with ability to design, write specs & negotiate direct sales. Exp & track record a must. Send resume to Dept S, PO Box 1024, Syosset, NY 11791

This ad may be small
But You're Reading It
For Rates and Information
Call (516) 767-2500

BLUE BOOK 1994

For Extra Copies Send $12.00 (postage & handling included) To:
Circulation Director,

The BLUE BOOK

25 Willowdale Ave., Port Washington, NY 11050

MARKETPLACE

How To Place a Sound & Communications Ad

Print or type copy indicating capital letters and bold type. All rates are based on column inch. 1X rate for a classified ad $63. (Includes borders, typesetting and company logo if desired.) 1X rate for a marketplace ad (product) is $96. Frequency discount available. Call for information.

CLASSIFIEDS

- ❑ Business Opportunities
- ❑ Equipment for Sale
- ❑ Help Wanted
- ❑ Employment Wanted
- ❑ Facility for Sale
- ❑ Miscellaneous

MARKETPLACE

- ❑ All product and services

Sound & Communications Ads Get Results!

Company Name _____ Name _____

Address _____ Phone _____

Method of Payment ❑ Check Eclosed ❑ Visa ❑ American Express ❑ MC

Card # _____ Exp. Date _____ Signature _____

Mail or Fax Copy to:
Sound & Communications Marketplace
25 Willowdale Avenue, Port Washington, NY 110050
Phone: 516-767-2500 FAX: 516-767-9335

PRODUCT CHECK: MALLS AND SHOPPING CENTERS

Products most frequently used in mall and shopping center installations...

. . . NOW IN PROGRESS

PRODUCTS	FIRST PLACE	SECOND PLACE	THIRD PLACE
Microphones	SHURE	TELEX	UNIVERSITY
Speakers	QUAM-NICHOLS	ATLAS/SOUNDOLIER	LOWELL
CD Players	SONY	PANASONIC	PIONEER, TEAC*
Tape Players	AEI	BOGEN	TEAC
Amplifiers	TOA	BOGEN	CROWN
Video Monitors	BURLE	SANYO	SONY
CCTV Cameras	BURLE	PANASONIC	SANYO

*** Indicates tie**

. . . IN LAST SIX MONTHS

PRODUCTS	FIRST PLACE	SECOND PLACE	THIRD PLACE
Microphones	SHURE	TELEX	UNIVERSITY
Speakers	QUAM-NICHOLS	ATLAS/SOUNDOLIER	LOWELL
CD Players	SONY	PANASONIC	PIONEER
Tape Players	AEI	TOA	TEAC
Amplifiers	TOA	BOGEN	CROWN
Video Monitors	BURLE	SANYO	SONY
CCTV Cameras	BURLE	PANASONIC	SANYO

*** Indicates tie**

SURVEY METHODOLOGY

1. The sampling pool for the survey consists of sound and communications contractors from Sound & Communications' subscription list. Only contractors within the United States and Canada are called.
2. In a telephone survey, contractors/installers selected at random are asked to identify what brand they used for various products in installations completed in the past six months and those in progress. A different type of installation is highlighted each month.
3. On completion of the survey, results are tabulated and the product brands are ranked on a scale from one to three, with number one having the most votes. Separate rankings are made for installations occurring in the past six months and for those in progress.
4. An asterisk (*) denotes a tie for that ranking.

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EQ Section

A warm, pristine, musical, British sounding EQ because it is British. The four band EQ (with in-out switch!), features fixed point shelving high and low frequencies with centre points of 12 khz and 70 Hz respectively. The peak/dip upper mid band sweep is continuously variable from 500 Hz to 15 khz, lower mid band from 35 Hz to 1.5 khz. All bands feature 14 db boost and cut at 18db per Octave.

Input Section

All inputs feature professional standard connectors. TRS balanced line inputs, and individual 48 v phantom power switch (avoid embarrassing pops and fully power your hottest, power hungry microphones.) Our mic/line switch works as a 20 db pad on the XLR connector allowing you to plug into balanced XLR line level inputs when you need to.

Output Section

All four discrete subgroup outputs, Left, Right and Main outputs feature balanced XLR connectors and TRS insert points for simple interfacing of your finest signal processors.

Stereo Inputs

Stereo inputs featuring more EQ than most consoles have on their *mono* inputs. With two sets of inputs per channel and an A/B switch, you have the flexibility to select between 4 stereo sources (keyboards, CD etc.) for multitrack recording, used in conjunction with the 4 AUX/tape returns, you can bring in 8 tracks of tape while still tracking all of the other 10 inputs and getting a full function studio monitor feeds as well!

Auxiliary Section

6 discrete auxiliary sends selectable pre fader (for monitor or studio headphone sends) or post fader (for effects sends). Routing and flexibility not found on mixers costing hundreds, even thousands more!

AUX Reverse Routing

Full function stage monitor console, ***it's that simple!*** Routing switches via our unique source reverse switch allows the console to be converted from a recording/Front of House sound reinforcement board to an expandable 18:6 stage monitor console with a fully selectable engineer's cue mix.

Faders

As is the standard on all professional mixers of its class, the GL2 boasts full throw 100 mm Alps™ faders for thousands of hours of smooth, seamless operation.

Master Section

Four discrete subgroups, left and right outputs, and the AUX reverse section allow the GL2 to adapt in ways impossible on other compact mixers.

Tools, not toys.

Under the Hood

Careful attention to detail, as in individual circuit boards for each channel, fastidious component selection, and the best of British engineering all combine to establish the highest standard of performance... performance that is daily tested and confirmed anew.

The GL2 is the worlds first multi-function mixer perfectly suited for Front-of-House Monitor, and Multitrack recording. ■ The ultimate in flexibility, this compact rackmount unit reveals a world of new opportunity — the ability to adapt. ■ In basic format, the **GL2** is a 16 by 4 by 2 by 1 system for quality Front-of-House mixing, but at the touch of a button it's instantly configured as a 16 by 6 plus 1 Stage Monitor mixer. Another button and you're set up for digital Multitrack recording. No fuss — no compromise — no limitations for the future. Our unique SYS-LINK™ system gives the **GL2** the means to grow as you do. Designed and built by engineers that have been bringing you audio tools with the superb specifications and quality you expect from Allen & Heath. ■ Audition the latest tool for the working professional at your nearest Allen & Heath dealer or call us for more information.

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ALLEN & HEATH

Nearly 2 inches maximum excursion without mechanical failure.

An all-new, long-span cloth surround offers high axial stability and freedom from coil rubs.

What a difference an "A" makes...

A few years ago, designers of professional high-output woofers fought to keep voice coils cool–and in one piece–with high power inputs. Today, there is a new battleground–maintaining mechanical stability over months and even years of actual use. Only Electro-Voice has engaged this battle–and won.

Our 1000-watt EVX woofers were subjected to five years of rigorous field testing and research into failure modes not revealed in normal lab testing. The result: **the new EVX-150A and EVX-180A high-power woofers** are the finest woofers currently available.

A variety of carefully evaluated changes were made to the geometry and materials of all moving parts–spider, surround, cone and voice-coil leads–giving the new EVX woofers **10 times greater resistance to long-term fatigue and as much as 5 dB more output capability than their predecessors.**

Nothing comes close to the performance and reliability of an EVX. Arrange for a demo at your EV dealer and hear for yourself what a difference an "A" makes.

New spider lasts 10 times longer.

Increased clearance eliminates lead breakage and ticking noises at excursion extremes.

Electro-Voice, Inc. a MARK IV company 600 Cecil St. Buchanan, MI 49107
Phone: 616/695-6831 Toll free: 800/234-6831 In Canada: 613/382-2141

Circle 201 on Reader Response Card