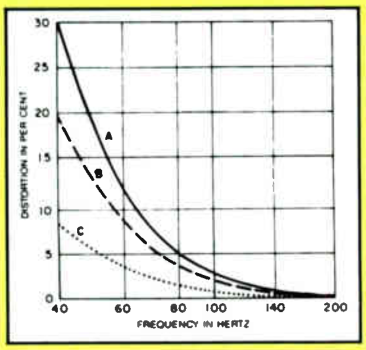
SOUND & COMMUNICATIONS

Volume 35 Number 1 January 1989

THE WORLD TRADE CONFERENCE CENTER

It takes more than podium mics and chalkboards to create a conference center capable of enticing a business to choose an outside facility for important gatherings. In an unusually cooperative effort between the architects and the acoustical consultants, an elegant, state-of-the-art conference center has been constructed in St. Paul, MN. The combined excellence of architectural and technological design make this facility an extremely attractive alternative to in-house meeting and conference rooms. **38**

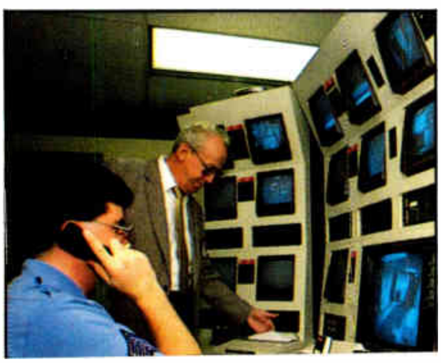


THE VOLKMANN LIBRARY

The "voice of RCA," audio pioneer Harry F. Olson, did a great deal of research into the problem of nonlinear distortion in direct radiator loudspeakers. From the archives of the John Emil Volkmann library, we pre[illegible] proposed method of reduc[illegible] of distortion.

SOFTWARE REVIEW: CADP

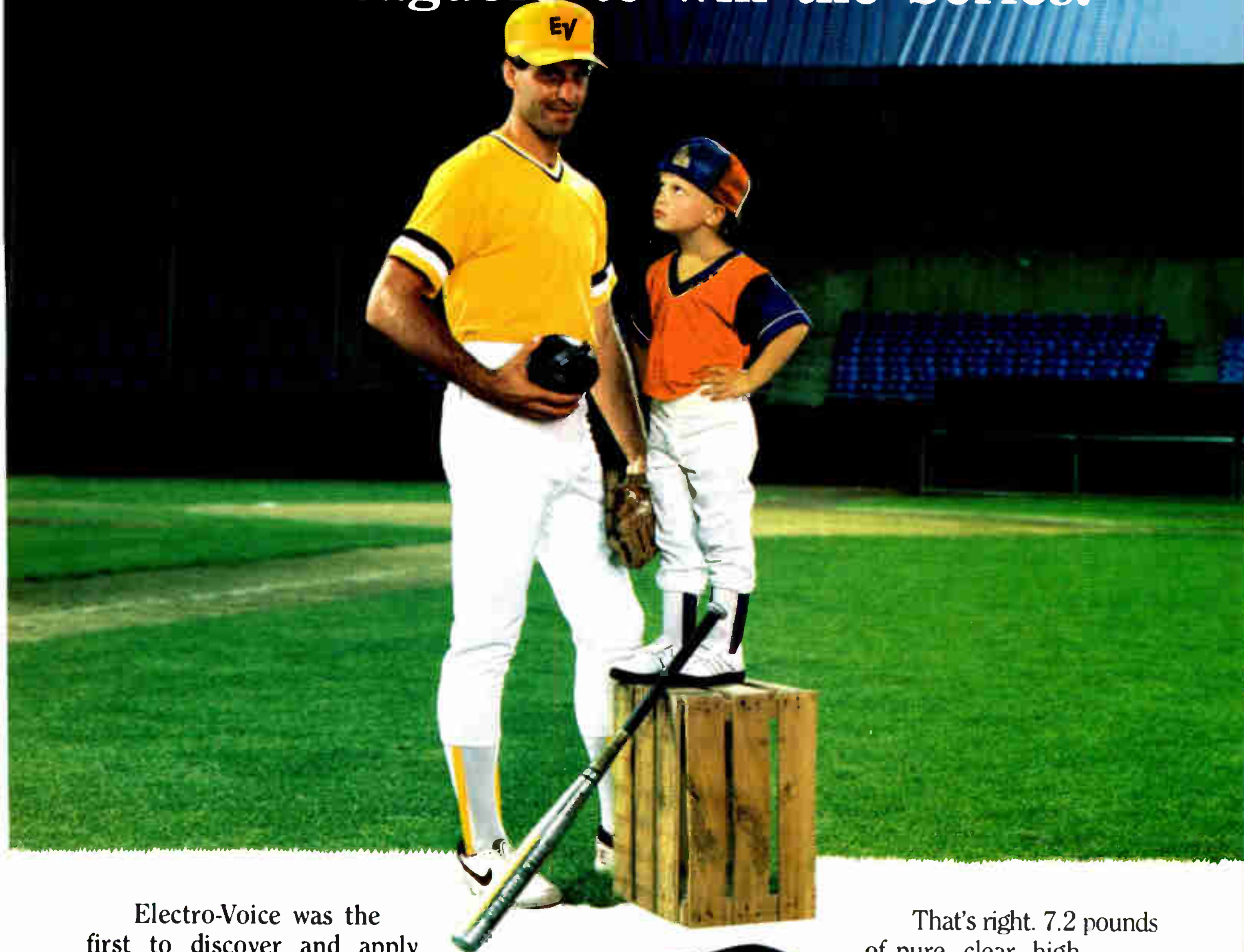
In this installment of our series reviewing sound system design software, we take an in-depth look at the Central Array Design Program (CADP) from JBL. Many improvements have been made to the program since its exciting and controversial introduction in 1983, as we'll discover in this review (the first of two parts). **30**



INNOVATIVE SECURITY

Security is a concern for any hospital; security requirements are particularly demanding in a hospital serving young children, a complex of many different buildings, each with its own access control requirements. Add to this the location of Children's Hospital—an area with one of the highest crime rates in the city of Pittsburgh—and you've got a complicated security problem. How did the hospital administrators find the solution? **21**

Trusting anyone but EV® with neodymium drivers is like betting on little leaguers to win the Series.



Electro-Voice was the first to discover and apply neodymium technology in professional audio products.

You'll find that experience in our exclusive N/DYM™ 1 high-frequency driver.

The N/DYM 1 outperforms our very own DH1A—the industry standard some said couldn't be improved—by offering a high-frequency efficiency increase of about 1.5 dB above 2 kHz. An increase that results from 22.5 kilogauss of flux density . . . the world's highest.

The N/DYM 1 is also less than ⅔ the size of the DH1A. And at 7.2 pounds, it's ⅓ the weight.

That's right. 7.2 pounds of pure, clear, high-frequency power.

Our competitors are correct. It *does* take more than neodymium to change the future of driver technology.

It takes years of experience.

Electro-Voice®
a MARK IV company

600 Cecil Street
Buchanan, Michigan 49107
Phone: 616-695-6831

In Canada: Electro-Voice, Div.
345 Herbert Street
Gananoque, Ontario K7G2V1

Circle 201 on Reader Response Card

MORE SOUND PER POUND

The Bose® 302 Series II Acoustimass® Bass System.

This compact bass system, designed and optimized for use with Bose 802™ Series II speakers, delivers *more bass and purer sound* than larger components. From nightclubs to stadium concerts, the 302-II bass system delivers clean, powerful performance that's easy to transport and easy to connect.

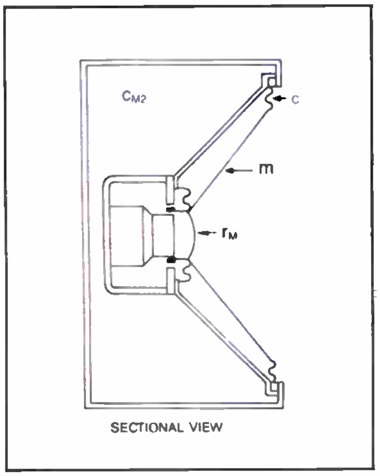
The key to large-system performance in a small package is the patented Acoustimass system with the Electro-Magnetic Braking (MB-12) woofer. Rather than producing sound by a cone surface vibrating directly into a room, Bose uses the MB-12 woofer to energize the Acoustimass system, which actually launches sound into the room using two precisely controlled air masses. The Acoustimass system also acts as an acoustic filter, removing unwanted distortion where no electronic filter can—after sound is produced but before it reaches the audience. The result—the 302-II system gives you more bass output with less cone motion and lower distortion than any conventional bass bin its size.

Listen and judge for yourself. Compare the 302-II system to any other bass system. Then *you* decide how well we stack up (and how easily). The 302 Series II Acoustimass bass system . . . just one of the reasons Bose is becoming the professional system of choice. For the name of your nearest authorized dealer, write Bose Corporation, Professional Products, Department SC, The Mountain, Framingham, MA 01701-9168 or call us at 1-508-879-7330.

BOSE
Better sound through research.

C O N T E N T S

Volume 35 Number 1 January 1989



25

38

FEATURES

COLUMNS

DEPARTMENTS

SOUND COMMUNICATIONS

 Sound & Communications (U.S. P.S. 943-140) is published monthly by Sound & Communications Publications, Inc., 25 Willowdale Avenue, Port Washington, N.Y. 11050. 516-767-2500. President, Vincent P. Testa. Subscription rates: U.S.—3 years $37.50, 1 year $15.00. Canada and Mexico—3 years $48.00, 1 year $18.00. Foreign and South America—3 years $60.00, 1 year $25.00. Second-class postage paid at Port Washington, NY and at additional mailing office. POSTMASTER: Send address changes to Sound & Communications, 25 Willowdale Avenue, Port Washington, NY 11050.

Coming in February...

We explore what's new in teleconferencing, what's "old" in the Jack Mullin collection, and present the next installment in our software review series. Don't miss it!

Stage 22 is available with the Electro-Voice N/Dym 757 microphone sold exclusively in wireless by Samson.

Circle 205 on Reader Response Card

SOUND & COMMUNICATIONS

Editorial Director/Publisher
Vincent P. Testa

Managing Editor
Bill Intemann

Technical Editor
Jesse Klapholz

Editorial Assistant
Stacey Zable

Contributors
Don Borchert, Gary D. Davis, Mary C. Gruszka, Mike Klasco, Rob McManus, Steven Orfield, Monroe Porter, John Sprecher

Consulting Editors
Jerome J. Brookman, Chris Foreman

Technical Council
Dr. Mort Altshuler
Professor Audiology, Hahneman University, Chief of Audiology, V.A. Hospital, Phila, PA
Mike Biegel
EPD Technology Corporation
C. Leroy James
Rees Associates, Inc.
Richard N. Jamieson
Jamieson and Associates, Inc,
Russell Johnson
Artec Consultants, Inc.
Richard Negus
Purcell Noppe Associates, Inc.
William Parry
Maryland Sound Industries, Inc.
Daniel Queen
Daniel Queen Associates
Jon Sank
Cross Country Consultants
William R. Thornton
Phd, PE

Art Director
Gail Meyer

Staff Artist
Gerard Caramannello
John M. Prytyskacz

Typesetting
Leo Ancona

Circulation Director
Deborah A. Droge

Advertising Director
Thomas Soevyn

Vice President/Editorial
Judith Morrison

Editorial and Sales Office
Sound & Communications
25 Willowdale Avenue
Port Washington, New York 11050
(516) 767-2500

BPA MEMBERSHIP APPLIED FOR MAY 1988

TESTA COMMUNICATIONS

Sound & Communications • Stage & Studio
DJ Times • The Music & Sound Buyer's Guide • Post
NSCA-TV News • NAMM-TV News • CES-TV News
The Music & Sound Retailer
Home Entertainment

Our most exciting switch since we changed our name.

BURLE, formerly RCA New Products Division, advances its commitment to innovation and expertise in CCTV systems. Designed and manufactured in Lancaster, PA, our newest generation of video sequential switchers, in 4, 8, 12 and 24 position models, provide unsurpassed features and flexibility. All units allow for user selectable looping or terminating inputs. The 12 and 24 position models offer SalvoSwitching™, which instructs monitors to switch video scenes as a synchronized group. Plus, programmable camera inputs and alarm call-ups for display on any or all monitors. All units have UL, CSA and FCC agency approvals, and are backed by experienced BURLE applications support. Contact your local dealer, distributor, manufacturer's representative, or BURLE INDUSTRIES, 1000 New Holland Avenue, Lancaster, PA 17601-5688. Telephone: (717) 295-6123. See why the security industry knows . . .

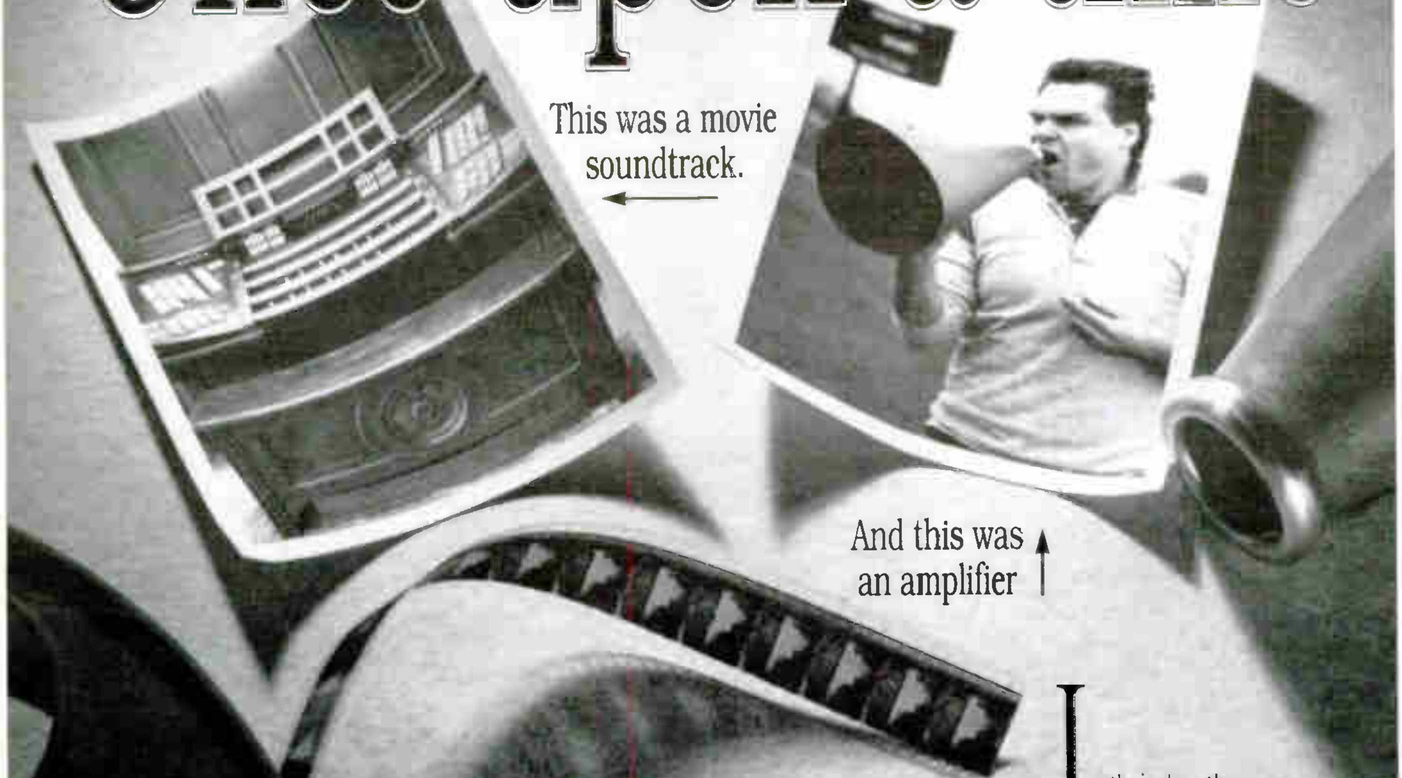
BURLE
SECURITY PRODUCTS

Formerly RCA Closed-Circuit Video Equipment

The solution is a BURLE SYSTEM

Circle 209 on Reader Response Card

Once upon a time



In their day, they were the state-of-the-art. The theater organ (or piano) provided all of the sonic textures required to completely involve an audience with the film on screen. The megaphone was reliable, but its limitations quickly became obvious. Its frequency response was rather limited, and its direct dependence on input level made it usable only by oral athletes.

With man's undying need to to expand his ears' horizons, the film soundtrack came to replace live accompaniment. Sound reinforcement came to span everything from audio in the home, to rock and roll in the arena. As the quality of these mediums grew, the need to surpass the limitations of existing amplification became apparent.

Ashly's MOS-FET Power Amplifiers represent our ongoing dedication to exceeding these boundaries. They feature an open, modular design with a Class-A, full-complementary, two-stage front end for stability and speed; MOS-FET output devices which contribute to both high sound quality and near-perfect reliability; a self-protection mode under virtually any conditions including short and open circuits, reactive loads and high frequency overdrive; perfect overload and square wave response with no extra transients or ringing; and they're stable into any load, including inductors, capacitors and resistors. The result: Amplifiers that are powerful and quick, delivering unrestrained, uncolored sound quality with remarkable accuracy.

Available at finer audio dealers worldwide.

Today

Things are a little different.

ASHLY

Ashly Audio Inc. 100 Fernwood Ave. Rochester, NY 14621. Telephone: 716-544-5191. Toll Free (Outside NYS): 800-828-[illegible]

In Canada: [illegible]

Circle 215 on Reader Response Card

NEWSLETTER

MORE ON ELECTRO-VOICE MANAGEMENT RESTRUCTURING

As previously reported, Electro-Voice (EV) has restructured various upper management positions. We have since learned that Paul McGuire, vice-president of marketing at EV, will head an EV management team, consisting of Roger Gaines, vice-president of manufacturing, and Alan Watson, director of engineering. The team is responsible for present operations, as well as the execution of future plans and programs. "I will continue to participate in strategic direction, product planning, evaluation of major investments, and policy decisions," Robert Pabst, president of EV, said. "Most questions regarding operations and company decisions can be directed to and answered by Paul McGuire," Pabst continued.

MATSUMOTO NAMED PRESIDENT OF AIPHONE

Jun Matsumoto has been named acting president of the Aiphone Corporation. For the past year, Matsumoto has worked at Aiphone's headquarters in Nagoya, Japan. Previously, he was chief engineer at the company's U.S. distributor, Aiphone Corp., in Bellevue, Washington.

ROUDEBUSH RESIGNS FROM OTARI

David Roudebush has resigned from his position of sales manager for the Otari Corporation. He had been with the company since 1982, and had been responsible for the domestic and Latin American sales of Otari's recorder and industrial product lines. John Carey, marketing manager for Otari, will assume the responsibilities of sales management. There will be no immediate search for a successor, according to Carey. Carey expects Otari to begin looking "in the spring" for Roudebush's replacement.

REPORT SEES PDR MARKET GROWING

Frost & Sullivan's 279-page study titled: "The Competitive Market in the U.S. For Portable Data Recorders [PDRs]" (#A1885), examines the evolution of the PDR in the last few years. Applications for the PDRs include hospital/health care information recording, where pen and pad can be replaced by hand-held, battery-powered, programmable portable data recorders.

The latest programmable models examined in the study have 256K or more of random access memory (RAM), expandable to 1 MB. Input options range from keyboards and touch screens to wands and scanners. Output to the host computer can go via telephone lines, aided by acoustic couplers and/or modems, or by radio frequency (RF) in real time.

CORADIAN DISTRIBUTOR FOR VIDEOTELECOM

Coradian Corporation has signed a two year contract for national distribution of VideoTelecom's video teleconferencing product line. VideoTelecom introduced its family of interactive low-cost, long-distance "plug and play" videoconferencing systems in May, 1988. They include built-in proprietary full-duplex audio in addition to the video codec operating at 56 to 768 kilobits per second over digital long-distance networks.

JBL ADDS SECK MIXING CONSOLES TO LINE

JBL Professional has added the Seck mixing consoles to its line of consoles. The Seck line features various console configurations which are suited for either recording or live performance applications. Seck was purchased in 1988 by Harman International, the parent company of JBL Professional. The consoles will be marketed and distributed through the Soundcraft distribution channels in the United States and Mexico. The consoles are available in a wide variety of frame sizes up to 24 inputs, with two and eight sub group configurations.

ANIXTER REACHES BILLION DOLLAR SALES MARK

Anixter surpassed $1 billion in sales for 1988 on Wednesday, December 28, 1988, for the first time in the company's 31 year history. Itel Corporation purchased Anixter in December of 1986, when the company's

NEWSLETTER

annual sales totaled $656 million. "[Anixter] nearly doubled its sales in the last two years and proves to be an excellent investment for Itel," said Rod Dammeyer, president of Itel.

When the company was on the verge of reaching $1 billion in sales, John Pigott, president of Anixter, announced a "Countdown to a Billion" promotion to spur the salespeople on and add to the excitement of the occasion, the company said.

UNIVERSITY SOUND RELOCATES TO SYLMAR, CALIFORNIA

University Sound, Inc., a Mark IV Company, has moved its corporate headquarters to Sylmar, California. Mark IV's recent acquisition of the Cetec group of companies included the Raymer group of commercial sound products. Upon this acquisition, University Sound expanded its product line to include Raymer products and moved into Raymer's facility in Sylmar.

MICRO-COAX OPENS EUROPEAN OFFICE

Micro-Coax Components, Inc. has opened an international office to serve the microwave transmissions line components needs of Europe, the company said. The new European office will be headed by Dave Walker and is located in Lower-Early — Reading, Berkshire, England. Micro-Coax specializes in passive microwave transmission line components including semi-rigid and flexible coaxial cable and cable assemblies, connectors for semi-rigid and flexible cable, "in-a-cable" lowpass, highpass and band pass tubular filters, attenuators and waveguide and flange material.

RESTRUCTURING, EXPANSION AT BURLE INDUSTRIES

Burle Industries electron tube products division, formerly RCA's new products division, has received a Federal Trademark Registration for Ultricon from the U.S. Patent and Trademark office. Ultricon, manufactured at the Lancaster, Pennsylvania plant, is a silicon target camera tube and is the most sensitive vidicon tube on the market for general CCTV application, according to the company.

Burle Industries security products division, formerly RCA's new products division, has restructured its spare parts distribution system to include 18 distributors of Closed-Circuit Video Equipment Parts with 30 outlets throughout North America. The distributors, located throughout the United States and Canada, will provide technical and sales support for Burle spare part numbers for CCVE products. Burle Industries Service Manuals and Parts Reference Guides are also available through these distributors.

Burle also has purchased the Imperial Machine and Tool, Inc., now known as the Imperial Division of Burle Industries, on January 1, 1989. Established in 1972, Imperial Division of Burle spans 24,000 square feet and employs 27 people. Based in Winston-Salem, North Carolina this machining and tooling facility has the technology for making components and parts for Burle's Tubes and Security Products Divisions. In the past, Burle purchased the mechanical parts and CCTV accessories from other companies. Now Burle will be making its own parts and will be know as a whole systems supplier, according to the company.

Frederick R. Hughes has been appointed vice president and general manager of the Imperial Division of Burle. Prior to his newly appointed position, Hughes was vice president of engineering in the Tubes division. Hughes has experience in product and process engineering, manufacturing engineering and operations management.

Burle has established a Washington, D.C. office to handle government agencies for Burle security and electron tube products. The Washington office will assist government agencies in the design and use of Burle security and tube products; provide the government agencies with on-site support; and aid in planning long term programs. Terry Crawford, technical marketing manager, government, will manage the new office.

No One Takes The Rigors Of The Road As Seriously As BGW.

It's true. Next to BGW Grand Touring Amplifiers, other so-called touring amps are just "tourists." Our Grand Touring Amps deliver the power, performance and features you need on the road. And they're built to keep on doing the job under conditions that send other amps packing.

Take our new heavy-duty model **GTB**. You won't find this combination of road-ready features in a Crown Macro-Tech, a QSC Series III, or ANY other power amp (except our own flagship model **GTA**).

- One-piece welded steel chassis withstands rough rides and load-outs.
- Forced-air cooled, massive extruded aluminum heat sinks provide continuous operation in hot, crowded racks.
- Two ohm capability allows BGW amps to drive more speakers with fewer amps — saving money and rack space.
- Magnetic circuit breaker/front panel power switch affords instant overload protection. (You have to pull a Crown out of the rack to change a 20¢ fuse!)
- DC Crowbar speaker protection — a BGW first since 1971 — provides positive protection for expensive speakers, without relays.
- Modular construction means fast, easy field service.
- 100% discrete circuitry (no IC's) with low feedback delivers superb sonic performance.
- Active balanced inputs with looping XLR-type connectors provide greater than 70 dB common mode rejection — some of our competitors don't even spec this crucial parameter. Optional transformer-isolated inputs offer absolute isolation.
- Switchable subsonic filters protect low frequency drivers from excursion limit damage.
- Crossover capability — two BGW cross-over cards can be mounted in our touring amps, safe from abuse.
- Large LED indicators maintain readability across the stage.

A touring amp with all these essentials, plus legendary BGW reliability and sonic integrity, will make our competition nervous — especially since the GTB costs no more than their "comparable" amps. Too bad for them. But peace of mind for you, when you go with BGW Grand Touring Amplifiers.

You know a professional tour is no place for "tourists." (And neither is a fixed-location amp rack, right?) So call BGW Systems toll free at **1-800-468-AMPS** (in USA and Canada) to arrange a demo of our new "workhorse" model **GTB** or the "2.4 Horsepower" model **GTA**.

BGW SYSTEMS

BGW SYSTEMS INC.
13130 SOUTH YUKON AVE.
HAWTHORNE, CA 90250
Tel: 213-973-8090
Fax: 213-676-6713

ENGINEERED TO BE THE BEST

Circle 204 on Reader Response Card

CUSTOMER SERVICE: STARTING THE JOB RIGHT

by Monroe Porter

Successful contractors today know that their service technicians must be responsible for more than just "fixing" technical problems. Today, service techs must be the company's customer service representatives as well. Expecting technicians to assume this role is fair, but management must groom them and teach them the skills they need to handle this responsibility. Technicians spend years perfecting their trade but a very small amount of time learning basic selling skills, job courtesies, and customer service. With technicians assuming such a vital role in the future business of the company, an investment must be made in their development of finesse. The following is a simplified customer service checklist. It will be a good starting point for this crucial training.

Techs must be prepared. Before going to the job they must have all the information they'll need, such as the customer's name, full address (with directions if the location is remote or newly developed), and a description of the problem. A good order starts with clear instructions taken over the phone: communication is the key. Getting lost, or wasting time with incorrect information can make the tech late and the customer irate. This is no way to start off a good customer service relationship.

Knowing the kind of service that the company expects will help get technicians to be a part of the team. Explain that being courteous and pleasant are part of the company philosophy. As long as employees know you do not expect them to beg, borrow, or steal, they will go along with the idea. Give them introduction and departing procedures and help them understand why simple steps can be very important. For example, when servicing a residence it is important to give the customer some space. After knocking at the door, techs should stand back and give the customer room to identify them. Smiling and clearly stating the purpose of the call will put the customer's mind at ease. With the rise in household burglaries and door-to-door scams, such a simple gesture can create a very positive first impression.

'Technicians spend years perfecting their trade, but very little time learning basic customer service skills. Management must help technicians to develop these important skills.'

Give technicians business cards. This adds to their professional demeanor, as well as transferring to them the ownership or responsibility for the quality of the work. Their name is literally on the job. Some type of work order form is also recommended. Paperwork assures the customer that there is a working organization behind the representative at their door.

Although they already have a brief description of the work to be performed, technicians must make it a habit to ask to see the job before bringing in all of their equipment. Customers will be inclined to explain the problem, but it's always best for the tech to see it first hand. Again, good communication skills are a must. Asking questions can save time and get to the root of the problem more quickly. Once the preliminary inspection is complete, techs then must ask for other service details, such as which door to use, where to park the truck, and whether there is a dog or cat that should not be let outside. Simple concern for the customer's environment is reassurance that someone is actually concerned about their problem.

Technicians must have the ammunition to handle a variety of situations. When asked if they would like a cup of coffee, an effective reply would be "that would be great if you have a cup I could use while I'm working. You don't want to pay me to stand around and drink coffee." An aggressive stance is part of a professional image; with practice and guidance techs will know when that type of approach is ap-

Porter is vice president of Proof Management Consultants, Richmond, VA.

It's Not Just A Phase We're Going Through.

The tremendous success of the Tannoy PBM series of reference monitors is by no means coincidental. Since the introduction of the world renowned NFM-8 nearfield monitor, much time and effort has been spent on discerning the needs of the mixing engineer and the applied requirements of "playback monitors". The PBM Line exemplifies this commitment to excellence in reference studio monitoring. These compact loudspeakers sport robust poly cone mid-bass transducers utilizing efficient long-throw, high power voice coils. The low frequencies are carefully controlled by optimumly tuned ports located on the rear of the loudspeakers. Hi frequencies are provided by Hi Power ferro fluid cooled polyamide dome tweeters which extend H.F. bandwidth beyond 20KHZ. The driver accompaniment is knitted together by means of a precision hardwired crossover unit, utilizing robust low loss components, and heavy-duty input terminals which will accept standard 3/4" spaced banana plugs and the majority of high quality, specialist audio cables. Transducers and crossover assemblies are neatly housed in a stylish, high density, partical wrap cabinet, specially designed to minimize unwanted cabinet resonance, and high frequency reflection. In summarizing, we have left the best feature of all for last "price versus performance."

TANNOY
Professional Products

Tannoy North America, Inc.
300 Gage Ave., Unit 1
Kitchener, Ont.,
Canada, N2M 2C8
(519) 745-1158
Telex 069-55328
Fax (519) 745-2364

1 9 8 8
TEC
TECHNICAL EXCELLENCE & CREATIVITY
AWARD WINNER
TRANSDUCER TECHNOLOGY

TANNOY®

Circle 213 on Reader Response Card

propriate. Customers who stop work with personal stories and "back-seat driving" the job must be handled in much the same way. A firm comment reminding them that they called the company to have the problem fixed, and that the faster the job is done the less expensive the bill will be.

Techs must be trained not to take personally the hostile customer's emotions. The nature of the business means techs are thrown into often unpleasant circumstances and situations. Customers are not angry with the tech; they are angry with the problem, and having it occur at such an inopportune time. Part of the tech's professional image is to stay calm and to quietly assure the customer that help is on the way. Once the customer doesn't feel quite so helpless, customers will become calmer and easier to handle. Screw-ups, like poor directions that cause the tech to be late, or poor communication from the office ("the tech should be at your house in a few minutes" and two hours pass) only add fuel to an already burning fire. Basic sales training and people skills can give techs the confidence needed to turn these bad situations around.

> 'These skills can give the tech the confidence to handle difficult situations.'

Customer service is a team effort. Often the only face-to-face contact customers have with your company is the service tech's visit. Your future business will depend heavily on the quality of this encounter. A simple list of suggestions like the ones we have provided can begin to have an immediate impact on the image your company is trying to build. ■

How to make your best church sound systems disappear from sight!

Actual Size
Model AT853 Unidirectional
Condenser Choir Microphone

Install Audio-Technica UniPoint® miniature studio-quality microphones

Every congregation deserves the best possible sound, whether at the service or listening to broadcasts or tape. Now you can install superior sound without bulky microphones and awkward microphone stands that intrude on the services.

New Directional Choir Microphone

Audio-Technica engineers have broken new ground with our UniPoint design that delivers studio-quality sound from tiny, inconspicuous *directional* microphones. Our new choir microphone is so small and light that it can be suspended by its own slim cable, making it virtually invisible. Yet it offers controlled pickup of only the choir, sharply reducing room noise and reverberation.

Directional models for altar, lectern, pulpit, plus lavaliers

Four other UniPoint models for use at the lectern or pulpit offer the same clarity, full range, and directional pickup control. Our comprehensive approach to church sound also includes a surface-mounted directional microphone that lies flat on altar, table, or floor. We round out the selection with directional lavalier microphones that solve acoustic problems other lavaliers can't handle. The entire line provides full freedom of movement to the participants, yet the microphone is almost unseen.

Model AT871
UniPlate Boundary Cardioid

Model AT857AM
Podium Cardioid

Better sound is now smaller, lighter, less visible

Whether your customer's sound system is solely for sound reinforcement, or is also used for radio/TV or tape recording of the service, UniPoint microphones improve the sound quality while remaining almost invisible.

Our experts are ready to help

If you ever need help with specific installations – whether large or small – our Audio-Technica church sound experts are ready with answers to your most difficult problems. To watch your toughest church sound installation problems disappear, call or write us today.

audio-technica.

1221 Commerce Drive, Stow, OH 44224
(216) 686-2600

Circle 207 on Reader Response Card

MEASURING LOUDSPEAKERS WITH TEF: PART I

By Mary C. Gruszka

We are all familiar with the frequency response curves found on manufacturer's data sheets; this is often the first thing we want to know about a loudspeaker. We need to know if the frequency range, as well as the response variations in that range, are adequate for the intended application, and we'd also like some indication of the quality of the speaker (and whether it was worth the cost).

The frequency response curve of primary interest is that of the speaker alone, without taking into consideration the room in which it is placed. In other words, room reflections should not enter these first measurements; if measurements show that the speaker by itself is not suitable for your application, the room is not going to improve it. Anechoic measurements (measurements made without echoes or reflections) must be obtained, and without a TEF or other appropriate spectrum analyzer, these measurements would have to be made in an anechoic chamber (or even outdoors).

An anechoic chamber, within limits, absorbs energy at the surfaces of its walls, floor, and ceiling, allowing only the direct sound from the loudspeaker to enter the measurements. In the great outdoors, there aren't any walls to worry about (assuming you are far enough away from any buildings) and with judicious placement of the speaker in the ground, the "floor" can effectively be eliminated for the purposes of measurement.

However, without a special chamber, and within your own facility, a TEF analyzer can be used to measure frequency response at any chosen point in time. A speaker can be measured in any size room; the TEF will "zero in" on the direct sound from that speaker so that this is the only sound that enters the measurements. Too good to be true? Well, there are limits: low frequency anechoic measurements.

To measure low frequencies without interference from room reflections, a large space is needed to get enough distance between any of the room surfaces and the measurement setup. Sound travels at a rate of about 1130 feet per second in air at room temperature. One cycle of a 100 Hz acoustic wave is about 11.3 feet long, and a 20 Hz wave is about 56.5 feet long. It would take a very large space to keep very low frequency reflections from entering the measurements. It may not be possible to totally do away with anechoic or outdoor measurements if very low frequency response is of particular importance.

The speed of sound in air also gives rise to another consideration when making acoustic measurements. A typical measurement setup for a loudspeaker would include a test microphone placed some distance from the speaker to pick up the output from the speaker (which is being fed a test signal). Since there is some distance between the loudspeaker and the microphone, it takes a certain amount of time for the sound wave to travel to the microphone. Measuring this time offset is the prime means of determining when the direct sound occurs at the

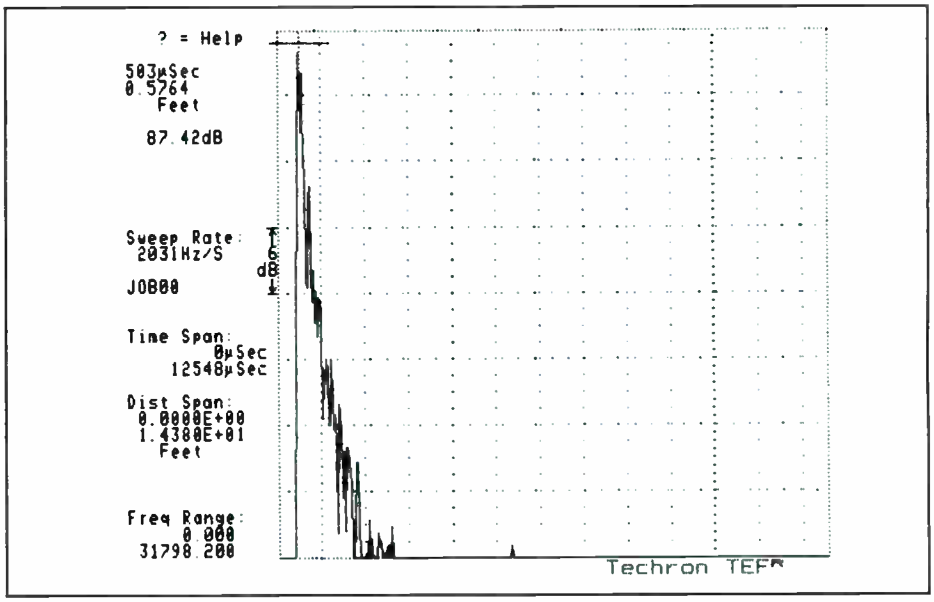
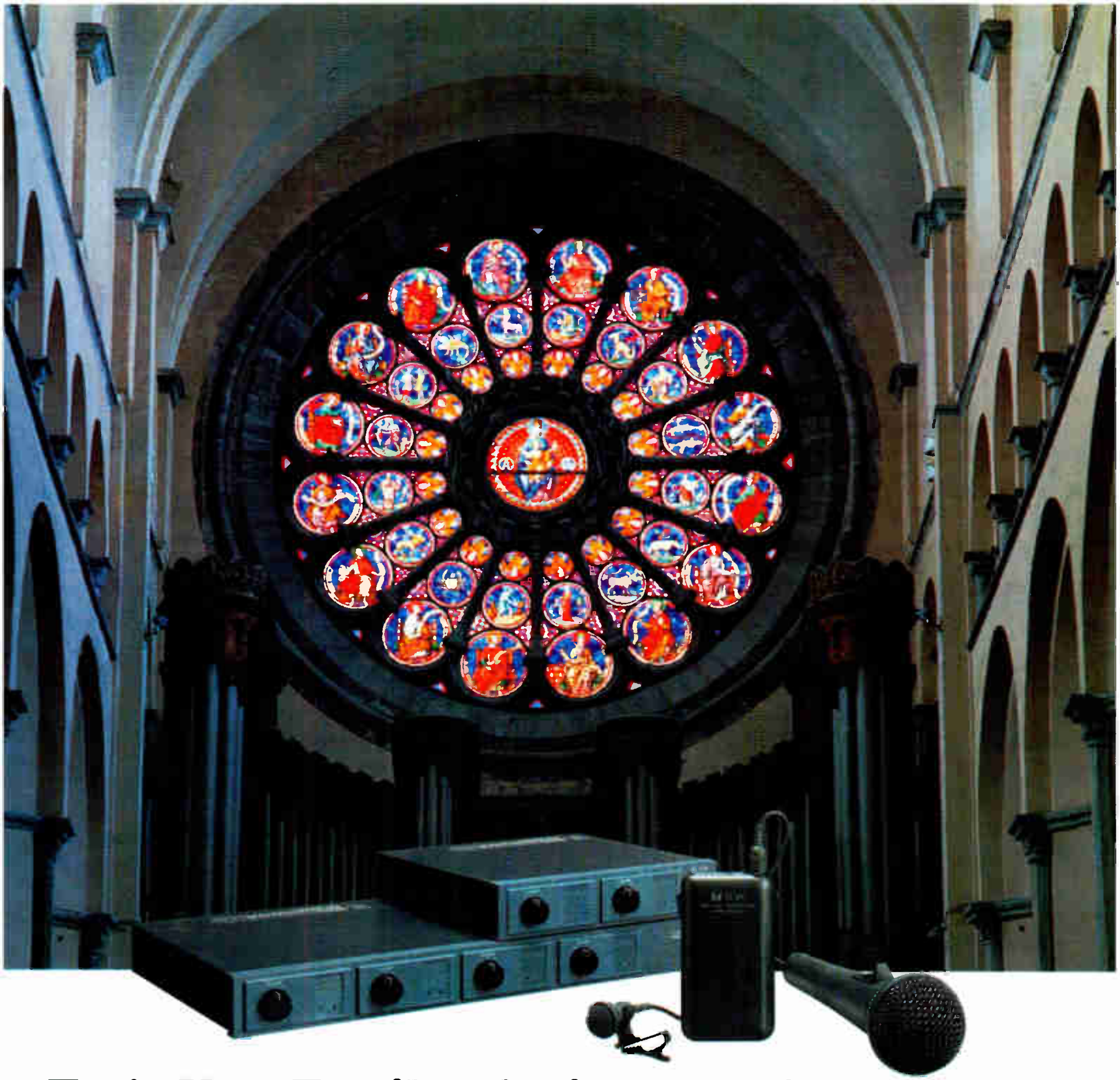


Figure 1: ETC of a self-powered single driver speaker with cursor set at the direct sound.

Gruszka is president of MCG Audio Consulting, Edgewater, NJ.



Toa's New Family of Wireless Microphones Created to Reinforce the Spoken Word

With the introduction of our new vhf hi-band wireless microphones, Toa has redefined the concept of outstanding wireless performance at an affordable price.

You asked for wireless microphone technology that delivers substantially longer battery life. Toa responsed by incorporating the latest advancements in miniaturized surface mount components into our new wireless microphones. Battery life has been extended to over thirty hours during continuous use, utilizing one AA battery.

You needed extended dynamic range and superior signal-to-noise ratios. Toa responded by designing a unique new compander circuit that achieves wide dynamic range against a background of vanishing low noise.

You wanted a wireless system completely free from external interference. Toa responded by introducing our fabulous new tone-key circuit design. This technological breakthrough virtually dispenses with the possibility of external interference.

Toa's new modular wireless systems are available in diversity and non diversity configurations.

TOA

Wireless Microphones from Toa Created to Reinforce the Spoken Word

Toa Electronics, Inc.
Commercial Products Group
601 Gateway Blvd., South San Francisco, CA 94080
Tel (415) 588-2538 Telex 331332 Fax 588 3349

Toa Canada (403) 489-5511 Edmonton
(416) 624-2317 Toronto or (514) 931 5888 Montreal—
Toa UK., (0277) 233882 Essex—Toa Europe,
(040) 2506091 Hamburg—Toa Japan, (0797) 71 2222

Circle 206 on Reader Response Card

microphone. Remember that with the TEF analyzer, the time response can be measured with the Energy-Time-Curve (ETC). With the same ETC, you can also tell when the direct sound occurs, as well as any room reflections.

Figure 1 shows a single driver, self-powered loudspeaker. This speaker is typical of one that might be used in equipment racks or portable PA applications, and is a good example for introducing loudspeaker measurements. Figure 1 shows the ETC of the speaker with the cursor set at the maximum level of the direct sound. The direct sound from the speaker is displaced a small distance from the left hand side of the display. This represents the distance from the acoustic center of the loudspeaker to the measurement microphone.

In this example, the distance from the acoustic center to the measurement microphone is about 7 inches (.5764 feet). Another way of looking at this is that it takes the direct sound about 503 micro-seconds to travel from the speaker to the mic. This is the time that you would like to start looking at the frequency response once you are in the TDS (frequency domain) mode.

While looking at the ETC, we should note the following. First, the frequency sweep is from 0 to 31798 Hz. This indicates that the time scale is relatively short, only 12.5 ms. (Remember, the wider the range of frequencies, the narrower the time scale.) This further indicates that the ETC is weighted more towards the high frequencies (primarily because there are more of the high frequencies compared to the lows in the calculation of the total energy at a particular time, something to keep in mind when we look at the frequency response).

The vertical scale represents the sound pressure level on a logarithmic scale (in dB). In this case, there is an increment of 6 dB per division. The sound from the speaker decays fairly quickly and smoothly. Now that we have located the direct sound and studied the time response of the speaker, we are ready to obtain a frequency response curve. And that's just what we'll do in part two of this article, next month. ■

Reprinted with permission from TV Technology.

CHILDREN'S HOSPITAL OF PITTSBURGH

BY JOHN SPRECHER

When your hospital is located in an area with the second-highest crime rate in the city, security is an obvious and pressing concern. That was the situation facing Children's Hospital (a 247-bed pediatric facility in Pittsburgh, PA) and its director of public safety, William Hilf, in late 1985. It was then that the city government mandated that every parking structure in Pittsburgh be monitored by alarm systems or security guards.

Hilf moved to comply with that mandate; little did he know that in setting out to make his hospital more secure, he would at the same time help to make it one of the most innovative health care complexes in the country — one that utilizes security technology not only to protect lives, but to help preserve bacterial studies as well.

After weighing the costs of technology versus personnel, Hilf determined that the most effective and economical way to insure the protection of people using Children's two-story underground parking structure would be the installation of an alarm system — one that included moveable closed-circuit television and immediate two-way communications (which in effect would allow anyone in an emergency to talk to and be seen by security personnel in the central control room).

Having reached this decision, Hilf began the process of educating himself about the myriad options available to him. He knew what he wanted, but not being an electronics expert, he was not sure exactly what kind of system he needed (or how to go about making such a system operational). Seeking out professional advice, Hilf began talking to security company representatives. He then compared their claims with security systems his friends and associates already had up and running.

"There's a little fact and a little fiction in most sales pitches," said Hilf. "After I talked to the sales people, I called my counterparts to see just how much I could believe."

The search led Hilf to Carl Sandulli, president of Sandulli & Associates (a local alarm and security firm specializing in the installation of computer-controlled card access systems), and his company was selected for the project.

Sprecher is a partner in the public relations firm Ellingsen Sprecher, Milwaukee, WI.

PARKING SECURITY

After examining the security needs of the parking structure, Sandulli recommended installing the N-1000-II control panel manufactured by Northern Computers, Inc., Milwaukee, WI. With 16 alarm inputs and four relay outputs, the N-1000 acts much like a "conduit" between the parking structure's alarms and the monitoring equipment of the security control room. Should an emergency situation occur, a person activates one of the six alarms situated throughout the garage. These alarms signal the N-1000, which forwards the signal to the control room where an audible alarm (and a printer's readout of the emergency by level, location, time and date) alerts the security guard on duty.

At the same time, parallel processing of the N-1000 outputs opens a two-way, hands-free intercom channel between the person in distress and the control room guard. Control of closed-circuit television also interfaces with the N-1000, and allows security personnel to transfer any one of the 30 television monitor pictures to a central viewing screen by simply pushing a button

The security control center at Children's Hospital.

(which also activates a VCR recording of the event).

COMPLEX SECURITY

The parking structure was only the beginning. The hospital complex contains many other areas of interest to the criminally-inclined, such as parking booths, pharmacies, and gift shops. And, as Hilf noted, being a pediatric hospital there are unfortunately "a lot of child abuse cases, and some folks become a little irate when they find out their children have become wards of the court and won't be going home with them."

As a result, Hilf and Sandulli have outfitted all administrative, social services, and cash-handling personnel with wireless "panic" transmitters. N-1000 control panels are stationed on each critical floor, with four linear receivers (connected to the units via inputs) adjacent to each control panel. Because the whole hospital was pre-wired for N-1000 components, these units also feed information directly to the security control room. In a situation of theft (or threatened violence by an angry parent), hospital personnel simply trigger their "panic" alarms, which through the N-1000 alert the control room to the emergency by location, as well as by the individual requesting help.

Above:
In emergency situations, the wall-mounted proximity card reading unit opens the locked door as personnel and equipment approach.

Left:
Every second counts: proximity cards are fitted to vital equipment as well as personnel, saving precious moments when approaching secure areas.

"SMART" ACCESS CONTROL

However, the security system installation for this part of the multi-hospital complex not only posed, but in at least one case *created* a security problem for Hilf. Witness the cardiology care unit of Children's Hospital.

This area (along with others less critical) shares a common hallway and doorway with its Presbyterian University Hospital neighbor. Because this is considered by security a "perimeter" door, it must be locked every evening at 8:00 PM. The problem: how to facilitate treatment if a patient on one side of this locked door needed the emergency help of personnel or equipment on the other side?

Sandulli's solution was the "proximity card" system from Northern Computers. This system consists of plastic cards (with or without photo identification) that are simply "waved" at a card-reading unit at the secured door by personnel seeking access. The card-reading unit scans the card for the correct coding and unlocks the door, allowing authorized personnel entry to secured areas.

This technology was taken a step further: along with hospital personnel, cardiac emergency "crash-carts" were outfitted with the proximity cards as well. In effect, people and equipment rushing down a hallway toward a locked door will find the door open as they come into range — thereby saving precious moments that might otherwise have been wasted, moments that could spell the difference between saving or losing a life.

"Fortunately, we haven't had many emergencies like this," Hilf said, "but they have occurred, and every time [the proximity cards] have been a success in unlocking the door and getting help to where it's needed without delay." Manual entry is possible should the technology for some reason ever fail.

Sandulli noted that more proximity readers further down the hallway are planned. Each would issue a signal to the next reader in line, effectively opening the locked door even sooner.

PROTECTING OTHER LIFE FORMS

Yet another unique application Hilf and Sandulli are currently working on involves the Shanahan Building, a laboratory research center a block away currently undergoing renovation. Here, bacterial and viral studies — some 20 to 25 years old — will be housed. Hilf noted that these studies "will demand perfect atmospheric and climatic conditions, and perfect security" to protect the decades of investment in labor and capital.

For climate control, plans call for Northern's N-1000-II units to serve as the watchful eyes that signal changes in critical

temperature, humidity, and other factors vital to keeping these studies alive. Remote alarm units will be tied into the building's HVAC control technology, as well as the N-1000 units (via its alarm inputs). If any deviation from the norm occurs, the alarm signals the N-1000, which then forwards the information to the control room. Since the N-1000 control panel can open and close switches, outputs will be associated with relay valves, and will automatically compensate and correct the climate problem. Manual correction from the control room will also be possible.

For security, Northern's ''Weingand'' cards will be assigned to each research and support person at Shanahan — and Northern's PC-PAK software will be used to track the entry and exit history of all employees. As Hilf explained, ''research people don't often work the typical eight-hour day. They come back at night and on weekends. With the major investment that will be represented there — decades of research — we need to know who goes in and out every minute of every day.''

The Weingand cards will do just that, with each card representing the personal identification number of each employee (and only those employees with valid standing permitted access to the building). And with the PC-PAK software, a history (or ''audit trail'') of every employee's actions will be continuously recorded — by day/date, time of day, and location of entry and exit. In the case of any theft or vandalism, this audit trail can be reviewed for possible suspects.

FUTURE APPLICATIONS

Hilf continues to look for new and better ways of applying the power of electronic security to what might not ordinarily be viewed as ''security'' problems.

One such problem is child protection. As a pediatric hospital, Hilf recognizes that the possibility always exists for a child to be kidnapped — and one future application includes rigging a proximity card to the children in such a way that an alarm would sound if they left (or were removed from) the building.

Hilf explains that this is, unfortunately, typical of the security concerns facing hospitals today. ''Fifty years ago, nobody sued hospitals. But today? Burglary, rape, and assault automatically mean litigation. We have to prove we've done everything possible to make sure people are safe and secure while they're here. I think we're one of the forerunners in health care security, certainly in this part of the country.'' ■

REDUCING DISTORTION IN LOUDSPEAKERS

BY HARRY F. OLSON

Editor's note: Harry Olson is credited with providing us a fundamental understanding of loudspeaker mechanisms. This understanding is based in part on his now-famous analogies, where both acoustomechanical components and systems were modeled as electrical circuits. In his logical, deductive manner Olson clearly classified many typical situations, breaking them down into their most basic components. His book, Acoustical Engineering *published in 1957 (and about to be re-printed by the ASA), is perhaps the greatest and most widely referenced source of this information. However, through the early 60s, Olson and others at RCA continued working in loudspeaker research. Only part of this work was ever published, in 1962 in the AES Journal, and in a paper presented by Olson in 1963. Both of these works were a precursor to the article presented here. Since these earlier works are rather difficult for most to obtain, this new article (actually written in 1967) includes information on loudspeaker mechanics and the way in which those mechanics contribute to distortion. And in this article, Olson provides us with several distortion reduction schemes—some of which are only now receiving the attention of loudspeaker manufacturers.—J.K.*

The major contributors to nonlinear distortion in direct radiator loudspeakers are the suspension and driving elements. These elements are linear for small and moderate amplitudes, but depart from linearity for large excursions of the cone. There are two expedients employed to reduce the nonlinear distortion, namely, compliance control by the cabinet and electroacoustical feedback. The first is practical only if relatively costly and complex loudspeaker mechanisms are employed. The second has not been commercialized because the system is entirely too costly and complex.

A practical solution to a reduction in distortion due to the nonlinearities of the suspension and driving elements of a direct radiator loudspeaker is to introduce complementary distortion of such form and magnitude so as to cancel the original distortion. This report will outline and describe a system for the reduction of distortion by the introduction of a compensating distortion element which cancels the original distortion. The distorting element is a relatively simple voltage amplifier; therefore, the additional cost would be quite small.

NONLINEAR LOUDSPEAKERS

A sectional view of the direct radiator loudspeaker is shown in Figure 1. The axial length of the voice coil is equal to the axial length of the air gap. The outside suspension and the center suspension are of the conventional type.

The force due to a current in the voice is given by the following:

$$f_M = B\,l\,i$$

where f_M = force (in dynes), B = flux density in the air gap (in gausses), l = length of the conductor (in centimeters), and i = current (in abamperes).

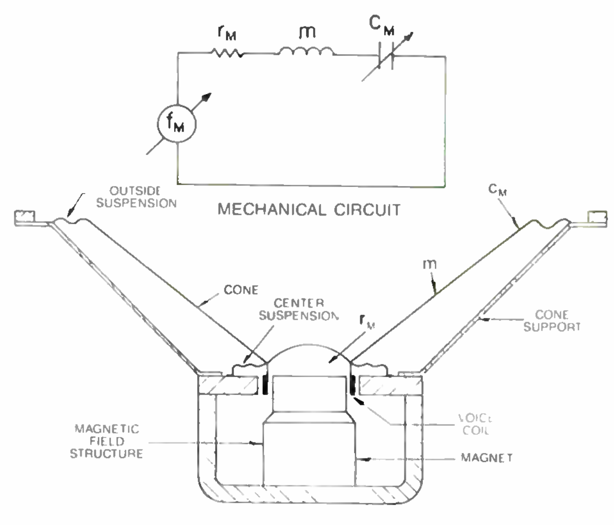


Figure 1. Sectional view and mechanical circuit, dynamic direct radiator loudspeaker. (f_M = nonlinear driving force, r_M = mechanical resistance, m = mass of the cone and the coil, C_M = nonlinear compliance of the suspension.)

The flux density distribution is shown in Figure 2. The flux density is a constant in the air gap. However, the flux density falls off with the distance outside of the air gap. Therefore, as the voice coil of Figure 2 moves out of the air gap, the force for a constant current falls off. The force under these conditions is given by the following:

$$f_M = \sum_{0}^{M} B_n l_n i$$

where B_n = flux density associated with the turn l_n, and where M = the total number of turns in the voice coil.

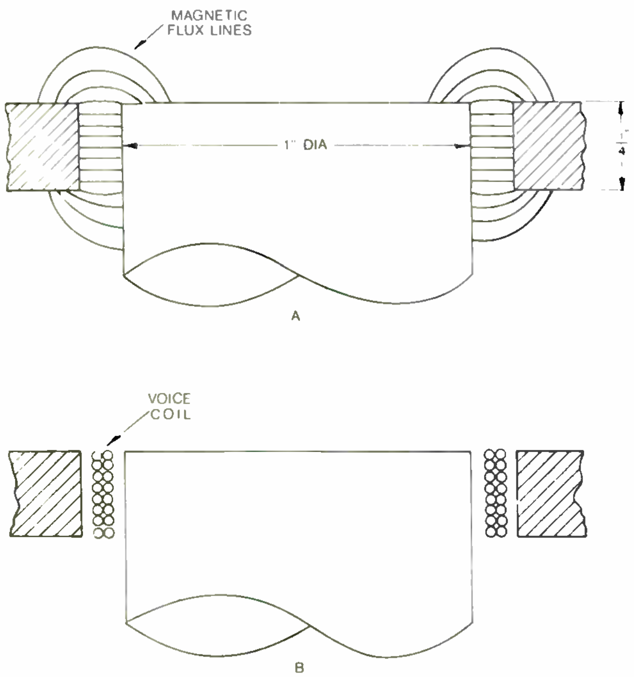


Figure 2. Magnetic flux lines (A) and voice coil (B) in the magnetic air gap of a dynamic direct radiator loudspeaker.

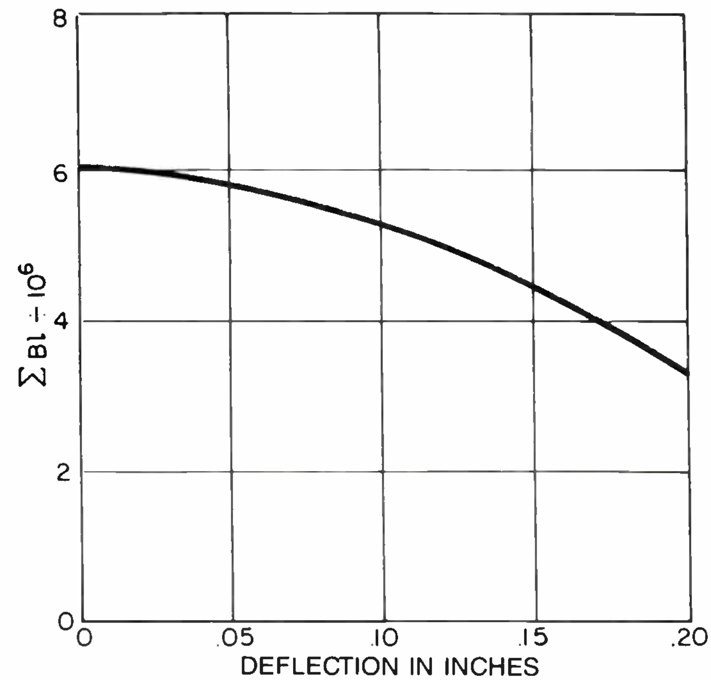


Figure 3. The $\Sigma B l$ of the voice coil as a function of the deflection of the voice coil.

The quantity of the right hand side of equation (2) as a function of the axial displacement of the voice coil is given by the graph in Figure 3. The graph in Figure 3 shows that for a constant current the force decreases as the voice coil moves out of the air gap. Under these conditions the driving force is a nonlinear function.

The stiffness of the suspension system is also a nonlinear function. As a consequence, the displacement of the cone as a function of the displacement is shown in Figure 4.

The displacement of the cone as a function of the current in the voice coil follows from the combination of the characteristics

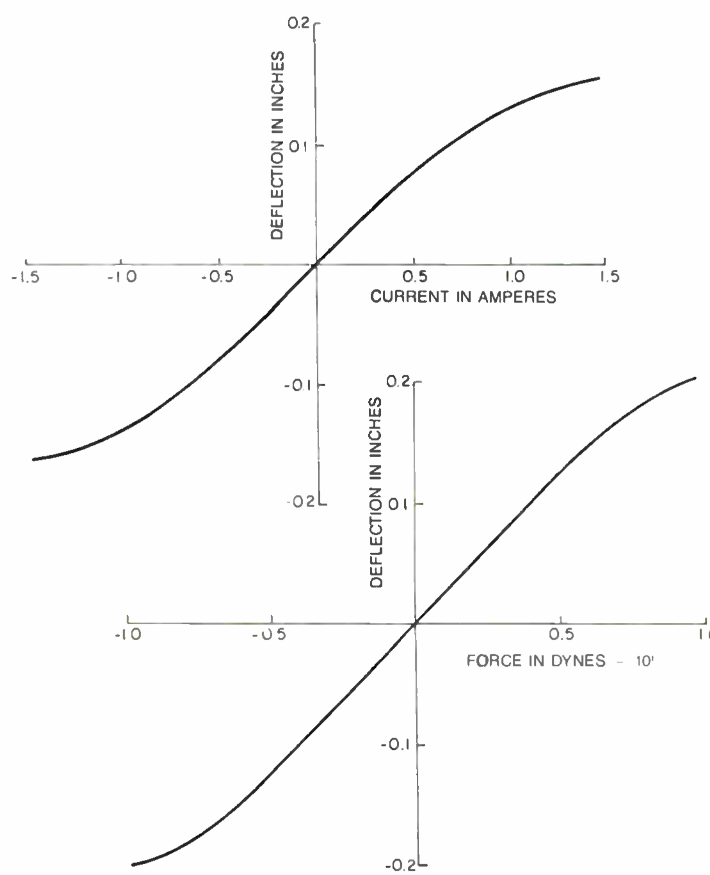


Figure 4. The deflection as a function of the force (in dynes) of the cone suspension system, and as a function of the current (in amperes) in the voice coil.

of Figures 3 and 4 and is depicted in the top scale of Figure 4.

The combination of the direct radiator loudspeaker mechanism of Figure 1 mounted in a completely enclosed cabinet is coupled to a power amplifier. The cabinet is assumed to be so large that the stiffness introduced by the cabinet is negligible compared to that of the suspension system. If the electrical input is a sine wave, the wave shape of the sound pressure output for a large input (that is, large deflections of the cone) will not be a sine wave. The amplitude of the fundamental is reduced and odd-order harmonics are introduced. The sound output of the loudspeaker for a cosine wave electrical input contains two components, namely, the fundamental and third harmonic of the cosine wave. There are, of course, higher order components. These are in general quite small compared to the third harmonic. However, this distortion can be reduced to a negligible amount by means of a complementary nonlinear distortion cancelling system as described in a later section.

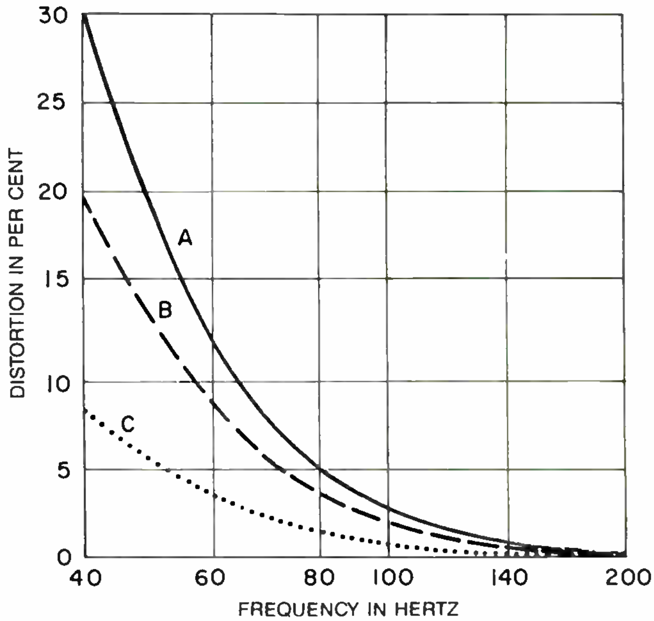


Figure 5. Nonlinear distortion produced in dynamic direct radiator loudspeakers of different designs: a nonlinear driving system/nonlinear suspension (A), a linear driving system/nonlinear suspension system (B), and a linear driving system/low resonant suspension system (C).

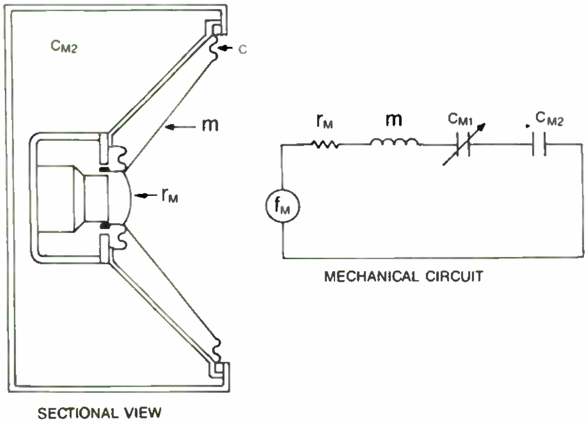


Figure 6. Sectional view and mechanical circuit of a dynamic direct radiator loudspeaker mounted in a completely enclosed cabinet. (f_M = driving force, r_M = mechanical resistance, m = mass of the cone and coil, c_{M1} = nonlinear compliance of the suspension system. c_{M2} = compliance of the air in the cabinet.

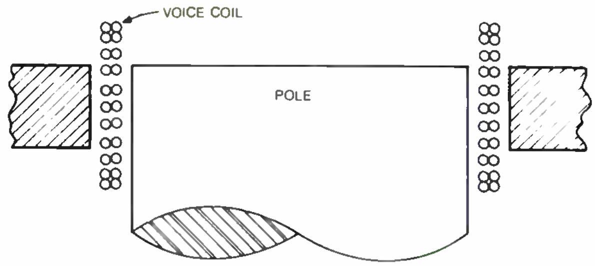


Figure 7. Voice coil and magnetic structure of a dynamic loudspeaker in which the turns are distributed with the major concentration at the two ends.

DISTORTION CHARACTERISTIC

The nonlinear distortion frequency characteristic of a typical dynamic direct radiator loudspeaker mounted in a large flat baffle (as depicted in Figure 1), and operating near the upper limit of output in the low frequency range is shown in Figure 5. The characteristic of Figure 5 includes the combination of the distortion due to the nonlinear suspension system and nonlinear driving system.

(continued on page 67)

THE IEQ WITH Smartcurve™

Not Just Another Programmable Equalizer With MIDI™

The IEQ with Smartcurve™ is a programmable, high performance graphic equalizer that includes a video output. For those who wish to enjoy the video output of the IEQ, ART makes the IEQ Video Monitor.* Smartcurve™, proprietary software developed by ART gives you instant actual frequency response as easy as the push of a button.

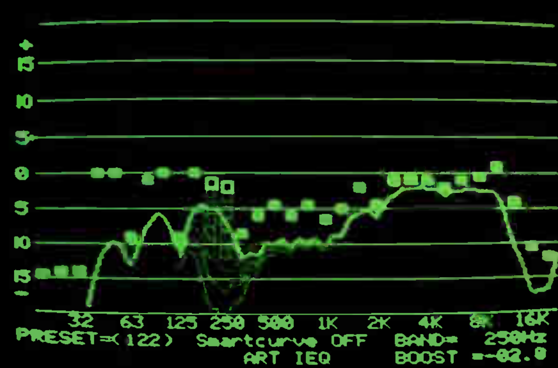
The IEQ Family consists of both the 2/3 octave and the 1/3 octave graphic equalizers. Both types come in two varieties, Controllers and Satellites. A Controller is a self-contained programmable intelligent graphic equalizer capable of controlling 15 satellites at once. IEQ Satellites are exactly the same unit except the front panel controls are eliminated.

IEQ Model Specifications:
Controller & Satellite

- 128 battery backed presets
- MIDI
- Frequency Response 20Hz-20kHz ± 0.5dB
- THD - ≤ .009% @ 1kHz, 0dBM typical
- Dynamic Range - ≥ 100dB typical
- Balanced inputs and outputs

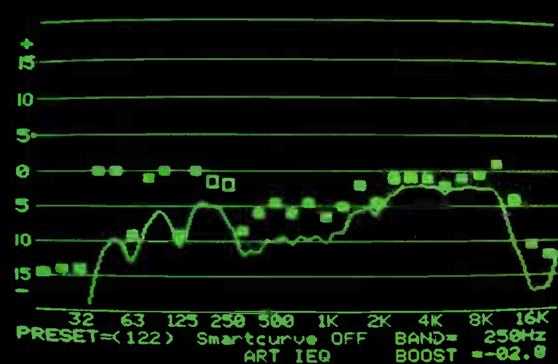
***IEQ Video Monitor Features**

- 19" rack mountable
- NTSC compatible monochrome monitor
- 4 Selectable inputs
- Standard RCA jacks for easy connections



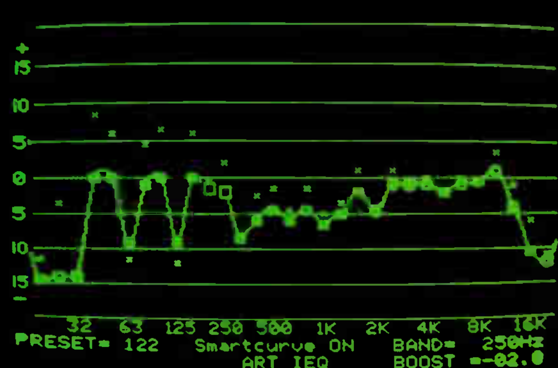
1 See the Sound

This is a video output of the IEQ as the unit is being adjusted. The sliders can be moved ± 15dB in 1/2dB steps to get the exact response you need. With the simple push of a button, complex equalization can be done in seconds with incredible accuracy.



2 Hear the Sound

The power of the IEQ readily becomes apparent as the video display plots the frequency response due to the slider settings. The IEQ offers high quality constant "Q" equalization. The video graphic display shows the correlation between the sliders and the frequency response.



3 Perfect Sound

Turn Smartcurve™ on and perfect equalization is at your fingertips. Note the difference between the second frame (Smartcurve™ OFF) and this frame. The position of the sliders represent the actual frequency response of the EQ. Interaction between bands is virtually eliminated. Incredible! Just think, now when you adjust the EQ you get exactly what you need. The "perfect" EQ? Let your eyes and ears decide.

It Has To Be A Work Of . . .

ART

Applied Research & Technology
215 Tremont Street
Rochester, NY 14608
(716) 436-2720
TELEX: 4949793 ARTROC
FAX: (716) 436-3942

For more information see your local dealer.

Circle 214 on Reader Response Card

CADP: JBL'S CENTRAL ARRAY DESIGN PROGRAM

BY MIKE KLASCO

It seems hard to believe that an entire decade has passed since Ed Seeley and Tom McCarthy presented their papers on loudspeaker array and room mapping techniques. Last month we discussed how the first generation programs used the Hewlett Packard HP 41 scientific calculator and peripheral mechanical hardware such as spheres, overlays, or other devices. Some of these programs were later rewritten for the Apple II and the IBM PC. These early efforts were typically single function utilities for RT60 calculations, coverage uniformity, driver selection, and so on.

In mid-1983 JBL introduced CADP (Central-Array-Design-Program) with great fanfare and some controversy. CADP was the first integrated design program that was commercially marketed (North Star Sound had developed a program a year earlier, but never actively marketed it; its use was primarily for in-house engineering). JBL's CADP was a milestone in introducing practical computer modeling techniques to sound contractors and the first program to calculate sound levels of user-definable arrays projecting into complex seating areas. In many ways CADP holds the same position as does Wordstar for word processing or Visicalc for spreadsheet programs. These programs were ambitious, bold projects that became the targets of much competition (while providing the foundation on which much of that competition was built). Later programs had the advantage of hindsight and the benefit of the incorporation of newer techniques and trends.

CADP is completely computer based, and does not use spheres or other external devices for visualization or documentation of the sound system design. CADP release 1.0 was infamous for its rudeness, with the slightest operator error often crashing the program and losing data that had taken much time to develop. Most of the bugs were fixed by release 2.0, and the latest version has been significantly improved.

Software development cycles seem to start with bug-infested innovation, moving to mature and reliable programs, by which time obsolescence has set in. While CADP is not obsolete, many new concepts and levels of sophistication in graphics resolution, acoustical analysis, and program function operation (known as "user interface") have been incorporated by competing sound system design programs. JBL is presently developing the next generation of this program and anticipates its introduction late this year. Although JBL intends to continue to support CADP, users will be able to exchange CADP for credit towards licensing the new program.

HARDWARE REQUIREMENTS

CADP will run on IBM (MS-DOS) compatibles using a single 360K 5.25-inch floppy drive, medium resolution (CGA) graphics board and color monitor. An Epson compatible printer can be used for hard-copy. This configuration, although not optimum, can be purchased for about $1000. Alternatively, a higher resolution video system with EGA or VGA graphics board/monitor (that is backwards compatible with CGA) would be a better investment and would add about $500 to the tab. The very popular Hercules high-resolution monochrome graphics standard will not normally work with CADP. There are emulator programs that allow CGA software to work with the Hercules graphics standard, but there are MS-DOS computer compatibility problems with many combinations of hardware and emulator software.

Welcome to the Central Array Design Program.

A hard disk drive would save a lot of time by eliminating floppy disk swapping and searching for which disk had the data files you needed. Hard disks with controller boards cost $250 and up. The present version of CADP does not yet support use of the math co-processor option on MS-DOS computers. Math co-processors cost between $150 and $250 depending on the speed and type of microprocessor used in your computer. The co-processor plugs into a socket on the computer's mother-board and would be an appealing addition, as software that takes advantage of this option can run from 2x to 10x faster. Epson compatible printers cost from $200 on up. The bare bones system with EGA high resolution monitor sub-system would still be only about $1500,

Klasco is president of Menlo Scientific, Berkeley, CA.

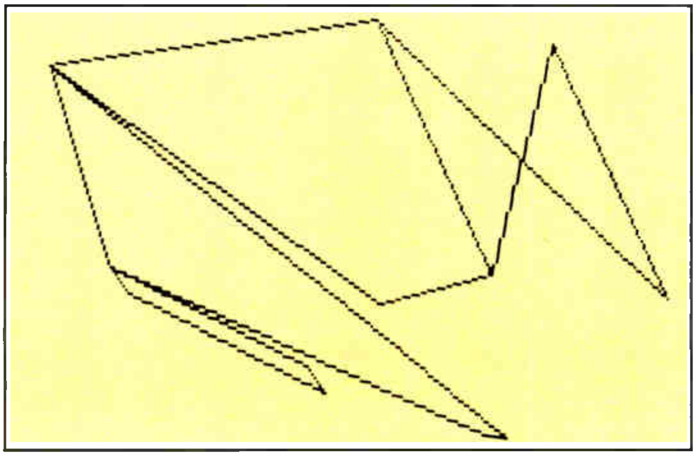


Figure 1. the existing RT60 has been entered into the CADP room model (a single quadrant of the lower seating level of a sports arena). The data for seating plane 4 has been entered incorrectly, as CADP makes immediately apparent.

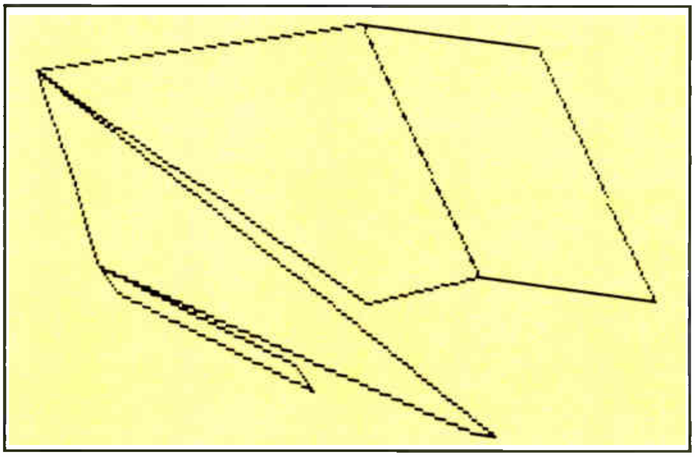


Figure 2. The same room model, with the corrected room approximation.

And the other goodies can all be added later (without throwing anything away).

SOFTWARE REQUIREMENTS AND AVAILABILITY

CADP is licensed to authorized JBL dealers and is also available to acoustical consultants. A one-time licensing fee of $600 covers updates and a quarterly newsletter. The program includes a data library for JBL components only, but data libraries are available at no charge from EV, Community, Renkus-Heinz and others. If you have a non-Epson or IBM compatible printer you will need a printer utility disk, such as Pizazz. This will let you exploit the special features of some printers, such as color printing, wide carriage, high resolution 24 pin dot matrix or laser printing. Even if you have an Epson or IBM compatible printer you should consider this type of print utility.

USER INTERFACE

When CADP was introduced, the use of multi-layer menus was considered progressive. Earlier generations of software programs required the user to know special commands, and the program would wait until an acceptable command was entered by the user. CADP is menu-driven, but the structure is awkward by the most recent standards. No contextual help system is provided. Some programs have a designated "help" function key you press when you don't understand what is going on, and information on the aspect of the program you are using appears on the screen. CADP's menu system uses the number keys rather than the special function keys, and common commands change numbers on different layers of the menu. If a standardized common hierarchy was set up then a function key overlay with commands labeled could be implemented. Re-aiming horns require a number of keystrokes, and JBL recommends Pro-Key, a utility program from Rosesoft that "automates" these steps.

DOCUMENTATION AND SUPPORT

CADP comes provided with an adequate manual and a quarterly newsletter. The manual provides some specific examples, but does not always show the exact procedures nor the full examples (although tutorial segments are included). A workbook would be highly recommended, and data disks with various completed jobs also would aid learning. The newsletter is helpful with program updates and descriptions of large jobs done with CADP.

GETTING STARTED

Work sheets can be printed out before you begin the program. As they cannot be accessed from within the program, it is easier to run off a number of the work sheets on a copy machine at some point). The two work sheets are for preparing the lists of coordinates for the locations of the seating plane corners and the loudspeaker component coordinates and acoustical data. By entering the room and speaker information into the program, a

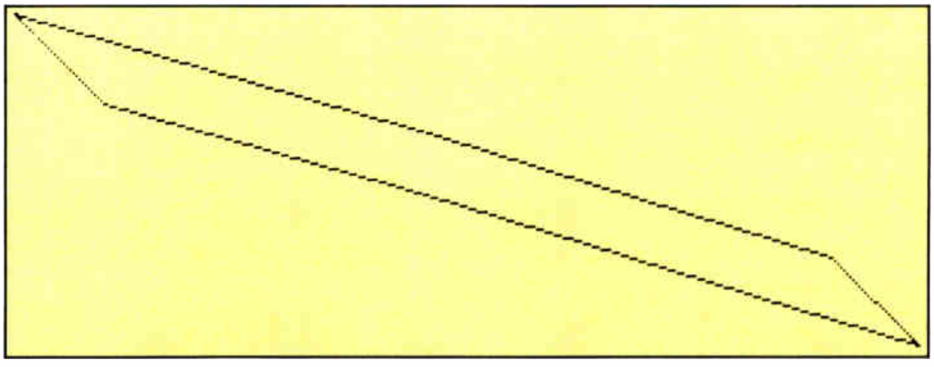


Figure 3. A single seating plane can be viewed (in this case, seating plane 1).

model of the proposed sound system and the room is created within the computer.

The time I spend on accuracy and attention to detail in preparing the worksheets to create this model reflects whether the effort is for a sales presentation, rough cost estimate, or a full design study.

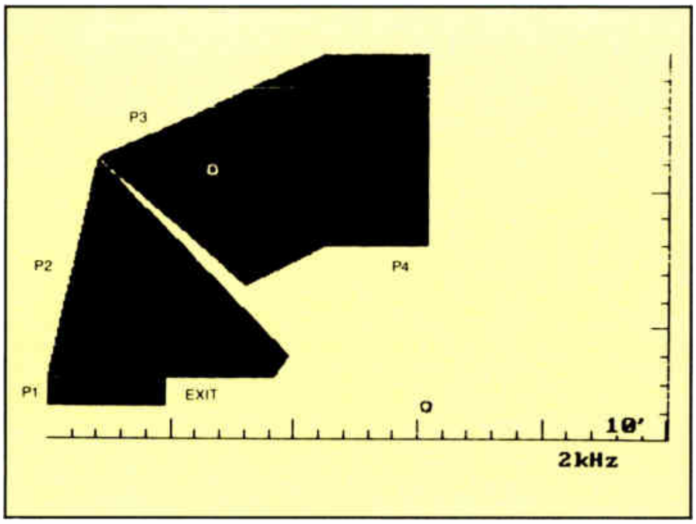


Figure 4. A single horn is aimed at seating plane 3 (up to 20 horns can be used in a model). All simulations are shown in plan view.

QUICK JOB ESTIMATES

I mark up the floor plan and elevation drawings with a scale on the borders of the prints. A T-square or a drafting table would be helpful. CADP allows you to use feet or meters and switch in mid-stream without any problems. Up to 20 seating planes (with up to 12 corners each) may be entered within one job. If the seating area is all on one plane, then only one floor section need be entered. While this room modeling approach is cruder than the Bose Modeler and Altec Acousta-CADD, it is also significantly faster, especially when doing quick estimates. Details such as small outcroppings of the wall, beams, etc. generally are not entered because only the floor plane can be modeled in CADP and obstructions cannot be shadowed within the program. While leaving out the walls and ceiling features expedites modeling, care is required by the designer to carefully view the room from time to time, in order to account for features such as beams, reflecting surfaces, and other characteristics that should be accounted for that will not appear in the computer model.

After you enter the corner locations and the height of the seating plane, the program displays a (3-D) oblique view. You are either rewarded for your efforts, or are punished with a twisted view of the seating plane due to some data entry or otherwise misplaced coordinate. (See Figures 1, 2, and 3.)

Although the procedures for data entry and revisions are awkward, room mapping is fairly quick after you become familiar with the program. I usually look over the floor plan and elevation prints for half an hour, another half an hour to add scales to the border and sketch-in the approximated room model. Without interruptions (turn off your phones, lock the door) this should take even less time.

Curved walls should be approximated with a number of straight lines that fall outside of the curved boundaries. I like to sketch in the curve so I don't try to improve room coverage for an area outside the window of the job. Data entry into the worksheet from the marked-up prints can take from a few minutes on a simple job, to half an hour or more depending on the complexity and number of the seating planes and sound system. Some users do not use the worksheet, but enter the data directly into the program; mistakes then become harder to trace.

Seating plane coordinates cannot be viewed after they are entered, unless they are printed out. An error in any coordinate requires the entire seating plane to be removed and re-entered. When CADP was introduced most spreadsheet programs were still in their developmental stages; the current release of CADP could benefit from the techniques used in spreadsheet programs.

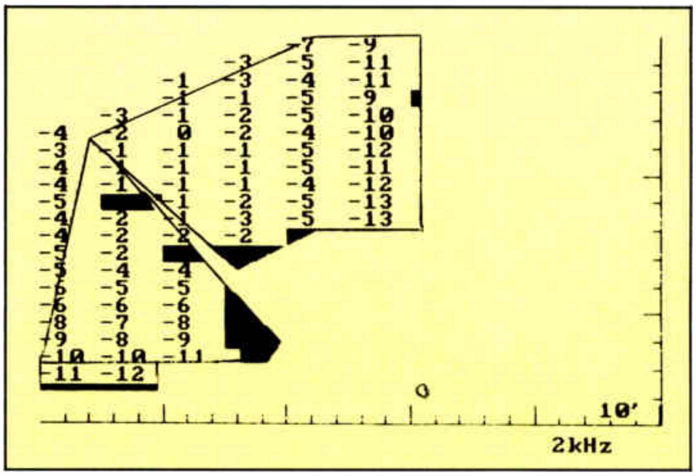


Figure 5. This shows the normalized direct field (0 dB indicates the loudest point). With this initial simulation, preliminary aiming angles for the entire tier of the array can be determined.

Spreadsheet layout would greatly speed and simplify creating the room and speaker models. The most recent release of the Bose Modeler program has taken this approach.

At times CADP can be unnecessarily time-consuming, unless "trick" techniques are used. An example is trying to move the cluster up a few feet, which is never addressed in the manual, and normally requires separately moving each component. JBL's Drew Daniels suggests dropping the floor rather than moving the cluster up. Other situations, such as changing the elevation on a bank of horns, can be efficiently edited by a text editor (JBL suggests Sidekick, which is memory-resident, and can pop-up while you are in CADP).

It is unfortunate that none of the sound system design programs support digitizing tablets. With a tablet, the drawing's scale

The difference between hearing most of the music and all of it.

It's a vital difference. Especially if you're an engineer, musician, vocalist, composer, producer or broadcaster.

BBE Makes The Difference
And the difference is heard around the world. In leading recording studios, at major live concerts, and by audiences of top-rated radio stations.

What's The BBE Difference?
We make an exclusive line of audio processors. For all audio uses. Professional. Personal. Industrial. Wherever sound is involved, so are we.

Our technology restores the proper harmonic structure of sound by compensating for amplitude and phase distortion.

What's The Result?
You won't believe it. You literally will hear nothing like it. That's because instead of hearing most of the music, you'll hear all of it.

How Is It Done?
Well, we began 10 years and 42 patent claim awards ago. But simply, the BBE SYSTEM:

- Divides the audio spectrum into three bandwidths
- Applies specific phase corrections to each band
- Makes dynamic high-frequency amplitude compensations as required

What Do The Experts Say About BBE?
"The most hearable advance in audio technology since high fidelity itself."— *Music Connection Magazine*

"The effect is shattering!"— *Music Technology Magazine*

"I can't imagine working on another album without BBE."— *Steve Levine, producer of The Beach Boys, Culture Club, Denice Williams, and BPI Producer of the Year*

"The difference in (BBE) processed audio and non-processed audio is like the difference between high-fidelity speakers with and without pillows placed in front of them."— *Radio World Magazine*

"For my own personal system, it was the answer to problems I had been trying to solve with a graphic equalizer. The system has never sounded so good." —*Mix Magazine*

"You're in aural heaven."— *Music & Sound Output Magazine*

Full Warranty
All BBE products are backed by a full year's warranty on all parts and labor.

Where Can You Hear The BBE Difference?
For the name of the BBE professional sound dealer nearest you call toll free **1-800-233-8346**. In California 1-800-558-3963.

Then stop by. You'll love what you hear. All of it.

BBE™
Sound Inc.
5500 Bolsa Avenue
Suite 245
Huntington Beach, CA 92649
(714) 897-6766

Circle 211 on Reader Response Card

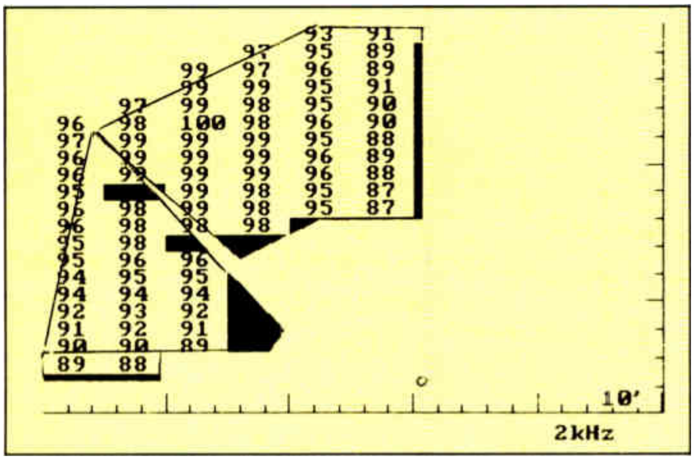


Figure 6. This shows the maximum direct field (the direct sound field SPL at the seating area). The single 60 x 40 horn is obviously inadequate for the 3000 seats depicted.

is entered, and a "puck" with cross-hairs is located at corner points and loudspeaker locations on the architectural print. A single keystroke enters the coordinate, reducing time and errors significantly.

After the room coordinates are entered, you may wonder what to do next. Remember that these programs are computer-aided sound system design, not computer sound system design. CADP is menu driven, which means you must know what to do, or at least already know how to design a sound system without the computer. JBL has tried to make this point clear, but sometimes it is forgotten (by the user). What you do next, then, is what you would normally do without the program. You determine, through experience or common sense what horn you should use to cover a section of the seating area. The location of the horn is entered into the loudspeaker worksheet with XYZ coordinates. These Cartesian coordinates are the same as the room model. Unfortunately, different programs use x, y, and z to denote length, width, and height differently. In CADP, horn aiming is defined as Elevation, Azimuth, and Rotation. Other programs use different terms for manipulating horns and I have not encountered two programs using the same terms.

Once the best guess is taken of which horn to use, the data is entered into the worksheet or directly into the program. This can take 20 minutes to an hour, depending on the number of components used, whether there are split clusters, and collision avoidance between components. (See Figure 4.)

CADP can accommodate a maximum of 20 speakers. For large jobs of 20 or more speakers, the acoustic data (RT 60, surface area, volume) and seating plane data are saved as a file without the speakers. First the horns are entered and the 2 kHz band simulations run. Secondly, the speakerless file is retrieved and the bass boxes are entered, and the bass frequencies (500 Hz) are run. Many users only use the 2 kHz band as Peutz has shown this to be the most critical frequency for intelligibility, but there are many strong considerations for completing the simulations at other frequencies. If the job uses more than 20 horns for the mid-range, then the simulations can be done by bisecting (or quartering) the cluster. There is no provision for automatically mirroring symmetrical rooms or identical (split) clusters.

The first computer simulation I check out after verifying the horn aiming is the Normalized Direct Field, as shown in Figure 5. This is a floor plan of the seating area (that you created when you entered the seating plane data) with the loudest point referenced as the 0 db point. Of course the horn must be available in the library data files. Unlike all of its present competition, JBL provides data only on its own products. During the last few years EV, Community, and Renkus-Heinz have prepared data disks on their components for CADP users. The radiation pattern characterization developed by JBL for CADP was adopted by Bose for its modeler program, so some of the components available in the Modeler library can be manually entered by the user into CADP. As Modeler is a Macintosh program and CADP is IBM (MS-DOS), direct file interchange is not easily accomplished.

After you have selected a horn from your library, the computer will count down during its calculations and then ask if you want to see "phase effects." You press N (no) as phase effects are not generated from a single horn. Up to 200 data points showing the relative direct sound level will be plotted, although the layout (aspect ratio) of some seating planes may reduce that number significantly. One idiosyncrasy you may notice is the lack of symmetry in the predicted results. A 1 dB variation can result due to rounding (and computer hardware) so if a 3 dB uniformity limit is imposed, then the acceptable field of coverage may not appear symmetrically, even though the room and speakers are (actually) symmetrical. While 1 dB is not significant (production tolerances on loudspeakers are often greater), this can be awkward to explain to an unsophisticated client.

MAXIMUM SOUND LEVEL

The process used to view the Maximum Sound Level is the same as the Normalized Direct Field. If you have not changed the horn, its aiming, or the seating plane, then this calculation requires only a few moments. The peak sound level is shown for the same points as the Normalized Direct Field. (See Figure 6.)

If the coverage is not as desired, then re-aiming, a new speaker location, or a speaker with a different pattern may be tried. Basic intuition and experience are used to make these determinations, i.e., if the room is wide and not too deep, then try a wide coverage horn; if the room is long and narrow, try a high-Q/narrow coverage-angle horn; if the maximum sound level is not high enough, then try a 3-way system, or use multiple clusters closer to the audience, or a greater number of narrow pattern horns, and so on. Of course, this kind of information is not volunteered by the program, but must be externally supplied by the designer.

(continued on page 66)

90 ways to depart from the straight and narrow.

Prepare to expand your horizons. With the Yamaha DEQ7, the completely digital equalizer. With not one but 30 different EQ and filter configurations, in stereo.

To be specific, it has 11 graphic EQs, four parametric, three tone configurations, five band pass/band reject filters, six dynamic filters and one multi-notch filter configuration, plus up to 738 ms of delay per channel.

But, in the Yamaha tradition of never leaving well enough alone, we did some expanding of our own.

Like memory. The DEQ7 has sixty user-programmable memory locations, so you can store and title your favorite curves, and recall them any time manually or via MIDI. There are digital I/Os for direct connection to other digital components, as well as analog inputs and outputs.

Since we're on the subject of output, it's equally important to mention that, in the opinion of many critical users, the DEQ7 produces an open, natural-sounding EQ. Which means that you can create extreme EQ settings without creating extreme anxiety.

The Yamaha DEQ7 Digital Equalizer.

It'll throw you a few new curves. Catch one at your nearby Yamaha Professional Audio dealer.

Yamaha Music Corporation, Professional Audio Division, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Avenue, Scarborough, Ontario M1S 3R1.

YAMAHA
Engineering Imagination™

Circle 208 on Reader Response Card

Sound Thoughts on Live Performance

MEYER SOUND

"Creating the subjective experience of live performance sound belongs to the artists and sound designers. Our creativity comes in building speakers and systems that give the truest possible account of what the performers produce."

John Meyer, Founder and President, Meyer Sound Laboratories

John Meyer's involvement in loudspeaker design began in 1967 when, as a technician for a Berkeley, California Hi-Fi supplier, he set out to discover why a leading manufacturer's drivers kept tearing themselves to pieces. Further investigations convinced him that the market sorely needed a class of rugged professional speakers that would maintain their characteristics over time.

Research in Switzerland in the early seventies secured his knowledge base. In 1972, Meyer developed the JM3 all horn loaded tri-amp system with rigging, which was the standard for Broadway shows until the introduction of the UPA in 1980. From 1973 to 1979, Meyer sought out the best available parts and designed the first Ultra Series™ reinforcement speakers. In the decade since, John Meyer has established Meyer Sound Laboratories at the forefront of professional reinforcement technology.

Meyer Sound has devoted itself to designing, manufacturing, and refining components that deliver superb sonic reproduction and expand the artistic possibilities of professional sound reinforcement.

Meyer strives for professional sound quality that is predictable and neutral over an extended lifetime and across an extended range. Even after extended use, Meyer Sound performance is never compromised.

As a consequence, Meyer Sound products have earned a reputation for the highest reliability in the industry. All are guaranteed to meet or exceed specified performance levels when properly installed.

"The general public's sophistication keeps growing. Soon, if we have our way, the audience will demand the same accuracy in live performance that they get from home recordings."

Instead of second-guessing the tastes of the market, Meyer produces sound systems that most truly represent the character of the signal they receive, leaving artistic control where it belongs—with the artists and sound designers.

Meyer takes a conservative view of exotic loudspeaker materials, preferring to use proven materials in new, more elegant ways.

Every part of every component undergoes rigorous, comprehensive testing. Meyer Sound controls all aspects of the system design—if not by manufacturing, then by modification and refinement to Meyer's stringent standards.

"As expectations rise, our performance standards have to rise even higher. And the only way to increase performance is with increasingly sophisticated measurement.

"Which is how we found ourselves also in the measurement business."

Meyer originally intended to be solely a manufacturer of high-quality, rugged and reliable loudspeakers, expecting others to pioneer and perfect testing equipment. But the need to accurately measure the performance of Meyer components individually and in arrays outgrew the quality and resolution limitations of available testing equipment.

To make sound work in spaces, Meyer Sound Laboratories developed by necessity its own testing technology and methods.

John Meyer, his engineers and his designers have authored several definitive works, and research remains an integral, driving force behind all production.

SIM™ Equalization

SIM™ equalization is the logical result of Meyer's commitment to uncompromised sound quality through sophisticated measurement. The non-intrusive SIM technology uses real-world program material (either voice or music) as the test signal. Working interactively with the sound designer, a Meyer SIM engineer helps create superior clarity for every member of the audience.

Ask your distributor for more information on SIM equalization, or call Meyer Sound Laboratories direct.

Sound engineering for the art and science of sound.

Meyer Sound

Meyer Sound Laboratories, Inc.
2832 San Pablo Avenue
Berkeley, CA 94702
(415) 486-1166
FAX (415) 486-8356

Sound Science. Sound Art.
SIM™ Equalization from Meyer.

"Noise and light are not music." *John Meyer*

Dynamic sound behaves differently in each spatial context. And while schematic arrangement helps dramatically in predicting sound quality, only through live use and exhaustive testing can an installation be tuned for specific desired characteristcs.

Some sound designers still use noise, swept tones and light to set up a soundstage, as if projecting sightlines and frequency response in an empty room delivered the pure experience of music.

Meyer Sound recognizes the importance of both frequency response and phase response alignment and maintaining the *order* of the signal throughout a space. (For example, playing a tape backwards doesn't change frequency response, but changes phase response.) And the only way to gauge phase properly is through measurement.

Bob McCarthy
Senior SIM Engineer
at the 1988 Grammies

SIM Measures Music.

SIM™ equalization, a sophisticated acoustical analysis and correction technique using proprietary Meyer Sound technology, is performed nonintrusively, and with real-world accuracy, because it uses real-world program material (either voice or music) as the test signal. The technique may be used during actual performance, when the audience presents its true effects on the sound reinforcement.

Interactive Process.

SIM equalization involves the sound designer, consultant, mixer and SIM engineer in an interactive process of establishing the subjective sound dynamics of a space. When used with a properly aligned Meyer Sound system, it creates an environment in which both frequency response and phase response are dramatically improved, resulting in superior sound clarity for every member of the audience.

Results-Oriented Measurement.

A SIM engineer from Meyer operates the system, implementing the sound designer's desired effects.

SIM enhances the mixing function, making the spatial sound dynamics visible to the SIM engineer. Placing SIM microphones strategically throughout a space, the engineer first ensures all areas are covered, and then adjusts each area to attain a uniform sound experience through SIM's straightforward system of resolving complex measurement.

SIM equalization even has the ability to erase a room. The sound designer thus can bring back in the room's ambience or enhance it, to whatever degree deemed appropriate. SIM gives the designer qualitative, as well as quantitative, control of a space.

Clarity for the New Sophistication.

The audience is the true beneficiary of SIM equalization, enjoying better intelligibility and a more intimate relationship with the performers.

With SIM, Meyer is helping redefine the parameters of live performance sound quality.

Meyer Sound's CP-10
Complementary-Phase
Parametric Equalizers,
designed to correct the types
of acoustical problems found
in actual concert halls, are
an integral componenent of
the SIM equalization process.

Meyer originally intended to be solely a manufacturer of high-quality, rugged and reliable loudspeakers, but finding testing equipment which could meet Meyer's exacting standards proved impossible. To accurately measure the performance of Meyer Sound components individually and in arrays, and to make sound work in spaces, Meyer Sound Laboratories developed by necessity its own testing technology and methods.

SIM equalization grew out of Meyer's uncompromising production philosophy, and as such, SIM is applied only to Meyer Sound equipment installations. Instead of attempting to second-guess the tastes of the market, Meyer produces sound systems that most truly represent the character of the signal they receive, leaving artistic control to the artist. With SIM, Meyer offers an equalization tool that leaves complete control of spatial sound dynamics where it belongs—with sound designers, consultants, and mixers.

SIM Clients:

Irving Berlin Tribute, *Carnegie Hall, New York*
Budoken Hall, *Tokyo*
Stevie Wonder tour, *Wembley Arena, London*
Luciano Pavarotti, *several tours*
Les Miserables, *New York, Boston, Los Angeles, London*
Lily Tomlin, The Search for Signs of Intelligent Life in the Universe, *San Francisco, Washington D.C., Chicago*
Jubilee Auditorium, *Calgary, permanent installation*
1988 Grammy Awards, *New York*

Sound engineering for the art and science of sound.

Meyer Sound

Meyer Sound Laboratories, Inc.
2832 San Pablo Avenue
Berkeley, CA 94702
(415) 486-1166
FAX (415) 486-8356

MEYER SOUND

Circle 216 on Reader Response Card

THE MINNESOTA WORLD TRADE CONFERENCE CENTER

BY STEVEN J. ORFIELD

Typically, meeting center designs are driven either by architectural concerns (resulting in poor A-V system performance), or by technological concerns (resulting in less-than-optimum facility aesthetics). While the Minnesota World Trade Conference Center (MWTCC) began its concept and design with just that sort of choice, the result was an unusual blending of technology and architecture that speaks well for the potential of both fields, and was one of the reasons that this center was selected as the 1990 site of the World Trade Centers Association General Assembly.

The project team was comprised of the Minnesota World Trade Board, Ellerbe-Becket Architects (the third largest architectural & engineering firm in the U.S.), Orfield Associates as technical consultants (acoustics, A-V, lighting, daylighting, and thermal environmental consulting), and Blumberg Communications as the A-V vendor and systems engineer. Because of its size and its extensive in-house talent, Ellerbe-Becket had the potential (as do all large architectural firms) to dominate the decision-making process.

Orfield is president of Orfield Associates, Minneapolis, MN.

While both the design consultant (Ellerbe) and the performance consultant (Orfield) expressed reservations regarding design process and task definition, the client was very firm in expressing the desire that no compromise would be made between interior architecture and interior performance.

Project planning was begun by the architect prior to the commencement of technical consulting. After viewing initial project plans, the client decided that a high quality facility would require a more definite program than had been developed to date, and took the initiative to perform an extensive phone marketing survey prior to authorizing any final design work on the facility.

While the initial plans called for many small rooms, the survey concluded that:

Main entrance hallway, Minnesota World Trade Conference center.

1. Mainly large rooms were needed.
2. Rear screen spaces were very popular and not easily available to most users.
3. Higher ceilings were desired by meeting planners.
4. High quality lighting was very important to most users.
5. Audio and video systems should be better than those available to most large corporations in their own corporate facilities.
6. Daylighting was considered more desirable by most users.

Overall, the survey uncovered a significant perceived need for qualities that best described a luxurious high-tech center. Most users felt that there was an abundance of lower-quality centers, and that their own facilities were generally better than these centers. They also felt that the so-called "executive conference centers" were generally not much more than fancy hotels with very basic meeting facilities. The World Trade Center Corporation believed they had identified a significant niche that was not being addressed.

Having come to this conclusion, the MWTCC president, former Congressman Richard Nolan, and managing director Scott Johnson decided to become actively involved in major

The main studio/theater, looking towards podium and rear-projection screen.

design decisions, rather than placing their faith solely in the judgments of their consultants. During the subsequent process, both men frequently overruled the design team. When told that certain of their goals were not within the limits of their budget, they refused to accept this conclusion and sent the team members back to the drawing boards to determine better solutions. And when it became apparent that the building in which the Center was being constructed would not meet the NC (Noise Criteria) for this project, they insisted on a negotiation with the building developers to resolve problems of a noisy HVAC (heating and cooling) system (a problem resolved after much discussion and measurement).

As a further example of this hands-on approach, when the client was told that the A-V budget was too limited, they arranged for an additional line of credit in order to have the level of quality that was necessary to serve the identified market niche.

The MWTCC chose to open the facility without any fanfare, and will operate the facility for about three months prior to any formal opening. While most areas of performance were as expected at the informal opening date of this Center, the problems typical of initial operations suggest that the decision to delay a formal opening was correct. It is interesting to note that in spite of this lack of a formal opening, the project is receiving a great deal of favorable attention from the local press. For example, Larry Millet, architecture critic for the *St. Paul Pioneer Press Dispatch*, said: "The new World Trade Center conference facility...may well be the most sophisticated complex of its type in Minnesota."

The Center is made up of a large auditorium seating 112, a small "executive" auditorium seating 50 to 60, both large and small executive boardrooms, a number of classrooms, and a dining/display multipurpose room. Each of the areas has some unique features.

All of the major rooms have professional quality dual audio systems with major loudspeaker components, as well as the more conventional ceiling-mounted, distributed systems. Each speaker system type is separately equalized. There are automated microphones for local reinforcement in a number of rooms, and the rooms are equalized for the frequency sensitivity of these microphones. Major rooms have full podiums with automated A-V, lighting, window closure, and rear screen enclosure controls; the main auditorium podium also features built-in fully interactive video monitoring. All major rooms are interconnected by an A-V routing system with stereo, video, and intercom in and out lines. Each major room has a fully dedicated A-V system, totally built-in and custom-designed for that particular room.

Audio system components are very high in quality, with the principal sources being Community, Shure, Electro-Voice, and

The control room for the main studio/theater.

The executive boardroom.

Toa. Video projectors are Barco's top-of-the-line, highest light output products. To make the systems as "user-friendly" as possible, there is little "processing" componentry, and while the A-V systems can be manipulated by corporate A-V teams, all of the systems are automatic in operation. The main auditorium has a full control room at the rear and has a separate four-person booth for simultaneous language translation of speeches and lectures.

Although the World Trade Center Corporation decided initially to have both an up-link and a down-link on the building, their initial budget did not include this expense. However, they were able to negotiate an agreement with the Minnesota Vocational Education system, resulting in a state-funded joint-use effort to install these capabilities.

All of the meeting rooms are fully illuminated by daylighting, and all major rooms are lit totally via incandescent lighting sources, such as standard A-lamps, par lamps and quartz sources. The main dining room is lit via a parabolic fluorescent lighting system, featuring a Honeywell low-cost fluorescent dimming system. All of the major rooms have 8-scene preset lighting systems with no manual dimming controls, and the lighting is preset for the following four functions (with the other scenes available for custom client use):

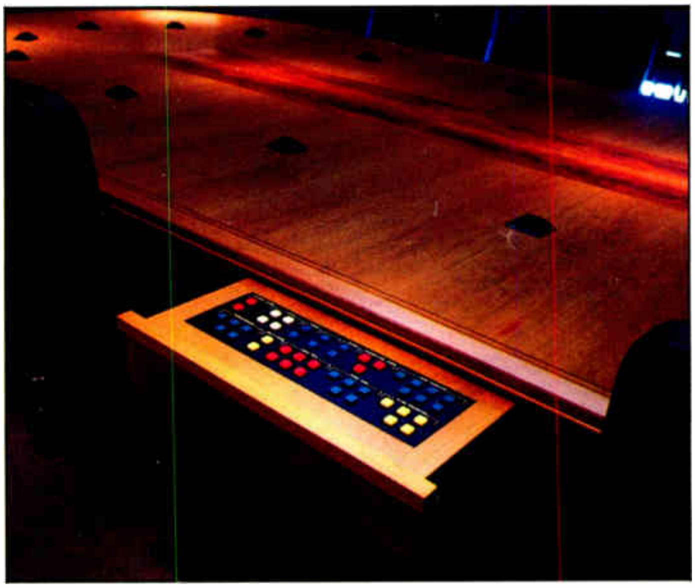
1. A-V high (note taking)
2. A-V low (visual presentations only)
3. Meeting high (formal)
4. Meeting low (relaxed)

The main A-V dedicated rooms have motorized window shades for daylighting control during presentations.

In terms of acoustics, all rooms in the Center have performance standards for NC values, reverberation time, intelligibility, and sound isolation, and all of these standards include verification testing prior to acceptance of the space. No major rooms share common walls and many "buffer spaces" (including rear screen rooms and public areas) serve to separate functions. Both of the auditoriums have full acoustical vestibules.

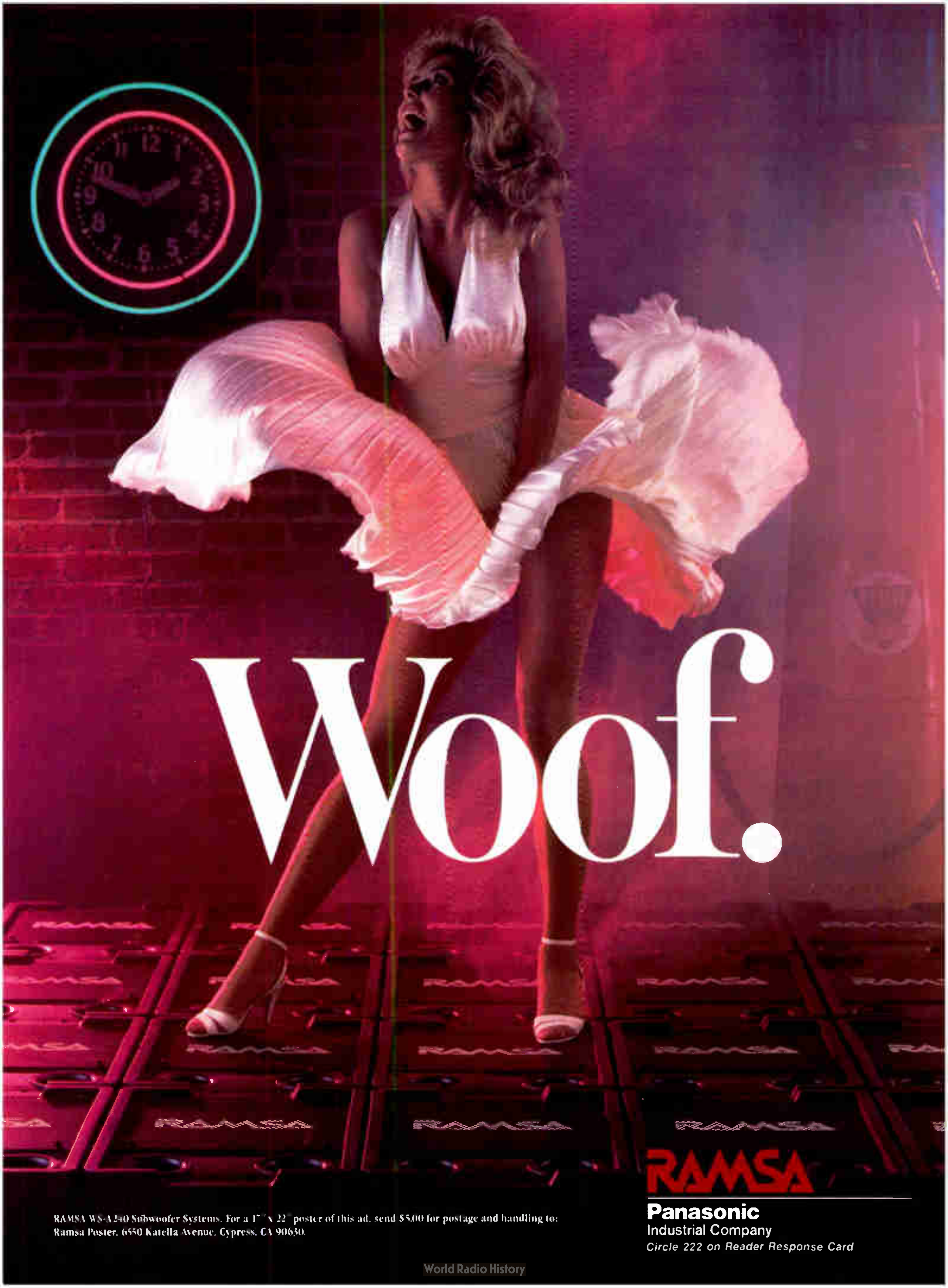
The Conference Center is modern rather than the "post-modern" style of so many current centers. While most of these centers tend toward dark, "sophisticated" colors, a light-reflectance standard was established on this project to insure limited daylighting contrast and visual comfort. This standard insured the use of very light colors in all meeting rooms, and even included furnishing colors. The look of the space is "bright and open" (as one newspaper critic described it), and this look is intended to be part of an underlying "comfort criteria" for this space. Rather than trying to impress the visitor, the space is intended to reduce the tension often found in business meetings; the primary function of the center is, after all, the successful direction and completion of such meetings.

This project demonstrated the high degree of quality it is possible to obtain when a variety of skills and interests are melded and focused on one design intent. In fact, the client, the architect, and the technical consultant are now exploring a long-term collaboration, and hope to offer the services of the design team and the programming expertise of the client to others engaging in similar projects. All too often, the skill and knowledge gained in facilities design is lost at the end of a project and the next client is simply the victim of a new experiment. All involved in this project hope that the long term results will suggest that some more permanent benefits may be derived from this collaboration.

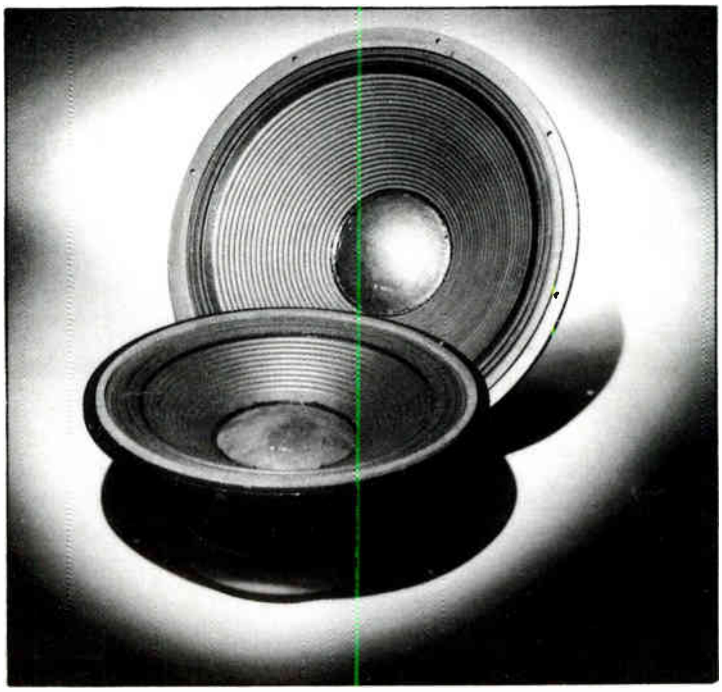


Automated main control panel, executive boardroom.

It is interesting to note the final point made by Mr. Millett in his review: "I've long since reached the conclusion that the only good meeting is one that I'm not attending." Instead of designing a center to impress the occupant, it is important to take note of this axiom and to understand that meeting facilities should be designed to minimize discomfort rather than to simply "excite the eye." A conference center design must be a "process design." The aesthetics of a facility is only a static, one-dimensional issue; the functions and problems of a conference center are quite dynamic and multi-dimensional.


Woof.
RAMSA WS-A240 Subwoofer Systems. For a 17" x 22" poster of this ad, send $5.00 for postage and handling to: Ramsa Poster, 6550 Katella Avenue, Cypress, CA 90630.
RAMSA
Panasonic
Industrial Company
Circle 222 on Reader Response Card

THE BRITISH ARE COMING! THE BRITISH ARE COMING!



Studio 7 15-inch & 18-inch sizes rated at 500 watts

- PRIZE WINNING QUALITY PROVEN IN BRITAIN AND EUROPE.
- AVAILABLE EXCLUSIVELY FROM WALDOM IN NORTH AMERICA.
- TWO SERIES AND 40 MODELS TO CHOOSE FROM.
- TOPS FOR MI AMPS AND SOUND REINFORCEMENT/ PRO SOUND.
- TOPS FOR CLUB, AUDITORIUM, PA INSTALLATIONS.

WALDOM INTRODUCES McKENZIE

THE SOUNDLY BRITISH LOUDSPEAKERS

MC KENZIE STUDIO 7 SERIES– POWER AND QUALITY TO SPARE!

- 20 MODELS RATED FROM 100 TO 500 WATTS.
- 10-INCH, 12-INCH, 15-INCH AND 18-INCH SIZES.
- 15-INCH AND 18-INCH MODELS RATED AT 500 WATTS.
- RUGGED CAST ALUMINUM BASKETS PLUS HIGH TEMP COILS.

MC KENZIE PRO SERIES– AFFORDABLE SOUND WITHOUT COMPROMISE.

- 20 MODELS RATED AT 50 TO 200 WATTS.
- 10-INCH, 12-INCH AND 15-INCH SIZES.
- 15-INCH SIZE EVEN HAS CAST ALUMINUM BASKET.
- HIGH TEMP COILS AND PARTS.

NOTE SOME DEALERSHIPS AND REP TERRITORIES STILL AVAILABLE.

waldom
ELECTRONICS, INC
A KATY INDUSTRIES COMPANY

. . . the Sound Source

4301 West 69th Street/Chicago, Illinois 60629
Telephone: (312) 585-1212/Telex: 244810/FAX: (312) 585-7847

Circle 210 on Reader Response Card

LOUDSPEAKER EVOLUTION

BY ROB McMANUS

Realistically speaking, all quality loudspeaker systems are based on a series of principles and discoveries made by many different people. Each of their contributions have been used in whole or in part by all loudspeaker manufacturers. To the sum of these contributions, each company adds its own "exclusive" production process or feature.

The first loudspeaker can be traced back to around 1861. A young science teacher by the name of Johann Phillip Reis was conducting experiments to develop an instrument for the transmission of sound. Although Alexander Graham Bell is given credit (and the patent) as the inventor of the telephone due to his distinctive "undulating current production" device, the receiver of John Phillip Reis' telephone was actually the first loudspeaker ever made.

The receiver was made of a coil of wire around an iron rod mounted on a resonating wooden box. "Its action was almost certainly magnetostrictive, and because it was provided with a wooden diaphragm to augment the sound radiation and because it was designed for receiving speech signals (whether it ever did or not), it can be accorded the distinction of standing as the first magnetostrictive loudspeaker, perhaps the first loudspeaker of any type." (Hunt, Frederick V., *Electroacoustics*.)

In 1877, Ernst Werner Siemens filed a patent for a moving-coil transducer mechanism that possessed some fundamental features used today. Siemens' transducer had a permanent magnet which produced a radial magnetic field. Also, his transducer contained a non-magnetic parchment diaphragm as the sound radiator, a diaphragm that Siemens specified should be conical in shape and exponentially flaring like a trumpet for directivity. Siemens' diaphragm could be considered the first attempt at making a horn-type loudspeaker.

Other contributions to diaphragm design were made by John Stroh, Louis Lumiere and C. L. Farrand. Stroh is responsible for the first conical paper diaphragm in 1901. In 1908, Lumiere designed a ten-inch flat diaphragm with radial pleats to enhance the diaphragms rigidity. Though the Lumiere diaphragm was made to be used with a phonograph, it was used in one of the first large-diaphragm loudspeakers to become commercially available. The first coil-driven direct-radiator loudspeaker was called the "phonetron," and was invented by Farrand in 1921.

The economics of loudspeaker manufacturing was the driving force behind much of the research conducted on the topic of permanent magnet materials during the early 1900s. This research resulted in more knowledge of materials with high coercive force and high energy storage, and the application of that knowledge to improve basic loudspeaker drive mechanisms (with lower production costs). Alnico metal alloys, due to their stable characteristics at wide temperature variations, were used at first to replace the field-coils in loudspeakers; however, these days the majority of loudspeaker applications efficiencies.

Two General Electric Company engineers are responsible for the advances in transducer design that had a dramatic effect on the mass marketing of loudspeakers. In 1925, Chester Rice and Edward Kellogg set out to make the best "hornless loudspeaker" possible. To accomplish this, they required an amplifier capable of delivering sufficient power (without relying on resonance as a source of loudness) to the loudspeaker. After this, they could concentrate on faithfulness of reproduction instead of volume.

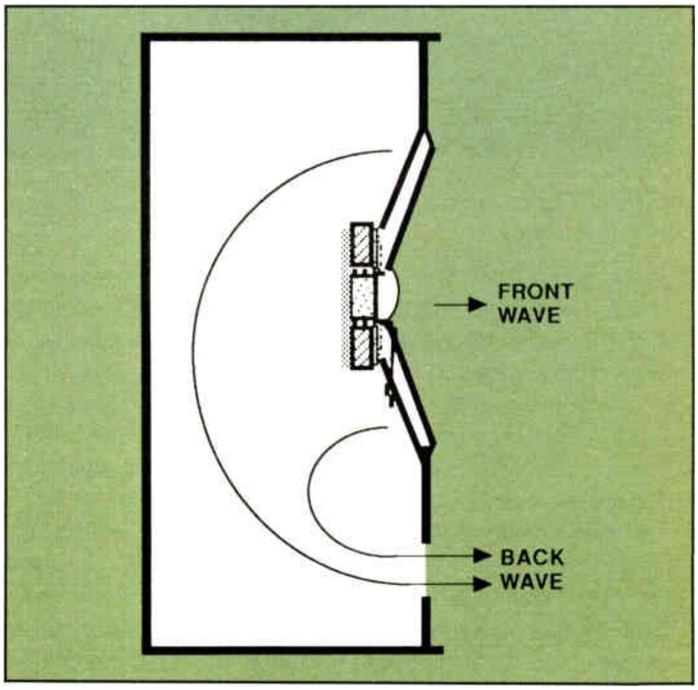


Figure 1. A vented, direct radiator low-frequency enclosure. (Courtesy Yamaha Corp.)

The result of their endeavors yielded a power amplifier capable of producing one watt of available power. The resultant demand for electroacoustic transducers literally rose into the millions.

The loudspeaker that Rice and Kellogg made was based on the conclusion that the if fundamental resonance of the diaphragm is below the lowest frequency of interest, then the variation with frequency of the two factors that jointly control the sound output will yield a uniform response throughout the middle range,

McManus is an acoustical consultant with Jaffe Acoustics, Norwalk, CT.

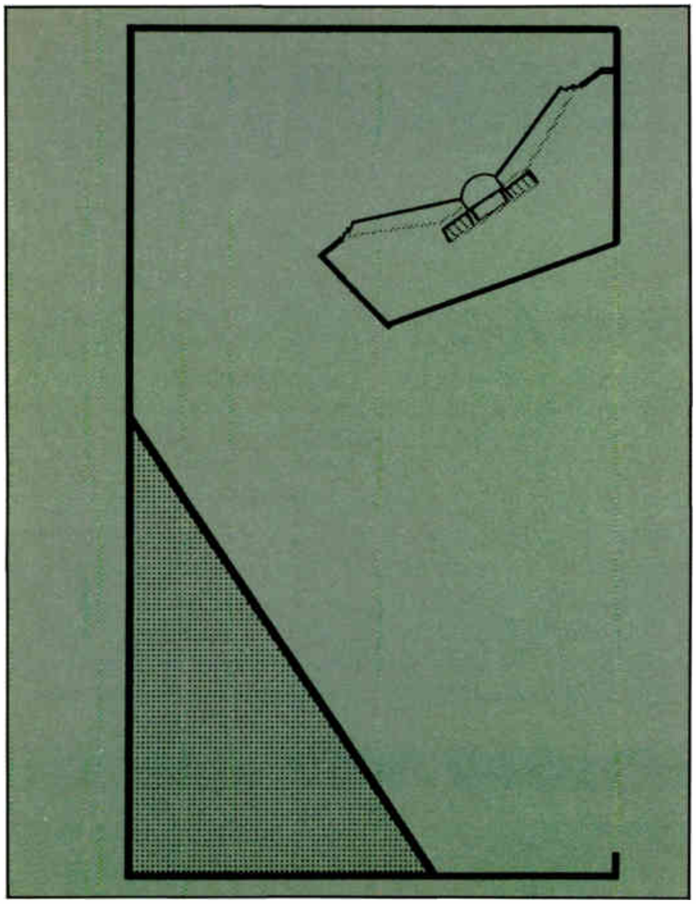


Figure 2. Cross-section of a folded low-frequency horn. (Courtesy Yamaha Corp.)

up to some higher frequency at which the assumption begins to fail. The two joint factors being: the relation of sound radiation to a mechanical resistance of a diaphragm in a baffle (sound power will increase with the square of the frequency if the velocity of vibration is constant), and the control of the motion of the system by mass reactance (the square of the vibratory velocity will decrease with the square of the frequency throughout the frequency range above resonance).

The end result of the Rice-Kellogg effort was the "Radiola" Loudspeaker Model 104 with its built-in amplifier. The Model 104 also had four extra terminals on the connection board attached to the back of the speaker cabinet. This meant that the excess output capacity from the loudspeaker field coil could be used at these terminals to fulfill all the d.c. power requirements of the Radiola 28 super-heterodyne radio receiver. The Model 104 and 28 combination was the first radio receiver/loudspeaker that did not require batteries; it could simply be "plugged in."

This was an important turning point in electroacoustic transducer history. Previously, transducers had worked with d.c. power supplies, but with the Rice-Kellogg combination Radiola 104 and 28, and the new a.c. amplifier tubes on the market, the entire industry converted to a.c. operation during the period from 1926 to 1928.

As far back as 1868, Sir George G. Stokes (in his paper *On the Communication of Vibration from a Vibrating Body to a Surrounding Gas*) pointed out that sound radiation could be increased by stopping the circulatory flow of air around the sides of a vibrating surface. Several engineers experimented in the field of baffle art; the most important change to come out of all these experiments was the "phase inverter" housing or "bass-reflex" enclosure.

The theory behind the use of the "bass-reflex" enclosure is that high frequencies radiating from the back of the loudspeaker diaphragm will be absorbed in the enclosure. If a port or opening is made on the side of the enclosure on which the speaker is mounted, there will be no effect on these high frequencies because they are short, highly directional sound waves. However, low frequencies radiating from the back of the diaphragm will be diffracted back to the front (in the same direction as sound waves radiating from the front of the diaphragm). If the dimensions of the enclosure are such that the diffracted low frequencies arrive in-phase with the direct sound waves, reinforcement will be provided just above the extended low-frequency cutoff of the system.

While Albert L. Thuras was basically the first to use the bass-reflex enclosure, Jurjen S. High used an "acoustic labyrinth" (in which sound waves would radiate through from the back of the diaphragm). Selective absorption in the duct or "labyrinth" would attenuate high frequencies, and by diffraction, the low frequencies would return to the front of the enclosure in-phase with front diaphragm waves, thus boosting the bass response of the loudspeaker/enclosure interface while eliminating any cavity resonances.

John Minton and Abraham Ringel developed the first crossover network in 1925. Their two-way "dual loudspeaker" system used electric filter networks that would divide the frequency spectrum into two parts, where low frequencies would be delivered to the woofer, and high frequencies to the tweeter. (More on crossovers later.)

Other developments of note were made in diaphragm materials. Engineers at the BBC successfully used plastic compounds in place of paper cones in the mid-1960s, achieving improved performance and more consistent production means. In the 1970s, the Japanese began using carbon fibers in cones. Compression driver diaphragm materials also advanced with the introduction of beryllium and titanium.

LOUDSPEAKERS TODAY

Each of the loudspeakers from a very wide selection of designs on the market today can be classified as either direct or indirect radiators. Direct radiators are directly coupled to the surrounding air; indirect radiators are coupled to the air by a horn.

Basically, the direct radiator consists of a cone (diaphragm), voice coil, suspension, and magnetic field structure. The direct radiator converts electrical signals into corresponding acoustical waves a follows: when an electrical current is presented in the voice coil (that is wound around the air gap of the magnet) a mechanical force is produced that moves the diaphragm and creates sound waves. This force is equal to the flux density in the air gap (in gauss) times the length of the voice coil conductor (in centimeters) times the current in the voice coil (in amperes).

In general, direct radiators are only three to ten percent efficient. This poor efficiency is due to the mis-matched coupling of the high mechanical impedance of the speaker diaphragm to the low acoustical impedance of the surrounding air.

The indirect radiator uses the same mechanics as the direct radiator, but indirect radiators (or "horn") loudspeakers are considerably more efficient than direct radiators. Horn loudspeaker efficiencies range from 20 to 50 percent. This increase of efficiency is due to the fact that a horn acts as an acoustic transformer between the diaphragm of the loudspeaker and the air. The horn throat is narrower than the diameter of the diaphragm (resulting in high pressure at the throat) and is closer to the mechanical impedance of the speaker. As the horn broadens, sound waves likewise disperse over a greater area and as the sound waves reach the end of the horn, their pressure is accordingly matched to that of the surrounding air.

ENCLOSURES AND CROSSOVERS

"Every cone loudspeaker must be mounted in some kind of enclosure, and that enclosure is as important a part of the system as the loudspeaker itself." That statement is something of an oversimplification, but is accurate nevertheless: not only must the speaker be mounted, it must be mounted in an enclosure that is best suited for the speaker's intended use.

Several questions must be answered when considering the loudspeaker/enclosure interface. In what type of environment will the loudspeakers be used? Will the enclosures be stationary? Mounted? Will they be moved frequently from place to place? How many loudspeakers will be mounted in each enclosure?

Loudspeaker enclosures may be divided up into four major categories. The first category includes infinite baffles where the speaker is completely enclosed, exposing only the front of the diaphragm. The output of the system is independent of frequency above the resonant frequency of the enclosure. Below this resonant frequency, however, the compliance of the enclosure determines the acoustic impedance. Compliance can be defined as the stiffness or the ease with which the diaphragm moves within an enclosure. When the compliance of the enclosure is

(continued on page 55)

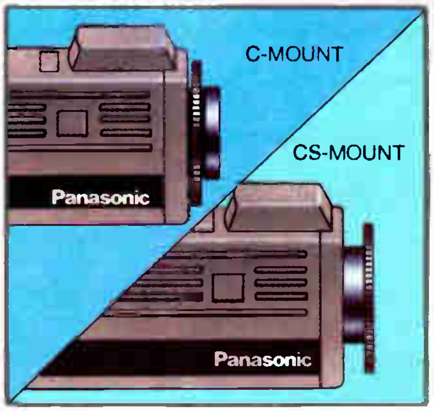
Designed For

WV-BL200 Shown With Optional Lens

Whether your customers are upgrading a security system or starting one from scratch, there's one line of CCD Cameras designed to meet all their needs — past, future and present. Introducing the Panasonic® WV-BL200 and WV-CL300 Series CCD Cameras.

Highlighting our new line of cameras is their optical versatility, as

our new line of optional lenses clearly demonstrates. Eleven in all, they let your customers select just the right



lens for any application. From wide angle to super-wide to telephoto. From manual to ALC (Automatic Light Compensation).

This unique combination of optics and CCD technology results in an extremely competitive advantage for you. And an affordable package for your customers.

Our new lens mount configuration represents a new technological breakthrough because it accepts both C-mount lenses and our new CS mount lenses. Including both DC and video controlled ALC lenses. So your customers have a choice of our new lenses or their existing lenses. And that can amount to big savings.

For even greater flexibility, our new cameras feature vertically mounted plug-in circuit boards. They not only make servicing easy, they help reduce down time. And at the same time lower operating costs.

And while fluctuating ambient operating temperatures can have a negative effect on most cameras, our new WV-BL200 Series Cameras

CCTV SOLUTION: THE HUNTINGTON BEACH POLICE DEPARTMENT

BY DON BORCHERT

Southern California: the words evoke images of surfers and dune buggies, hot tubs and wine-tastings, carefully planned communities swelling with measured growth beneath sun-filled skies.

Huntington Beach is one California community that lives up to those images. More than eight miles of public beach contribute to the area's laid-back, mellow reputation. Belying that reputation is the reality of Huntington Beach: a city that boasts successful and challenging projects in the residential, financial, and industrial areas, a result of the continuing efforts of city planners and community leaders. A carefully designed approach to development in Huntington Beach has resulted in the creation of such exemplary community projects as Huntington Center, Five Points Center, One Pacific Plaza, and Peter's Landing.

Police Department Headquarters, Huntington Beach, CA.

The Huntington Beach Police Department takes pride in matching the community's growth. Back in 1972, using what was then state-of-the-art technology, they built an underground Communications Center. Efficient and uninterrupted operation of the center is essential for the daily communications required to safeguard city operations, and is especially critical during times of extreme emergency.

Recently, the Huntington Beach Police decided there was a need to renovate these facilities. Besides increased demands on normal police communications, the rapid growth of the department led to the addition of several remote facilities: a shooting range, a new heliport, and the Huntington Beach jail. And at the rate the city itself was growing, the department needed the capability to monitor and actually view various areas throughout the city.

The Greater Alarm Company of Huntington Beach was among the several companies chosen by Roger Ham, communications administrator for the city, to update and enhance the capabilities of the police department. The Greater Alarm Company had recently completed several high-profile projects in the nearby area. One such project involved the installation of comprehensive intrusion and detection services for the Long Beach campus of California State University — part of a complete proprietary system that notifies campus police of specific emergencies. Another project provided security and fire protection for One Pacific Plaza, a sprawling business complex consisting of one twelve-story building, two six-story buildings, various smaller buildings, and a six-story parking structure.

Greater Alarm worked with Louis Yates, marketing program manager for Javelin Electronics, Torrance, CA, to re-design the police department's CCTV systems, solving the department's immediate problems while at the same time allowing maximum flexibility for future expansion. The re-designed system includes the Javelin Omni 2000A Central Processing Unit for the police facility, plus an Omni 100 system for monitoring the jail facility.

The main system now monitors two high public-traffic areas, plus the front desk and records areas. Other monitored areas are more restricted: the police car lot, four employee entrances,

Borchert is publications manager of Javelin Electronics, Torrance, CA.

The command center underneath the headquarters building. This is where all police communications are routed and all emergency activities are coordinated.

two prisoner transfer corridors, a city computer room, and the receiving area. The prisoner transfer areas and the parking lot also feature pan-and-tilt subsystems.

Along with the addition of an Omni 2000A CPU, the renovated system includes two JO305 gathering panels, identification panels, alarm panels for tamper protection, relay panels for special functions, and a video tape recorder. The CPU was located in a remote location from the operating control, and it was then necessary to bring the video portion up on an extra monitor.

Fortunately, the building had been piped during construction, making the bulk of the installation fairly simple. The system, including a total of forty cameras, was installed in about a month by one person. No major problems were reported the first time the system was powered up.

For Greater Alarm, the toughest part of this elaborate system was phasing the cameras, since the facility involved was spread out over such a large area. They finally used one of their radio technicians, a pair of hand-held radios, and the city's private radio channel to phase the entire system. Another problem related to a communication line that was too long. Greater Alarm installed a line driver — and the system has been working properly ever since.

Future planning for the system includes more remote monitoring sites: the city pier (about five miles from the police facility, pan-and-tilt with multiple home locations), and the police shooting range (about two miles from the police main facility). The system specified by Greater Alarm allows expandability to include these areas without obsoleting any of the department's existing equipment.

The IBM-compatible CCTV system specified can also use microwave-compressed video technology to transmit video signals from each protected area to Communication Center personnel. Up to 1,000 cameras can be added to the present system, allowing for even the most optimistic plans for future expansion. And the system offers total flexibility, since the cameras can be individually programed for most effective use.

Officials from around the world have been invited to view the Huntington Beach Communications Center, whose police department has once again set a standard of excellence by which other departments around the country will be measured.

Police monitor incoming calls and dispatch units and personnel as needed.

GAUSS. NO OTHER SPEAKER CAN COMPARE.

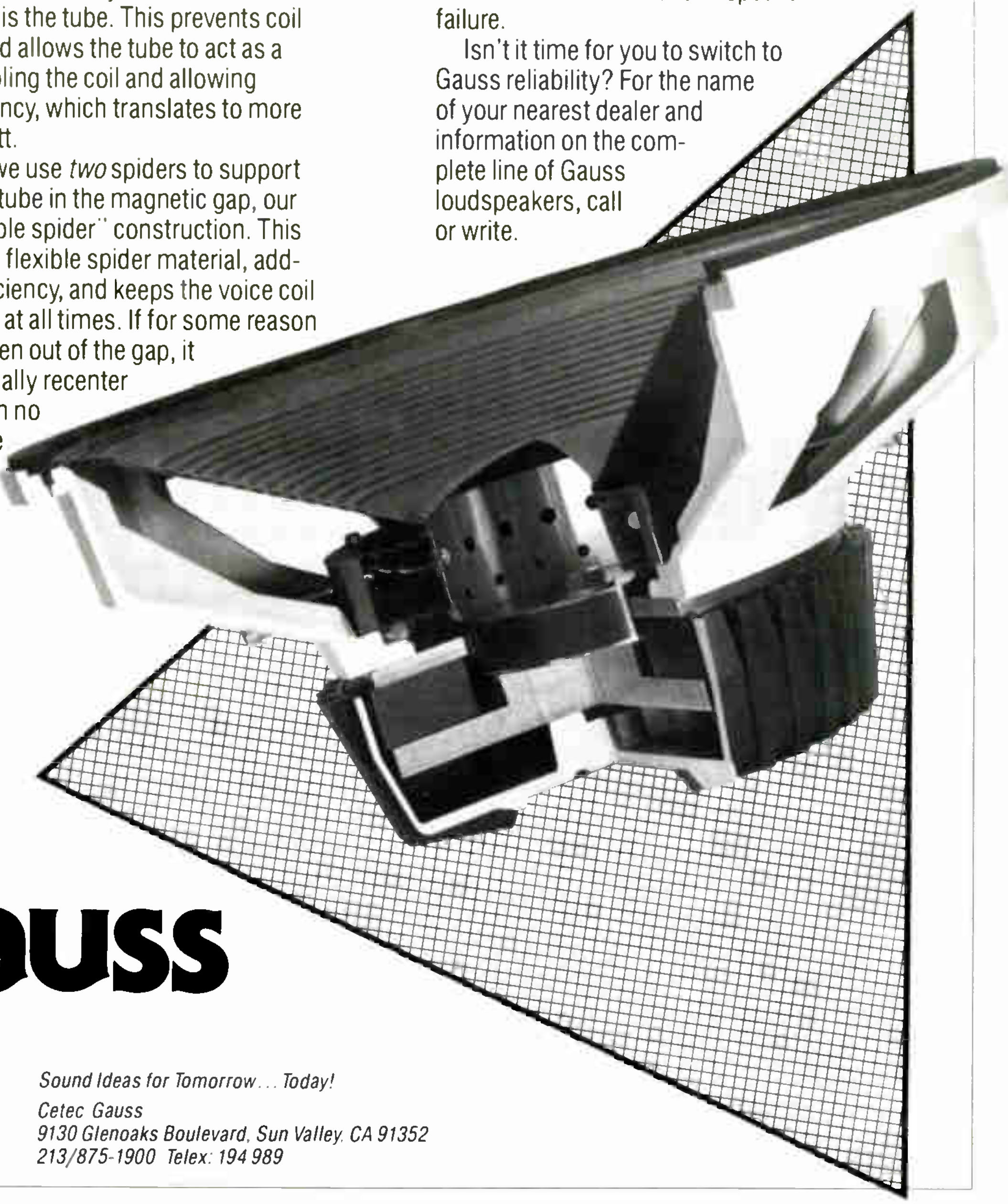
If you've ever used speakers for high levels, odds are you've blown one. A Gauss speaker would have saved money in the long run . . . because it probably wouldn't have blown. Gauss speakers are built to be almost blow-out proof, and torture tested to prove it.

Most companies wind their voice coils on a form, then slip it on a "tube." At Gauss, we wind our coils directly on an aluminum former which is the tube. This prevents coil separation and allows the tube to act as a heat sink, cooling the coil and allowing greater efficiency, which translates to more sound per watt.

At Gauss, we use *two* spiders to support the voice coil tube in the magnetic gap, our famous "double spider" construction. This allows a more flexible spider material, adding to our efficiency, and keeps the voice coil tube centered at all times. If for some reason the coil is driven out of the gap, it will automatically recenter everytime with no damage to the coil. All other speakers use a single spider . . . which leads to a lot of recone jobs!

Other manufacturers dress the voice coil wire leads to the cone, where terminal leads are then attached. This can create cone distortion and lead failure. At Gauss, we attach flexible silver braided lead wire directly from the coil to the terminals using gold plated eyelets. This eliminates lead breaks, the most common cause of speaker failure.

Isn't it time for you to switch to Gauss reliability? For the name of your nearest dealer and information on the complete line of Gauss loudspeakers, call or write.



gauss

Sound Ideas for Tomorrow . . . Today!

Cetec Gauss
9130 Glenoaks Boulevard, Sun Valley, CA 91352
213/875-1900 Telex: 194 989

TYPICAL LOUDSPEAKER FAILURE MODES

BY GARY D. DAVIS AND RALPH JONES

When a loudspeaker component fails, it is obviously important to identify and, if possible, correct the cause of the failure. In some cases, a fair amount of detective work will be required.

Failures in loudspeaker drivers are most often traceable to one of two sources: manufacturing defects or improper operation. Occasionally, drivers may also fail due to problems in external signal-processing components of the sound system. These problems may be more difficult to trace, particularly if they occur only intermittently. In such cases, the cooperation of the end user may be required to identify and correct the fault.

The starting point for identifying the cause of a loudspeaker failure is the failed component itself. By examining the symptoms and physical evidence, it is often possible to determine and correct the cause of the failure.

MANUFACTURING DEFECTS

Generally speaking, manufacturers of professional audio equipment are sensitive to the fact that their customers' livelihood depends in part on their products' quality and consistency. For this reason, every major pro audio manufacturer employs some measure of quality control as an integral part of the manufacturing process.

Loudspeaker drivers, which are made and sold in quantity, are sometimes subjected only to spot-checking, and the occasional defect may escape the manufacturer's attention. When this occurs, the defect may not show up until the driver is in the hands of the end user.

Manufacturing defects in drivers are usually mechanical in nature. Some common examples, and the symptoms that they may generate, are shown in Figure 1.

The proper handling of manufacturing defects involves knowledge of, and respect for, the service and warranty policies of the manufacturer in question. When manufacturing problems are suspected, consult the supplier's published warranty policy, and communicate with their service or warranty return offices. Responsible manufacturers will welcome identification of such problems, since the information can aid the manufacturers in refining their procedures. Most importantly, follow the manufacturers' repair or return policies to preserve the rights of the end user.

The editors would like to thank Gary Davis and Ralph Jones for permission to use material from the Yamaha Sound Reinforcement Handbook.

IMPROPER OPERATION

Particularly with less sophisticated installations or less knowledgeable operators, improper connection or operation accounts for the great majority of component failures. Such failures may take many forms, but they are usually catastrophic and, thus, readily identified.

Most failures resulting from improper operation can be identified through visual inspection of the failed component. In many cases, it will be necessary to disassemble or destroy the component in order to make a complete inspection. This will likely void any warranty that may apply, and this issue should be decided before undertaking inspection. Of course, if the failure was indeed caused by improper operation, it will undoubtedly not be covered by the product warranty anyway! Still, it's beneficial to

Defect	Test	Result
Insufficient gluing of suspension components	Sinewave sweep	Buzzing sounds; Separation of (surround and spider) cone or diaphragm
Incomplete bonding of the voice coil to the diaphragm	Sinewave sweep	Buzzing sounds; Coil rubbing; Separation of the coil from the diaphragm
Cold solder joints at coil lead-in wires	DC resistance of voice coil connection	Coil resistance greater than rated impedance of driver, or infinite
Faulty welds at the voice coil terminations on the coil former	DC resistance of voice coil connection	Coil resistance infinite or intermittent; sound ceases or is full of static
Poorly-assembled driver frame or casing	Visual check Sinewave sweep	Cracks or breaks; loose parts Buzzing sounds; Coil rubbing

Figure 1. Diagnosis of loudspeaker manufacturing defects.

Symptom	Probable Cause
Voice coil looks charred	Excessive continuous amplifier power
Fused or blackened coil lead-in wires	Excessive continuous amplifier power
Voice coil out of gap	Excessive peak amplifier power
Torn suspension	Excessive peak amplifier power; Possible out-of-phase connection, if used in a cluster
Coil rubbing	Improper mounting of driver resulting in deformation of frame; Excessive continuous amplifier power resulting in separation of coil from former; Dropping of cabinet or driver or severe Vibration in shipping resulting in deformation of frame; Shifted pole piece.
Burnt cone	Grossly excessive continuous amplifier power
Torn or punctured cone	Excessive peak amplifier power; careless transportation; Vandalism
Broken basket or misaligned magnet assembly	Dropping of cabinet or driver

Figure 2. Diagnosis of low frequency driver failures resulting from improper use.

establish what caused a failure so that future failures can be prevented. In any case, if the failure might be covered by a warranty, consult the manufacturer before tearing the component to pieces.

Figures 2 and 3 present common operation-induced failures in low-frequency and high-frequency drivers, respectively.

FAILURES DUE TO OTHER COMPONENTS

Occasionally, the action of an amplifier or signal processor will result in a condition that destroys one or more loudspeaker components. Such problems may not be readily identifiable except by careful testing of the entire sound system. The physical condition of the failed driver(s) can provide clues, however, that may help to identify the source of the problem.

One common source of driver failure is a DC voltage at the output of a power amplifier. Such a condition usually affects only low-frequency drivers, since high-frequency drivers are usually capacitively coupled.

If the DC offset is significant, and of the wrong polarity, it will cause the coil to jump the gap and burn, resembling a failure caused by excessive peak amplifier power. If the polarity of the offset pulls the cone inward, the cone will usually be frozen in that position by the burnt coil.

Less significant offsets may simply hold the cone continuously off-center. In this case, the suspension components will eventually retain the off-center position, and the cone will appear pushed in or out even when the driver is disconnected. The driver may not fail entirely, but it will usually generate a fair amount of distortion. (Similar distortion can occur when a loose-suspended cone type speaker is hung vertically, allowing gravity to create a mechanical "DC offset.")

If DC at the amplifier output is suspected, and the amplifier is AC coupled (does not pass DC), then the amplifier is failing or has failed. If the amplifier is DC coupled, the offset may be coming from a previous stage; in this case, the amplifier and the component feeding it must be tested separately.

Symptom	Probable Cause
Voice coil looks charred	Excessive continuous amplifier power; Amplifier failure (DC at amp output)
Fused or blackened coil lead-in wires	Excessive continuous amplifier power
Diaphragm out of gap or smashed against the pole piece	Excessive peak amplifier power; Connection to low-frequency amplifier in biamplified system
Diaphragm cracked or pulverized	Excessive continuous amplifier power (often frequency-related); Excessive peakpeak amplifier power; Connection to low-frequency amplifier in biamplified system
Diaphragm dimpled or torn	Mishandling of tools during attemped repair or disassembly
Coil rubbing	Dropping of cabinet or driver; Improper replacement of diaphragm assembly; Excessive continuous amplifier power resulting in separation of coil from former
Mechanical misalignment of magnet assembly or pole piece	Dropping of cabinet or driver

Figure 3. Diagnosis of high frequency driver failures resulting from improper use.

High-frequency oscillations in the signal chain may also destroy loudspeaker components P usually the high-frequency driver(s), since the low-frequency drivers are protected by the crossover filters. In biamplified systems, however, amplifier oscillation can "cook" low-frequency drivers just as readily.

Since they often occur at hypersonic frequencies, high-frequency oscillations may not be noticed: in fact, they can cause coil burning when the system is first turned on, with no audio input and no audible sound output from the loudspeakers!

Oscillations in a sound system may be difficult to track down. If they are suspected as a cause of driver failure, careful signal tracing with a wide-band oscilloscope, beginning at the amplifier output and working backward, is usually required. There is a less scientific, but often effective and inexpensive, means to trace RF oscillation; sometimes a portable AM radio receiver can be held near system cables and used to detect RF oscillations (which may either be heard as a noise while listening to a station, or as "hash" while tuned between stations).

'Improper connection or operation accounts for the great majority of component failures.'

Finally, turn-on or turn-off transients can destroy low- and high-frequency drivers alike. Such transients occur when an electronic component produces a spike at its output when it is powered up or down. For this reason, the following general rule should be adopted: *turn the amplifiers* OFF *first, and* ON *last*. This way, any power on/off transients generated by signal processors in the system can never find their way to the loudspeakers.

LOUDSPEAKERS

(continued from page 45)

the controlling acoustic impedance, excellent low frequency response may be obtained even with a small loudspeaker in a small cabinet.

The second category covers bass reflex enclosures, where you'll recall that a port or opening is made on the side of the cabinet on which the loudspeaker is mounted. By calculating the distance from the port to the diaphragm so that diffracted sound waves from the back of the diaphragm travel through the port in phase with direct sound waves from the front of the diaphragm, the bass response will be boosted.

The next category is that of the folded horn. When horns are used for low frequency reproduction, they must be quite long to properly transform high mechanical impedance to low acoustical impedance. In terms of practicality and space efficiency, these lengths can be achieved by folding the length of the horn as much as needed in an enclosure (see diagram). By the property of diffraction, these low frequencies will be transformed to match the acoustic impedance of the air. For a flat response down to 40 Hz, a horn length of 28.25 feet is needed. By bending or folding the horn within the enclosure, space efficiency is maintained.

The last category to be considered are those enclosures used for combinations of loudspeakers. Combinations may consist of all direct radiators of the same size speaker (e.g., columns for Public Address systems designed to cover one frequency range), or all direct radiators of different size speakers (e.g., monitors designed to cover a wide audio spectrum). Combination enclosures can also include all horn loudspeakers, (e.g., a folded horn and a straight-side high-frequency horn loudspeaker for maximum directivity for use in theaters, auditoriums or arenas). Other combinations may include direct radiators and horn units of various sizes and numbers.

When loudspeaker systems utilizing different size speakers for wide range frequency coverage are used, whether direct radiator systems, indirect radiator systems, or both, crossover networks are needed to deliver proper frequency-limited power into the appropriate drivers from the amplifier(s). If crossover networks were not used, drivers would suffer damage from inappropriate power delivery. Crossover networks employ high-pass, band-pass, and low-pass filters. The high-pass filter restricts mid- and low-frequency power from reaching high-frequency drivers. Similarly, the band-pass filter only allows mid-frequency power to drive the mid-range speaker. And the low-pass filter blocks high- and mid-frequency power from driving the low-frequency speaker.

Like loudspeakers, crossover networks come in many variations (or "orders.") In the simplest form of crossover network, an inductor directs bass power to the low-frequency driver and a capacitor passes treble power to the high-frequency unit. This is a two-way first-order passive network. In more complex circuits, four-way third- and fourth-order crossover networks are used that employ operational amplifiers. The roll-off rate, initial slope and shape of the response of loudspeakers may be controlled with various crossover applications.

(continued on page 65)

Contracting Close-up

McCune's "Video/Sound Screen": Reports From Blue Chip, Audio Video Engineering

McCune Constructs First Video-Sound Screen

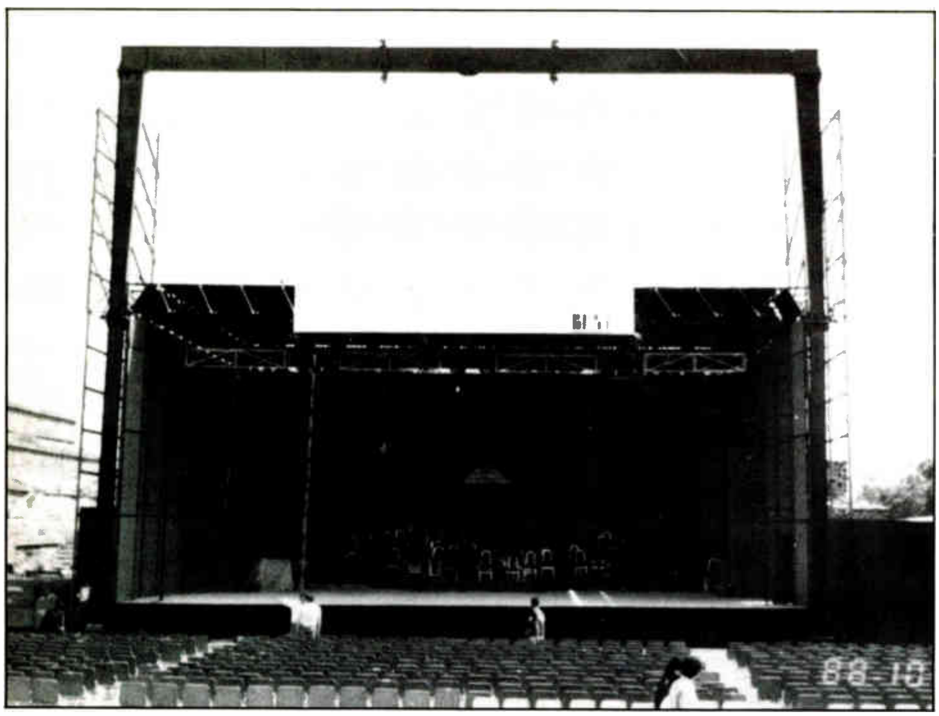
McCune Audio Visual, Anaheim, California, constructed a video projection "sound screen" for a one-day concert performed outdoors at the Pyramid of the Moon, a national historic site adjacent to Mexico City, in October 1988. The system was designed by Bertagni Electronic Sound Transducers, International Corporation (B.E.S.T.) of Cerritos, California.

"It's the first time [a combination video screen/sound system] has been done," said Danny Huebsch, regional manager for McCune. "It worked on paper but we weren't sure if it was going to work [in practice] — and it worked great. It was an extreme challenge working with no resources at all. We took a truck into Mexico with all the speakers."

McCune placed 192 styrofoam two-square-feet transducers, the size of ceiling tiles, onto the back of the 32 feet wide by 24 feet high video screen. The video/sound screen was then divided into eight sectors, with 24 transducers in each. On stage, eight Schoeps BLM-3 microphones were laid out in eight zones. The identical eight zones were assigned to the array of sound transducers above the orchestra. Sounds of instruments in each zone on the stage came from the same respective sector on the face of the sound screen.

The eight orchestra and four solo microphones fed a Ramsa 480L mini console with Klark Teknik equalizers and 24 Carver 2.0 amplifiers. No crossover or audio processing was used. The stage was designed as an acoustical shell, so no stage monitors were needed.

Other possible applications for this audio video design include nightclubs, meeting rooms, permanent amphitheaters and large outdoor events, according to B.E.S.T.



Blue Chip Sound and Light Installs Sound at Wang Center

Blue Chip Sound and Light completed the installation of a new sound system at the Wang Center for the Performing Arts in Boston December 6, 1988. The 4100-seat center's new system consists of 35 different speaker locations and is powered with 9,000 watts of amplification, according to Blue Chip Sound and Light.

Bose speakers are used throughout the system including 18 Bose 802s, eight Bose Acoustic Wave Cannons, 24 Bose 102s (for under the balcony) and four Bose 402s (for the rear loge). Power amplification is primarily Crown Macro Tech amplifiers while the 70 volt lines are powered with Crest Powerlines. Micro Audio equalizers also are used in the system.

Audio Video Engineering at the Marriott and at Apple Corp.

Audio Video Engineering of Concord, California is involved in the sound system renovation of nine meeting rooms at the Santa Clara Marriott. The installation is expected to be finished by the end of January.

The new distributed system includes: 54 Altec Lansing 409 ceiling loudspeakers with 5181 back boxes, 4284 baffles, nine 1674CM's and two 2280A's; FSR ML132 combined system; nine Aphex 301 levellers; and five

Micro Audio POD 3.1 dual-octave equalizers.

Audio Video Engineering is also working on the sound and video presentation system at Apple Computers Corporation in Cupertino, California that will be finished in February.

"[It has a] video projector with motorized screen," said Dave Gallatly, president of Audio Video Engineering. "Electronics allow any of the computers, which are on display, up on the screen. [There's a] very nice sound system with time delay."

The system at Apple includes: Industrial Research automatic mixer with a system 41 processing mainframe; Renkus-Heinz program speakers with 12 BES side-fill speakers on time delay; Tascam cassette players; Panasonic VCR; Sony VCR; York control system; and Barco video projector. ■

People

Doebel Joins Electro-Voice; Lewis Moves to Symetrix

Lewis Joins Symetrix

Symetrix has appointed Will Lewis to a newly created position, director of sales and marketing. With 12 years in professional audio, Lewis' experience includes live performance and studio engineering. For the last three years he has been sales and marketing manager for Carver Professional.

Will Lewis

Doebel Director of Employee Relations for EV

Electro-Voice has appointed Bob Doebel as director of employee relations. Doebel replaces Ron Graham, who was promoted to director of human resources at Mark IV Industries. Doebel will be responsible for employee training and development, wage and benefit administration, labor relations, community relations and government agency regulation compliance.

Doebel left his position as personnel director for Berrien County to join EV. Prior to his position at Berrien County, he was corporate manager of employee relations for National Standard Company.

Javelin Omni Systems New Positions

Javelin Electronics has promoted Louis Yates to the newly-created position of marketing program manager — Omni Systems. Yates will be responsible for developing a rapport between Javelin and architects, engineers and security consultants. The correctional market will be one of his prime responsibilities.

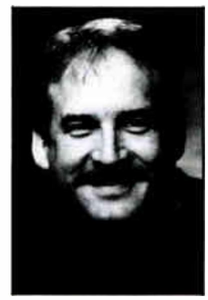
Yates has been involved with computerized CCTV systems at Javelin for eight years, and has over thirteen years of professional video sales and marketing management experience.

Frederick M. Vogel has joined Javelin in another newly-created position, Omni Systems group manager. Vogel will be responsible for coordinating all security system sales efforts for Javelin.

Vogel has over 25 years experience in technical sales and marketing management in the semiconductor security and closed-circuit video equipment industry. His professional associations include RCA/Burle Industries, Harris Semiconductor Corporation and Motorola Semiconductor Products Division.

Palmer Named President of Alesis

Russell Palmer has been appointed president of Alesis Corporation. Palmer, whose previous position was executive vice president, replaces Keith Barr, the company's founder, chairman and CEO.



Russel Palmer

Palmer joined Alesis in 1985 and has managed all corporate administration since that time, as well as holding the position of national sales manager for the first three years. Prior to joining Alesis, Palmer's experience includes 14 years in the recording industry, as well as being involved in the computer and business management fields.

New Appointments at Agfa

Agfa Corporation has appointed Helge H. Wehmeier president and CEO. Agfa Corporation officially was formed on January 1 through the integration of Agfa-Gevaert, Inc., Compugraphic Corporation and Matrix Corporation.

Helge H. Wehmeier

Wehmeier was also elected to the board of directors and executive committee of Bayer USA, of which Agfa is a wholly-owned subsidiary. He will remain on the board of management of the Agfa-Gevaert Group of Europe, where he has been a member since 1987.

Previously, Wehmeier was director of Agfa-Gevaert AG, Leverkusen, in charge of the Industrial Division. From 1981-1983, he served as manager of biozide sales in the organic chemicals department for Bayer AG in Leverkusen. From 1978-1981 he was head of the Bayer synthetic fibers division of Bayer UK, Ltd., in London. Wehmeier has also worked for Mobay in New York, another Bayer USA company, where he was responsible for marketing fibers in the U.S. and Canada.

Agfa-Gevaert has also appointed Bernard L. Freeman national customer service manager. He will be responsible for the company's regional distribution centers. Freeman has been with Agfa for 34 years, most recently as operations and purchasing manager for the Agfa-Gevaert Rex division.

General Instrument Elects DeFazio

General Instrument Corporation has elected Thomas C. DeFazio vice president-finance and chief financial officer. DeFazio has also been elected treasurer. He replaces Gerard G. Johnson, who has resigned.

DeFazio joined General Instrument in May 1986 as vice president and controller. Prior to joining General Instrument, DeFazio was vice president and controller of SCM Corporation. He held a variety of positions with SCM in finance and administration since joining that company in 1963.

SoundTech Names National Sales Director

SoundTech has named Todd Peden as national sales director. His responsibilities will include the management of all SoundTech dealer accounts in the USA as well as the promotion of new SoundTech products to dealers and consumers. He will also be available to sound contractors as a consultant. Peden has seven years experience in MI retailing, sound contracting and product design.

Todd Peden

Roland Audio Mixers

Roland Corporation has introduced the M-16E and M24E, two mixers designed for live performers, home studio owners and commercial studios, at all levels of the industry, the company says. Features for the mixers include signal-to-noise ratio, low distortion, frequency response and a selection of input and output buses. The rack-mountable M-16E has 16 inputs, while the tabletop M-24E has 24.

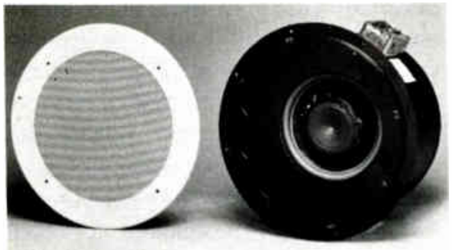
Circle 2 on Reader Response Card

Products

New Loudspeakers From Atlas/Soundolier: Stereo Amps, Signal Processors

Atlas/Soundolier Ceiling Loudspeakers

Atlas/Soundolier has introduced model EQ-818, a loudspeaker for recessed ceiling installations in foreground music and sound reinforcement systems. The system is designed for use with standard 70.7 or 25 volt constant output amplifiers. The power handling capacity of the loudspeaker is 50 watts and frequency range extends from 70 Hz to 20,000 Hz. The system integrates and combines an



eight-inch diameter loudspeaker emphasizing low end frequency response with a four-inch diameter cone type piezo high frequency reproducer within a ported bass reflex enclosure. It requires no supplemental electronic or acoustic crossover network, has a voice coil impedance of eight ohms and is available with a choice of three professional quality line matching transformers, the company says.

Circle 1 on Reader Response Card

Electro-Voice DeltaMax Subwoofer and Pro-Line Mic

Electro-Voice has added the DeltaMax DML-2181, an 18-inch electronically controlled subwoofer that uses the patented Manifold Technology, to its present series. The series includes the DML-1122 12-inch and DML-1152 15-inch full-range trapezoidal loudspeakers. The DeltaMax measures 36 x 22.5 x 30-inches and the sound has a range from 36 to 100 Hz.

EV's PL68 Pro-Line microphone comes in three versions: PL68, PL68S, and PL68SH. The PL68 and PL68S are low-impedence. The PL68SH is a high-impedence mic for guitar amp and DJ-mixer inputs.

SoundTech's First in a Series of Power Amps

SoundTech Systems's A600 is the first in a series of stereo power amps for the sound technician and musician.

The A600 requires three rack spaces and features four ohm rating of 300 watts per channel.

Circle 3 on Reader Response Card

ART High Definition Equalizers

Applied Research & Technology, Inc. (ART) has high definition graphic equalizers that feature faders with a full 60mm travel, switchable subsonic and ultrasonic filters, clip/signal metering, fail safe hardwire bypass in the event of power loss, balanced XLR, TRS and terminal block connectors, the company says.

Circle 4 on Reader Response Card

Peavey Impulse and Impulse II

Peavey Electronics's Impulse features an eight ohm enclosure housing a specially designed six-inch woofer and a conical tweeter with an internal passive crossover. In combination, the two speaker components produce a frequency response of 100 Hz to 20 KHz and a sensitivity rating of 91 dB, 1watt/1meter. It has a suggested retail price of $199.50 a pair.

The Impulse II is equipped with a specially designed mic stand adaptor and uses two 4½-inch speakers with a piezoelectric tweeter to deliver a full-range frequency response. It is a 16 ohm enclosure and has its own level control. It has a suggested retail price of $249.50 a pair.

Circle 5 on Reader Response Card

American Fibertek CCTV Module and Mini Transmitter

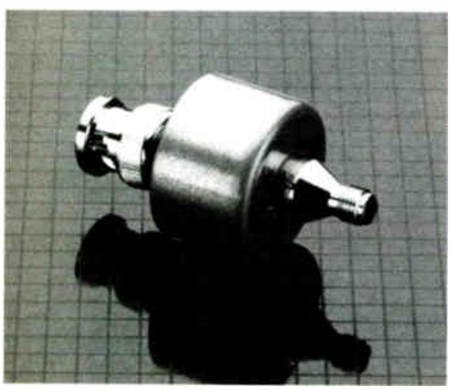
American Fibertek SentryVision CCTV fiberoptic MX-1400A module transmits video and transmits and receives RS-422 control signals. The MX-1400B module transmits and receives RS-422 control signals and

Circle 235 on Reader Response Card

Circle 231 on Reader Response Card

receives video. The systems interface will all 75 ohm camera and monitor brands and Vicon VPS-1200 (camera control) series.

The SentryVision fiberoptic CCTV mini transmitter is compatible with PAL and NTSC (RS-170A, RS-343A composite video 75 ohm). It measures one-inch in diameter and 2¼-inches in length including BNC and SMAL or ST



optical connector. It transmits a video picture that is immune to RFI and EMI, according to the company.

Circle 6 on Reader Response Card

Burle Industries Range of Products

Burle Industries security products division, formerly RCA's new products division, has introduced the TC406 and TC406X series of environmentalized intensified CCD (ICCD) cameras for critical low light level security, industrial and military applications. The TC406 and TC406X series is made up of high resolution intensified CCD cameras prepackaged in corrosion resistant, nitrogen pressurized, sealed housings, the company said. They are environmentalized versions of the TC400 Series and feature cameras with 818(H) X 513(V) total picture elements.

The security products division at Burle also has the TC4508S and TC4508SX eight-camera control transmitters with built-in microprocessor

controlled sequential switcher and two monitor outputs. The TC4508S and TC4508SX switcher/controllers operate pan/tilt and camera lens functions as well as auxiliary functions at up to eight camera locations when used in conjunction with TC4550, TC4550X Control Receivers form Burle.

The security products division's series of ½-inch format lenses for use with ½-inch solid state CCD cameras have an aperture of F1.2 for greater light transmission, the company says. Automatic iris lenses with internal spot filter are available in four different focal lengths: 4.2mm (TC1803D2); 6mm (TC1806D2); 12mm (TC1811D2); and 8-48mm zoom (TC1848D2).

Burle's security products division's TC400 and TC400X series high resolution intensified CCD (ICCD) cameras are for low-light-level security, industrial and military applications. The TC400 series cameras, with 768 (H) x 493 (V) active picture elements, and the TC400X, with 753 (H) x 531 (V), are bright light tolerant, and the variable gain AGC circuit with continuous inter-

nal adjustment provides up to 20 dB of additional amplification for increased sensitivity and picture sharpness at very low light levels, according to the company.

The security products division has completed the Burle switcher line with

the TC8112, TC8112X, and TC8124, TC8124X automatic sequential switchers. The TC8112 and TC8112X include 12 camera inputs and two monitor outputs, while the TC8124 and the TC8124X have 24 camera inputs and four monitor outputs.

Burle tube products division, former-

ly RCA new products division, has a high resolution, ICCD camera tube for use in a wide range of scientific, military and surveillance applications, including passive low-light-level surveillance television, laser ranging, astronomy, high-speed photography and spectroscopy. The ICCD uses a

first generation image intensifier with a 16mm fiber-optic input and an 11mm output fiber-optically coupled to the CCD, the company says.

Circle 7 on Reader Response Card

Telex Adds High Resolution LCD Projection Panel

Telex Communications, Inc. has added a series of high resolution products to its MagnaByte computer projection line. The 5080 series covers a full range of resolutions from 640 x 200 to 640 x 480 and beyond (Hercules or MDA graphics adaptor cards), the company says. The series is fully compatible with virtually all popular personal computers such as IBM PS/2, IBM PC/XT/AT, compatibles, Macintosh

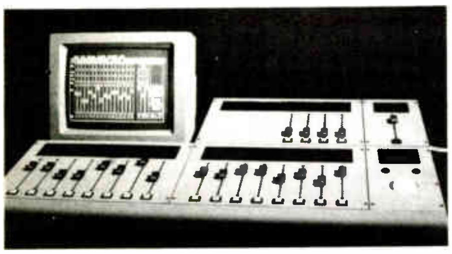
+/512/SE and Mac II. The 5080 features the Automatic Resolution Identifier, which recognizes and automatically adjusts for each PC video source, eliminating initial set-up and readjustment if computers or software are switched, the company says.

Circle 8 on Reader Response Card

Cuedos Controls Programmable Mixers

Cuedos, a software package developed by Cue Systems to control programmable mixers in live performance and fast production environments, is now available for the Yamaha DMP7 digital mixer. Offering full control of all

Circle 224 on Reader Response Card



level, muting, auxiliary EQ and pan parameters as well as onboard efffects programs, Cuedos allows all parameters to be saved as a sequence of preset snapshot mixes and entire sequences to be saved and reloaded onto floppy disc and the DMP7's own internal memories.

Circle 9 on Reader Response Card

Wheelock Telephone Paging Amp

Wheelock Inc.'s TPA-Series is a telephone paging amplifier with inputs for

telephone, music and microphone. The TPA amplifiers offer both automatic volume limiter circuit (ALC) and voice activated mute of music during paging. The amplifiers are available in both 20-watt and 35-watt models, and are designed for shelf or wall-mounting.

Circle 10 on Reader Response Card

Cohu Monochrome CCD Camera With Remote Head

Cohu, Inc. electronics division's 6400 series remote-head monochrome CCD cameras feature a remote imager measuring 1.5-inches in diameter and 2.125-inches in length. A 15-foot cable connects the remote imager to a com-

pact camera control unit, which measures 2 x 5 x 7-inches. The cable length can be extended to lengths up to 100 feet. ■

Circle 11 on Reader Response Card

Literature

Burle Industries Releases CCTV Databook; Wiring Safety Brochure From Vinyl Institute

Anixter Intros Wiring Systems Product Catalog

Anixter Bros., Inc. has introduced its Wiring Systems Product Catalog as a source and reference book for the selection of wiring products for voice, video, data and power applications. The 1184-page catalog, which contains 25 sections and a master glossary, describes all items required for specific system installations, including AT&T's Premises Distribution System, DECconnect, Ethernet, the IBM Cabling System and Nevada Western's Wire Management System.

In addition, a European counterpart to the Wiring Systems Catalog will be distributed to Anixter's international market. The European Wiring Systems Catalog is the first of its kind for this market, covering video and data products, the company says.

Circle 12 on Reader Response Card

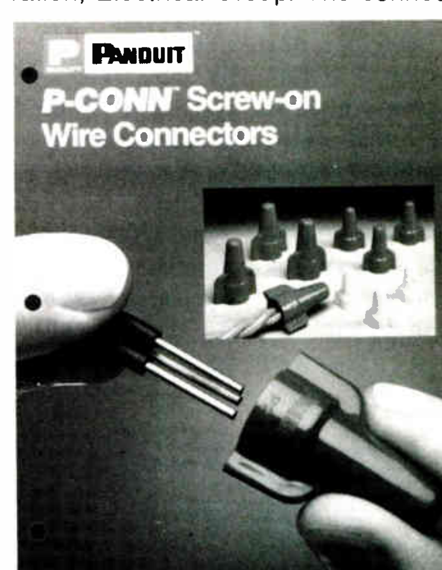
Dynaloy Technical Bulletin #4

Dynaloy, Inc., solvent specialists for the electronics industry, has released Technical Bulletin #4. This bulletin explains a new process for chemically deflashing epoxy molded semiconductor devices. By using Dynaloy's Dynasolve 185 and Dynasolve 162 in tandem, "safe, gentle, effective deflashing is achieved", particularly where fine-pitched leads in the newer molding compounds are involved, according to Dynaloy.

Circle 13 on Reader Response Card

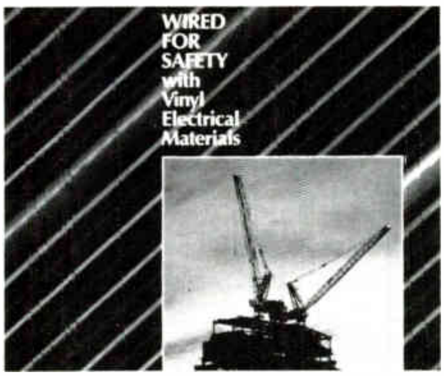
Bulletin Describes Panduit Screw-On Wire Connectors

A full color bulletin is available describing the line of screw-on wire connectors introduced by Panduit Corporation, Electrical Group. The connec-



tors are for use with either stranded or solid copper wire and are manufactured by Panduit in the U.S.A.

Circle 14 on Reader Response Card



Brochure on Safety With Vinyl Electrical Materials

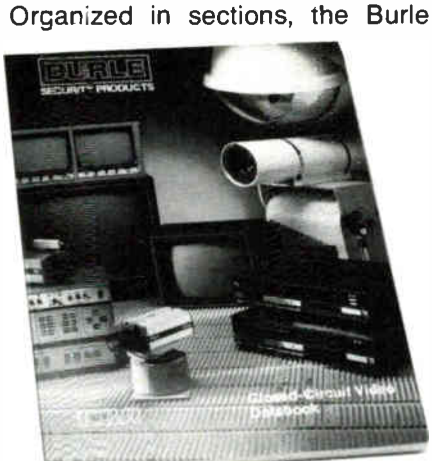
The "Wired for Safety with Vinyl Electrical Materials" brochure is published by the Vinyl Institute, the national trade association representing producers of PVC and PVC raw materials and additives. The four-color, eight-page brochure describes the electrical and physical properties that make PVC the leading insulation and sheathing material for wire and cable in construction applications, the Vinyl Institute says.

Circle 15 on Reader Response Card

Burle CCTV Equipment Databook

Burle Industries, Inc., security products division, formerly RCA's new products division, has released a Closed-Circuit Video Databook, detailing specifications and accessories for Burle's complete line of security products.

Organized in sections, the Burle Databook includes information on Burle CCTV cameras, monitors, recorders, lenses, positioning devices, housings, mounts, switchers, complete control systems and a wide variety of other video equipment and accessories designed to meet the needs of any surveillance system.

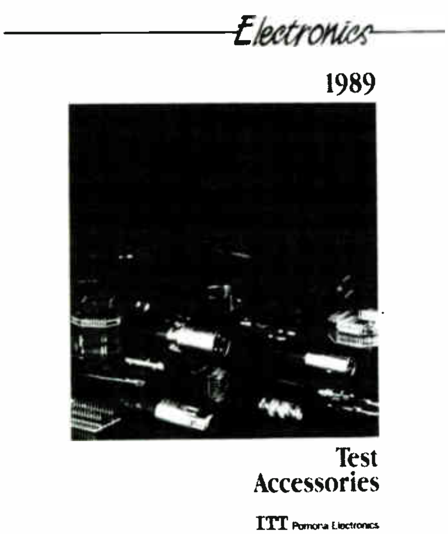


The 222-page databook is also available in a three-hole-punched version for storage in three-ring binders.

Circle 16 on Reader Response Card

Pomona Offers 1989 General Catalog

Pomona Electronics is offering its 1989 general catalog of electronic test accessories. The new 134-page edition describes and illustrates 900 test products; 90 of which are new this year. Pomona offers a selection of banana plugs/jacks/adaptors, coaxial/triaxial/audio connectors, "black" boxes, test clips, probes, patch cords, molded breakouts, cable assemblies and SMD test products.



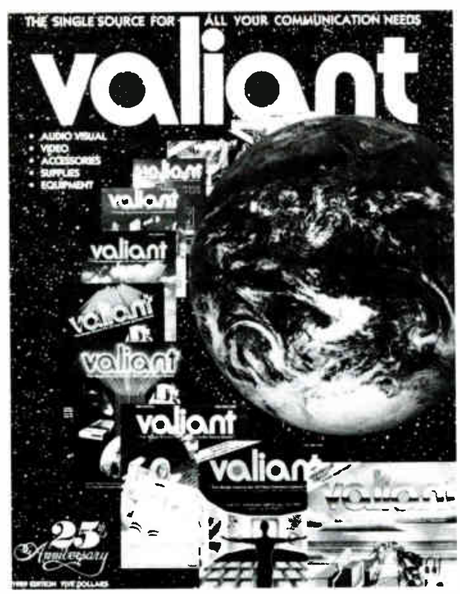
In addition to the existing line of products, the catalog features new static control products, oscilloscope probe kits, multimeter test lead adaptor kits, test probe kits, test clip kits and IC/SMD/VLSI test products.

Circle 17 on Reader Response Card

Valiant 25th Anniversary Edition of Audio-Visual Catalog

Valiant International Multi-Media Corporation has introduced its 1989 Valiant Audio-Visual Catalog — Silver Anniversary Edition. The edition features over 95 pages of audio-visual accessories, supplies and equipment for education, business and industry.

Circle 18 on Reader Response Card ■



Calendar

Upcoming Events

FEBRUARY

INFOCOMM, sponsored by ICIA and AECT: Dallas, TX. Contact: Kay Hynson 703-273-7200. February 2-4.

Video Expo San Francisco: San Francisco, CA. Contact: Ellen Greenfield 914-328-9157. February 13-17.

ISC South: Orlando, FL. Contact: 312-299-9311. February 16-18.

MARCH

National Association of Business & Educational Radio (NABER): New Orleans, LA. Contact: 703-739-0300. March 15-17.

Communciations Expo '89: Las Vegas, NV. Contact: 303-220-0600. March 29-31.

APRIL

National Relay Conference: Stillwater, OK. Contact: 219-264-9421. April 17-19.

ISC Conference: Anaheim, CA. Contact: 312-299-9311. April 25-27.

NAB: Las Vegas, NV. Contact: 202-429-5300. April 29 - May 2.

MAY

EDS: Las Vegas, NV. Contact: 312-648-1140. May 9-11.

National Fire Protection Conference: Washington, DC. Contact: 617-770-3000. May 15-16.

National Council of Acoustical Consultants (NCAC): Toronto, Canada. Contact: 201-379-1100. May 20-22.

National Sound and Communications Association Expo and Conference '89: Nashville, TN. Contact: 312-593-8360. May 25-27.

JUNE

National Presentation Expo: New York City. Contact: Barbara Stockwell, Ass. V.P., Knowledge Industry Publications, 800-328-5474, in New York State, 914-328-9157. June 6-8.

National Association of Music Merchants (NAMM): Chicago, IL. Contact: 619-438-8001. June 17-20.

American Society of Mechanical Engineers (ASME): Pittsburgh, PA. Contact: 212-705-7732. June 18-22. ■

LOUDSPEAKERS

(continued from page 55)

APPLICATIONS

The intended use for speakers has a large effect on the differences among them. Large sports arenas, medium-sized concert halls, and small restaurants all require loudspeakers specifically designed to meet their special requirements. Loudspeakers will perform differently in varying acoustical environments. The room in which a speaker will be used is an important consideration in loudspeaker applications. The importance of the electroacoustical interface of room and loudspeaker is becoming more apparent to every designer and installer of sound systems. Given this increasing sophistication, the loudspeaker industry will no doubt continue to make improvements in efficiency, frequency response, size reduction, directivity control, and intelligibility as it has done from its beginnings.

TECHNICALLY SPEAKING

(continued from page 70)

been able to work. Two other cases are pending in California (against Neil Young and David Lee Roth). Both of these cases are based on allegations of permanent hearing loss due to acoustic trauma — trauma that could have been prevented

> 'High SPL exposure does cause permanent damage, damage that can be described as maiming those sufficiently exposed.'

with prudent care. Instead the promoters, ushers, and even the musicians themselves insist on wearing ear plugs and are themselves negligent.

Bars have posted warnings to pregnant women; jacuzzis and roller coasters have posted warnings to the tame, elderly, and those with heart disease; and our movie theaters have signs placing us on notice that the language and nudity may be harmful to our young ones. Great movements have amassed protesting the lyrics of many rock groups. How about the fact that the cacophony of these words becomes a maiming projectile?

As an industry it is our obligation both morally and for the future of our business to educate those responsible. Manufacturers need to become more responsible for dangerous SPL-generating equipment. Specifiers should state a system's capabilities of damaging human anatomy. Sound systems dealers, installers, and renters should be better informed and in turn inform users about the effects their equipment may have. I do not welcome government regulating something as personal as music. But if we as an industry don't educate and police our business, shall we leave the job to the courts and government?

Jesse Klapholz
Technical Editor

JBL'S CADP

(continued from page 34)

This is also true for the other sound system design programs. Even if you move the crossover point upward (because you are using a mid-bass horn, or some sort of extended range bass system), your maximum level ratings will not automatically increase.

For example, say you are using a JBL 2425 compression driver, which has a 1.75-inch voice coil. The thermal power handling is higher than the excursion limited power handling below 1000 Hz. If the standard data files supplied by JBL are used, then a crossover point of 800 Hz is assumed for calculations of power handling (and maximum acoustic output) at 2 kHz. Remember, 2 kHz is the frequency band considered most critical for intelligibly testing. When a 1200 Hz crossover point is used, then a modified file for the 2425 will need to be created with the increased power handling, and therefore higher maximum acoustic output. The program also allows an arbitrary power level entry from its display menu. Consideration of the maximum acoustic output of the woofer and mid-bass system will also be required.

Since this aspect of CADP is used to predict what the total SPL in the direct-field will be, the real-world performance of the array is paramount. Because of the lack of ability to track the above mentioned parameters, the design may suffer. Therefore, this aspect should be more closely scrutinized with a second special-purpose program such as LEAP by CMS. LEAP will show the effects of multiple speakers, thermal limitations, and maximum acoustical output. Other programs for designing arrays from components that may be used would include CASD/CACD from Scientific Design Software.

The numerical plot format used by CADP is useful in providing hard data on performance, but does not provide an intuitively satisfying result. When compared to the 3-D sphere technique, CADP has been criticized for not providing an intuitive feel to system design, but only a way to "test out" designs. A computer-based alternative to the balloon provided by the Bose Modeler generates both the numerical plots and sound contour plots. Sound contour plots greatly aid visualization and are a helpful tool in horn aiming. When I first started using CADP a few years ago, I would also use ONLP, a program that ran on the Apple II. ONLP provided sound contour plots, but took hours to run, and required the redundancy of entering the data into a second program. An alternative approach would be to use a graphics plotting program, such as Surfer. This scientific program will plot both the top view and oblique (3-D) view of the floor plan. The amplitude of the sound level is the intensity (darkness) on the top view, and the height of the topology on the 3-D plot.

Unfortunately, CADP does not save the results of its calculations, and they are only accessible from the screen and must be saved by printing out. Screen images (and the screen dumps) are provided with calibrations and a scale. Surfer can access data from any file structure, but the calculated data simply is not saved. Therefore the data must be entered manually, by floor plan coordinates versus dB level. This is a time consuming operation best reserved for full scale studies, and not practical as a visualization aide for job estimating. Surfer is $900, but a 2-D only contour plotting shareware program called MapMaker is available from Public Brand Software for $5 and may be adequate for most users.

Once you have satisfactory projection to the farthest point of the seating area, and sufficient maximum sound level, you start adding horns to cover adjacent seating areas. If the projection requirements are less for the adjacent area, you would first try a wider pattern horn. Knowing the pattern of the horn you are trying and the horn previously entered, you can estimate the horn aiming coordinates. Data entry and "testing" procedures are the same as the first horn. If the horn overlapping levels are too high or the coverage uniformity otherwise unsatisfactory, you can re-aim the horns or change their relative levels. This process of adding and re-aiming horns is continued until half of all symmetrical areas are covered. This completes the simulation for cost estimating and a rough performance estimate can be determined of the coverage uniformity and maximum sound levels and horn aiming angles. Most sound contractors prepare bids on speculation and are not compensated for the time spent in preparation. The intelligibility predictions can be omitted from these estimates, or "guesstimates" can be entered for the preparation of the sales proposal.

Next Month: in part two we will take a look at the intelligibility, mechanical design, documentation, and sound system engineering aspects of the program.

> 'CADP was a milestone in the introduction of practical computer modeling techniques to sound contractors, and the first program to calculate sound levels of user-definable arrays projecting into complex seating areas. CADP provided the foundation on which much of its competition was built.'

REDUCING DISTORTION

(continued from page 28)

REDUCING THE DISTORTION

The nonlinearity of the driving system can be eliminated by making the voice coil larger (as shown in Figure 2). Under these conditions, the flux-turns product is independent of the axial displacement of the voice coil. The nonlinear distortion as a function of the frequency will be shown in Figure 5.

The nonlinear distortion due to the suspension system can be reduced by enclosing the back of the loudspeaker mechanism as shown the Figure 5. The mechanical circuit of the vibrating system is also shown in Figure 5. The compliance of the air in the cabinet is given by the following:

$$C_{M2} = \frac{V}{pc^2}\left(\pi R^2\right)^2$$

where V = volume of the cabinet, ϱ = density of air, c = velocity of sound, and R = radius of the cone.

The compliance of the air for the sound pressures encountered in the cabinet is linear. Referring to Figure 6, as the compliance due to the air in the cabinet is made smaller than the suspension system, the distortion will be reduced. Reducing the compliance due to the cabinet, of course, raises the resonant frequency of the system. This places a limit on the amount of reduction in nonlinear distortion that can be obtained by this expedient. If the compliance of the suspension is three times that of the compliance due to air in the cabinet, the nonlinear distortion frequency characteristic will be as shown in Figure 5.

A further reduction in nonlinear distortion may be achieved by a tapered voice coil as shown in Figure 7. The flux-turns product as a function of the axial displacement of the voice coil may be expressed this way:

$$\sum_{o}^{N}\left(B_m/m\right)_x = \left(\sum_{o}^{N} B_m/m\right)_o\left(1 + \gamma_1 x^2\right)$$

where $[\gamma_1]$ = constant.

The flux-turns product as a function of the axial displacement of the voice coil is given by characteristic of Figure 8.

A schematic sectional view of a direct radiator loudspeaker with a nonlinear suspension system and a complementary nonlinear driving system and the mechanical circuit are shown in Figure 1. The characteristics of a nonlinear suspension system is depicted in Figure 9. The characteristic of the complementary nonlinear driving system is shown in Figure 8. A consideration of Figs. 8 and 9 show that the two nonlinear characteristics are complementary.

The differential equation for the system of Figure 1 becomes the following:

$$m\ddot{x} + r_M\dot{x} + \frac{\left(1 + \beta_1 x^2\right)}{C_{Mo}} = \left(\sum_{o}^{N} B_m/m\right)_o\left(1 + \gamma_1 x^2\right) i_o \cos\omega t$$

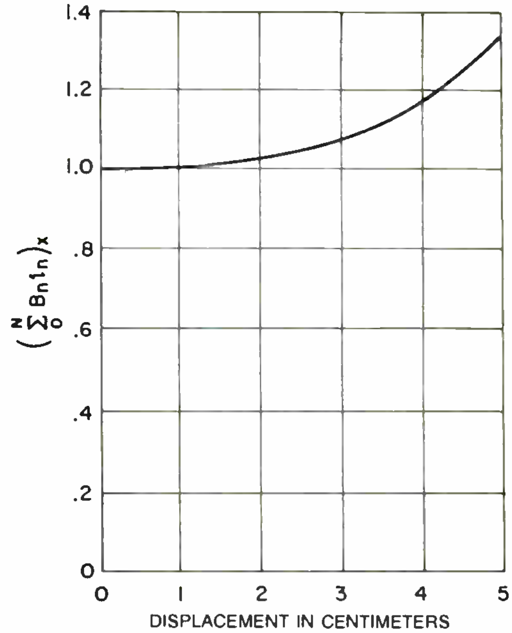


Figure 8. Summation of the flux-turns product of the voice coil of Figure 7 as a function of the axial displacement of the voice coil from the position of Figure 2 (B).

A consideration of the nonlinear differential equation shows that the two nonlinear distortions cancel each other. If the suspension nonlinear distortion is reduced by the expedient of Figure 5, the amount of driving system compensation will be smaller. In any event, the nonlinear distortion can be reduced to a negligible quantity by the complementary method.

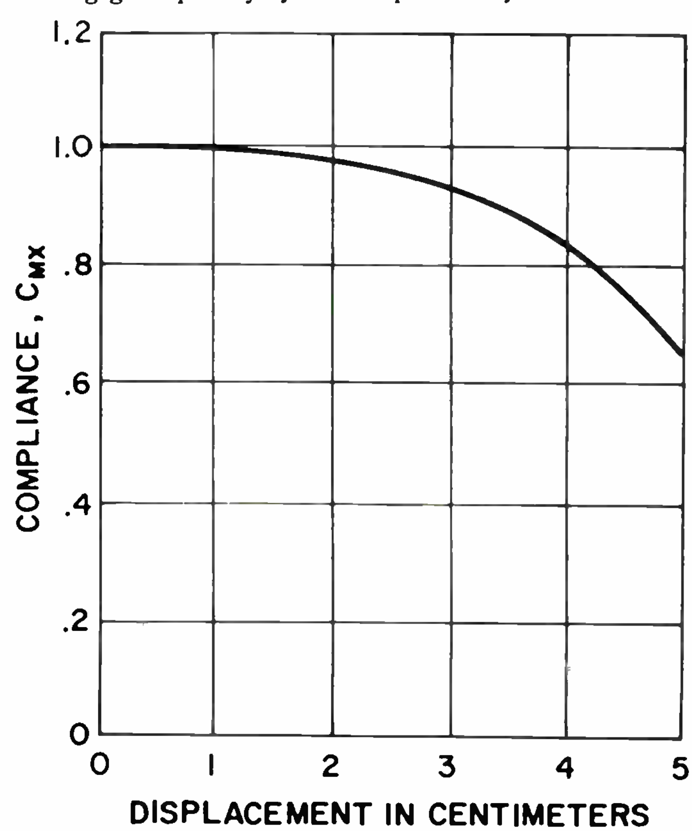


Figure 9. Characteristics of a nonlinear suspension system.

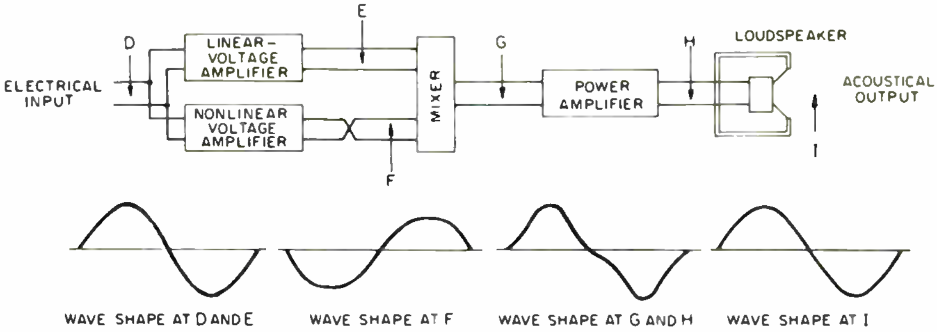


Figure 10. A schematic diagram of the linear voltage amplifier, an adder, a power amplifier, and a dynamic direct radiator loudspeaker. The wave forms at various parts of the system are shown below the schematic diagram.

NONLINEAR DISTORTION CANCELLING SYSTEM

The combination of a linear voltage amplifier, a nonlinear voltage amplifier, an adder, a power amplifier, and nonlinear direct radiator loudspeaker is shown in Figure 10. The nonlinear amplifier should exhibit nonlinear distortion characteristics similar to that of the loudspeaker. This can be accomplished by the simple overload of a push-pull voltage amplifier. The output of the linear and nonlinear voltage amplifiers are added to opposite phase. The result is a nonlinear characteristic which complements the nonlinear characteristic of the loudspeaker. The wave shapes in Figure 10 illustrate the principle.

> 'A practical solution is to introduce complementary distortion of such form and magnitude so as to cancel the original distortion.'

SYSTEM APPLICATION

Referring to Figure 10, the only additional element in the conventional amplifier system for driving the loudspeaker is the nonlinear voltage amplifier. The nonlinear amplifier is in fact a single stage push-pull amplifier which is operated in the nonlinear range for large amplitudes of the loudspeaker. Therefore, the nonlinear amplifier should be relatively simple to build and quite inexpensive.

The nature of the nonlinear distortion varies depending upon the loudspeaker. In addition, the design of the amplifier is a relatively simple task for an electronic circuit engineer. Therefore, it seems to be beyond the scope of this paper to develop the design of the amplifier.

ACOUSTIC FILTER

A theoretical consideration shows that the effect of the nonlinear distortion cancelling system is to introduce a small component of distortion in the high frequency range.

If the low frequency loudspeaker is employed to cover the frequency range of 30 to 200 Hz then an acoustic filter may be used to cut off the frequency range above 200 Hz and thereby eliminate the high order distortion components.

An acoustic low pass filter employed with a direct radiator loudspeaker is shown in Figure 11. The acoustical network indicates the physical action of the filter system. The frequency response characteristic is shown in Figure 11. Employing the system depicted in Figure 11, the high order distortion components will be eliminated by the filter system. The cost of the filter is practically negligible since all that is added is a perforated board. ■

CLASSIFIEDS

MOVE TO ARIZONA AND WRITE YOUR OWN PAYCHECK!

Sales/Marketing position open for the right person with Commercial Sound Systems and related experience. Minimal travel. Send Resume and salary history to:

P.O. Box 36994
Phoenix, AZ 85067

SYSTEMS ENGINEER/INSTALLER

Pacific Northwest company seeks motivated individual for engineering/installation of audio, video, remote control and teleconference systems. Become a member of a team that designs and installs audio-visual systems for presentation, boardrooms and auditoriums.

Background desired: Video projection of computer data, relay circuitry, electrical power, and a strong desire to solve problems. Autocad experience helpful.

Competitive salary and benefits plus incentives.

Qualified individuals should send resume and salary history in confidence to:

***Sound & Communications* Classifieds**
Box 102
25 Willowdale Ave.
Port Washington, NY 11050

Circle 238 on Reader Response Card

TELCONFERENCING TECHNICIAN

This position requires both bench and field service of Telconferencing site equipment such as:

- Echo Cancelling Audio Equipment
- Audio and Video Switchers
- Three Tube Color Cameras
- Large Screen Video Projector Systems
- High Resolution Video Systems
- Video Full Motion Codecs

The ability to do both component and equipment level service is required.

This position will also require regional air travel to customer sites. Some site service will require overnight or multiple day trips.

Nancy Sperow
Pierce-Phelps, Inc.
2000 N. 59th Street
Philadelphia, PA 19131-3099

Busy Manhattan audio prod. & post prod. studio needs top engineer. Must have thorough experience in all phases of audio engineering, most especially audio for video. Must have a following. Great salary, benefits & environment for right person.

Please respond to:

***Sound & Communications* Classifieds**
Box 101
25 Willowdale Ave.
Port Washington, NY 11050

AUDIO TECHNICIAN

This position requires both bench and field service experience of professional audio equipment such as:

- Sound Reinforcement Equipment
- Studio Recording Consoles
- Tape Duplicating Systems
- Two, Four and Multi-track Audio Tape Recorders
- Audio Teleconference Equipment

The ability to do component level service on the above equipment is required.

Nancy Sperow
Pierce-Phelps, Inc.
2000 N. 59th Street
Philadelphia, PA 19131-3099

TV STUDIO AND SYSTEMS TECHNICIAN

This position requires both bench and field service experience of professional Television studio and systems equipment such as:

- Special Effects Generators
- ¾-inch Video Tape Recorders
- Routing Switchers
- Editing Systems
- Time Base Correctors
- Synchronizing System and Distribution Equipment

The ability to do component level service on the above equipment is required.

Nancy Sperow
Pierce-Phelps, Inc.
2000 N. 59th Street
Philadelphia, PA 19131-3099

CLASSIFIEDS

☐ **Regular Classified—$52 per column inch.**
☐ **Marketplace Display—**
25 percent off rate card (up to 1/3 page).

Classified listings are accepted up to the 25th of the month preceeding publication.

Name ____________________
Address ____________________
City/State/Zip ____________________
Telephone ____________________
Credit Card # ____________________

Check Heading You Want

☐ SERVICES ☐ MISCELLANEOUS
☐ FOR SALE ☐ SITUATIONS WANTED
☐ FOR RENT ☐ HELP WANTED

Please send copy & payment to:
Sound & Communications Classifieds
220 Westbury Avenue Carle Place, NY 11514
TELEPHONE (516) 334-7880

ARE YOU HOLDING THE SMOKING GUN?

Recently, a local newspaper article told the story of a sporting goods store and their all too frequent trips to testify at murder trials. Unfortunately, as time went on some of the store's customers turned out to be murderers. After their last grueling trial the store's chagrined management removed all the stock from their shelves, ending many years of being a prime source of firearms and ammunition for area hunters.

Philosophically, how different is our industry? We design loudspeakers and systems that are capable of 100-plus SPLs. Many of us design, specify, sell, and/or install sound systems that are capable of SPLs in great excess of 100 dB; and many of us do not fully consider the acoustical environment and its role in generating unsafe SPLs.

First there was nicotine and environmental pollution, then there was asbestos, then came radon...the SPLs we are involved with are more assessable and dangerously harmful than the long-term effects of the popular issues. High SPL exposure does cause permanent damage that can be described as maiming those sufficiently exposed. This is not at all theoretical; it is not a laboratory animal study.

In the early 70s, a friend of mine traveled on the road mixing on-stage monitors. That daily 100-plus exposure level is typical of the levels today's youth is exposed to at night clubs and rock concerts, and from their car, home, and personal systems. One night, with an unsuspecting middle-ear, he innocently investigated the complaints of a rock group drummer's allegedly inoperational monitor. He was maimed for life, and will never again be able to perceive direction properly or pick out conversation over background noise to the extent that most of us can.

Several years ago I attended a concert by Bonnie Raitt in the intimate setting of the Valley Forge Music Fair. With me was an executive of a major loudspeaker manufacturer. Soon after the concert began we mutually retreated from our 10th-row seats to the sound console at the rear of the room. I politely told the sound mixer (I refuse to credit these types with the title "engineer") that the sound was quite loud at the main part of the room. He shrugged his shoulders defiantly and scoffed, "So what the (blank) do you want me to do!" Pointing to the faders, that were cleverly being manipulated beyond their limits, I shouted in order to be heard, "Those faders do work both ways!" He simply didn't have a clue.

That seems to be a great problem in this industry. Many so-called sound engineers don't understand the nature of hearing and what their roles really are. Is their megalomaniacal goal to spend as much as possible on hardware — filling the pockets of "innocent" manufacturers and dealers alike. Or was the intent for this person to design and orchestrate the sound, as the "5th musician," so concert attendees may hear what the musician intended. In fact, isn't extra expense and effort made to strategically place this person so that he can hear what the audience does? But if these people have suffered dramatic hearing losses, especially through the regions where the ear is most sensitive, how can he begin to represent what we hear — it's a sham! The twisted and contorted adjectives they use to describe the barrage of energy futilely distributed in venues around the country is a sad excuse for quality sound. While most musical groups these days produce slick digitally-mastered CDs, their live performances are only bleeding echos of the original.

In June 1987, Vittoria Hohman filed suit in Pinellas County Circuit Court against rock group Motley Crue and the concert promoter. Hohman, in her early 50s, claims that while attending a "concert" given by Motley Crue she suffered permanent hearing loss due to acoustic trauma. She has since not

(continued on page 65)

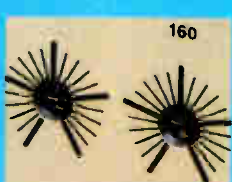
TEQ™ EQUALIZER TECHNOLOGY

...now available in 29 Band– 1/3 octave units

The benefits of transversal technology . . . Your choice of controls.

With a list of international installations to its credit, and praise from leading acoustical consultants, the TEQ™, Transversal Equalizer, is rapidly becoming the EQ of choice. TEQ™ eliminates unnecessary ringing and transient coloration of signals. While tuned filter equalizers respond correctly at their control frequencies they often create response ripples between control frequencies, causing audible coloration. But the unique TEQ™ design produces frequency responses with a single filter. Its transient response is the weighted response of a single tapped delay chain, and is ripple free over the entire 20dB adjustment range.

TEQ™ with sliders



TEQ™ with screwdriver slots

TEQ™ with rotary knobs

The TEQ™ is now available with the standard ISO 29-band, ⅓ octave frequencies. Also, choose the controls that best fit your particular applications—rotary knobs, sliders or screwdriver slots. Get the benefits of what Don Davis referred to as,

". . . the first genuine step forward in equalizers since the original ⅓ octave units . . ."

Expo '86, Vancouver

Discover for yourself how affordable state-of-the-art equalizer technology brings a transparent sound to your next installation. For more information, including technical data sheet, call or write:

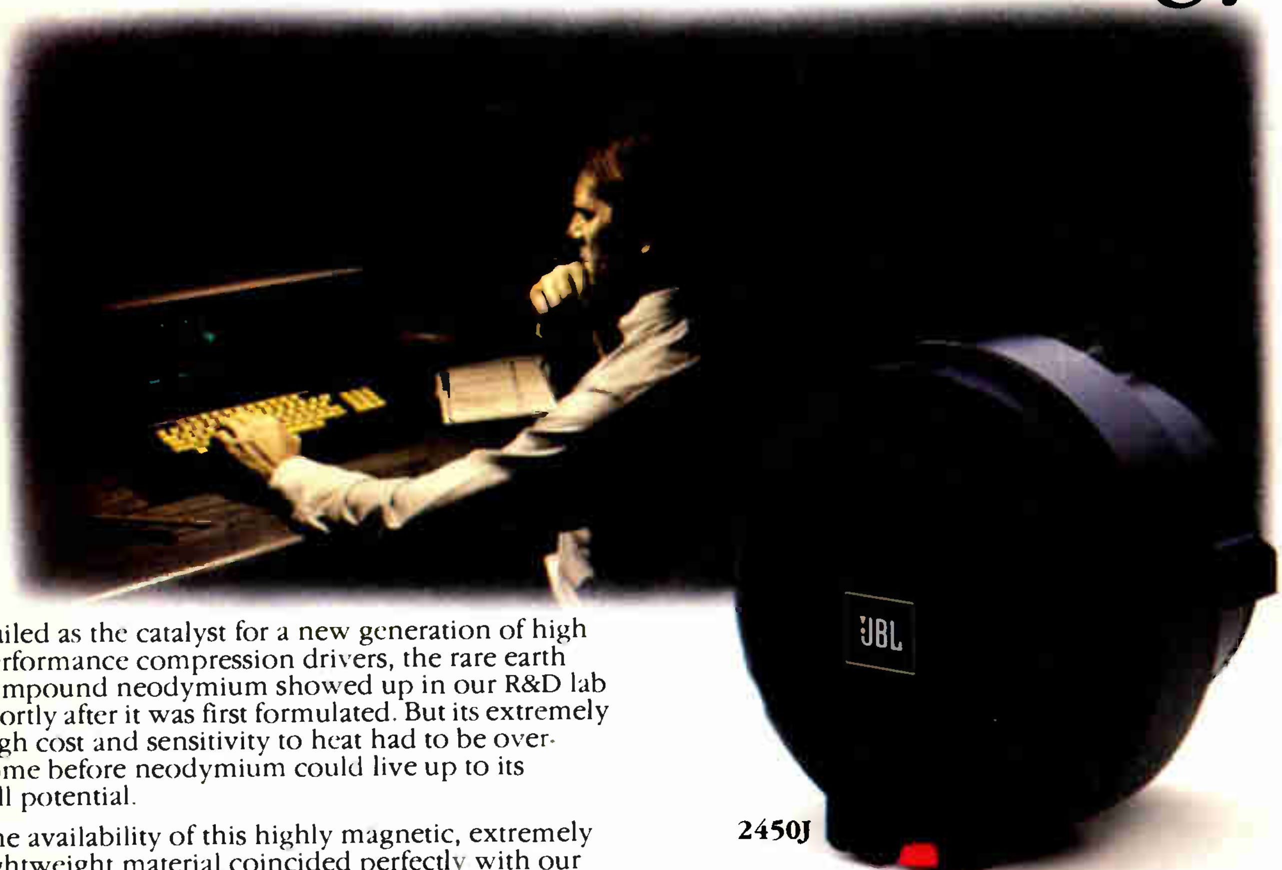
INDUSTRIAL RESEARCH PRODUCTS, INC.

A Knowles® COMPANY

321 Bond Street • Elk Grove Village, IL 60007
In IL: 312-439-3600
FAX: 312-640-9607 • TELEX: 701845
TOLL FREE: 1-800-255-6993

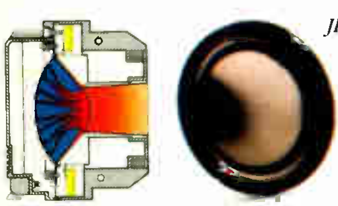
Circle 202 on Reader Response Card

It Takes More Than A Little Neodymium To Change The Face Of Driver Technology.



Hailed as the catalyst for a new generation of high performance compression drivers, the rare earth compound neodymium showed up in our R&D lab shortly after it was first formulated. But its extremely high cost and sensitivity to heat had to be overcome before neodymium could live up to its full potential.

The availability of this highly magnetic, extremely lightweight material coincided perfectly with our development of the Coherent Wave™ phasing plug.



JBL's 2450J Neodymium Compression Driver with Coherent Wave™ phasing plug provides in-phase combining of sound waves for extended high frequency performance. JBL's patented diamond surround titanium diaphragm with new embossed dome greatly reduces distortion and damage at high SPL.

This new design, a phasing plug with annular apertures of constant path length, uniformly directs sound through to the throat providing in-phase combining of sound waves for extended high frequency performance. This new technology is combined with our patented diamond surround titanium diaphragm, incorporating a new embossed dome, to reduce the possibility of distortion or damage at high SPL.

The 2450's smaller size translates to tighter spacing of horn arc arrays, more even and precise coverage and greatly reduced requirements for delay. Plus, the 2450 nets out at a mere 4.8 kg (10.5 lb). The benefits of this dramatic weight reduction include lower shipping costs to the site or on the road and significantly less load bearing requirements for both structures and rigging. With built-in mounting points, the 2450 will take much less time to install.

Yes, it took more than a little neodymium to change the face of driver technology. But we're confident you will find the breakthrough results were certainly well worth the wait and the effort.

JBL

JBL Professional
8500 Balboa Boulevard, Northridge, CA 91329