

SOUND COMMUNICATIONS

Volume 38 Number 7

July 28, 1992

AUDITORIUM UPGRADE

A college auditorium had to suffice for both meetings and touring sound. The upgrade concentrated on live sound — using EASE for prediction and an assortment of hardware with “proven stability.”

32

THE RETAIL MARKET

The retail market is contracting and the retailer is demanding more attention. Sound contractors are looking for creative ways to make money in a down market. Cost saving measures and flexible arrangements are keeping

20



IN THIS ISSUE

- **VISUAL INTELLIGIBILITY**

Although long regarded as a vital measurement in sound, display systems have yet to set a standard for intelligibility. The first in a series by Steve Orfield on the need for a new metric in the display field.

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- **CCTV AT RETAIL**

Efficiency and effectiveness characterize the latest developments in CCTV security. Retailers can assess the parameters of the systems they need. Installers can find efficient ways of designing the system.

26

How's business? The results are in as sound contractors respond to our annual survey — with some surprises and some room for optimism. Read on.

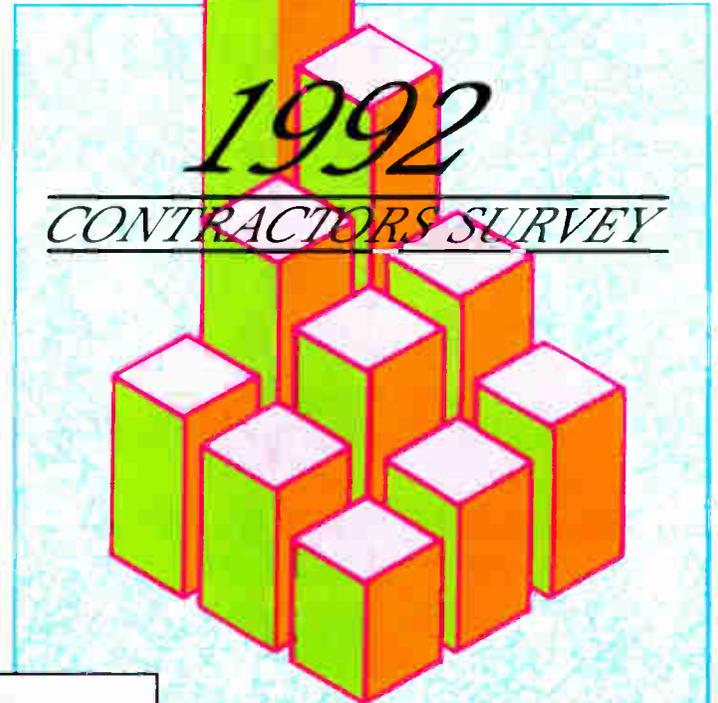
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LOUDSPEAKER DESIGN

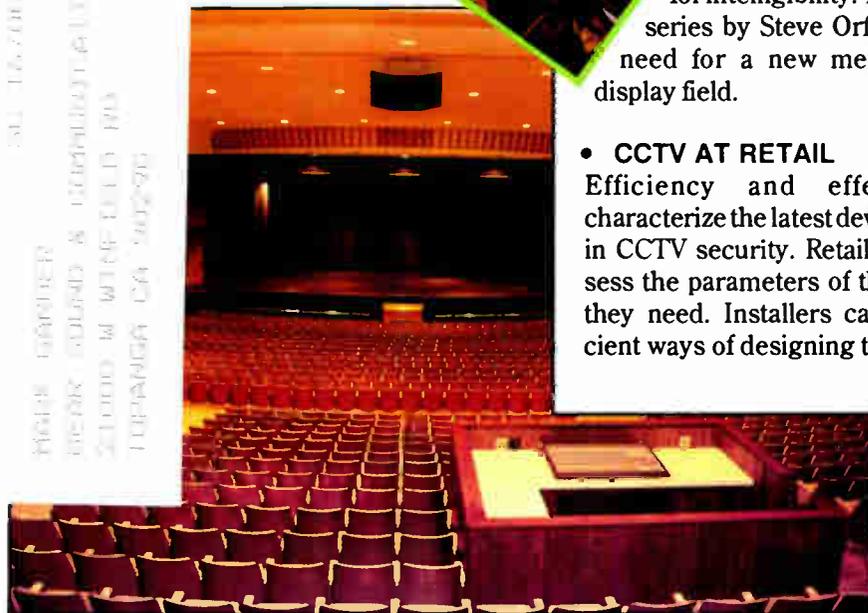
Everything you ever wanted to know about loudspeaker design. Why Alnico disappeared, why Beryllium is hard to find. And

how manufacturers trade designs, specs, and cost. A comprehensive tutorial by Mike Klasco.

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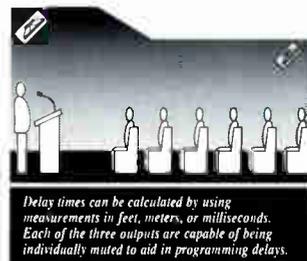
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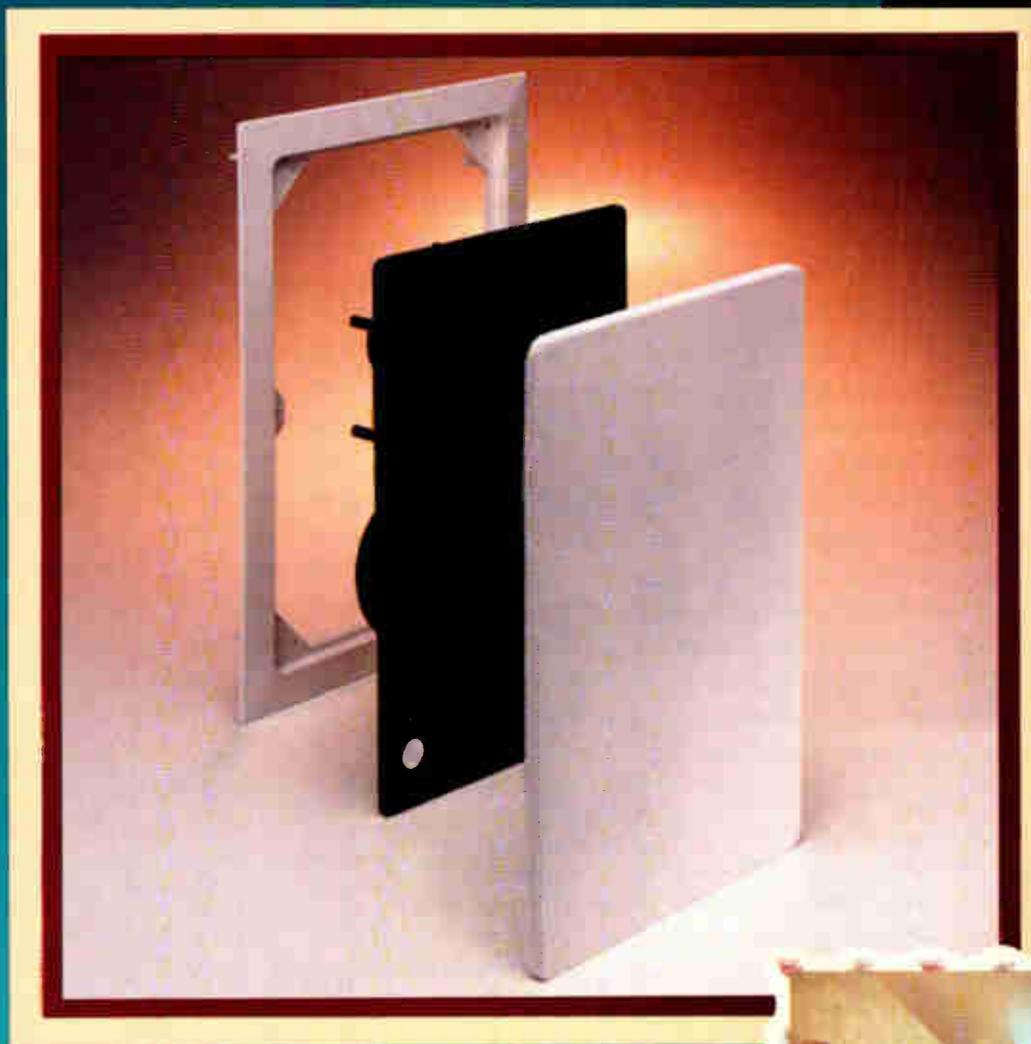
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op·por·tu·ni·ty \Ńp'Ńr-t/y/Ńn-Ń-Ń\ 1. a favorable or advantageous combination of circumstances 2. a chance for advancement or progress.

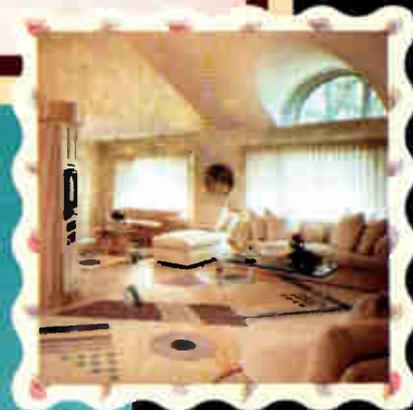


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*"an intimate part of the atmosphere,
but not the surroundings"*

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World Radio History

LETTER FROM THE EDITOR

Surveys and Consumers

Sound & Communications, throughout its 37 year history, has prided itself on its grasp of the market. Much of that grasp has come from you — the working professionals in the field. Each July, as many of you will remember, we publish the results of our annual Survey of Sound Contractors. This July is no different, as you'll find within these pages.

This spring, we sent out several thousand questionnaires to contractors. The questionnaires are designed to elicit information that can be quantified to give you and other professionals an idea of what the greater business is all about.



But more than that, we go to a lot of trouble to ask a series of open-ended questions. Our independent stat house looks askance at us, because the answers to those questions can't be quantified. But we think they are of vital importance.

They give our readers a chance to give their opinions, with no multiple choice answers. Since you're a voluble bunch, we trust the answers we get. They range from comments on the industry, on manufacturers, on the competition, and on the reps; to opinions on just what and whom

you trust — which brands you find most reliable, and what you expect from the industry in the future.

We go to a lot of trouble to put your answers together in a cohesive form. You can read what you said in this issue of Sound & Communications in our special eight-page section on the results of this year's Contractors Survey. I want to personally thank all of you who responded. Without the time you spent filling in the questionnaire, we'd have a far less valid study. I appreciate your answers, and the special write-in answers. We know how busy you are; so, thanks.

Surveys of course aren't exclusive to Sound & Communications. CEDIA, the Custom Electronic and Design Installation Association, undertook its own survey of its members this spring. The results were decidedly upbeat, with 71 percent of the respondents having increased their business last year, and with 30 percent having grown by at least 25 percent. Forty percent expect their businesses to grow 100 percent in the next five years. CEDIA's industry survey seems to be part of a general movement to establish the association as the center of the residential electronic systems industry.

A soft economy may require special outreach endeavors directly to customers. One of the questions we asked on our Contractors Survey was how much time you spend with your ultimate end-user customer. For the answer to that and myriad other questions, we hope you read the results of our annual survey. Thanks again for your generous responses.

Best regards,

Judith Morrison
Editor in Chief

SOUND COMMUNICATIONS

Publisher/Editorial Director
Vincent P. Testa

Editor-in-Chief
Judith Morrison

Technical Editor
Mike Klasco

Associate Editor
Steve Jacobs

Research Assistant
Mark Baard

Contributors

**Jeff Ader, Lon Brannies,
Maria M. Conforti, Steven J. Orfield,
Robert Wegner**

Technical Council
Dr. Mort Altschuler

*Professor Audiology, Hahnemann University,
Chief of Audiology, V.A. Hospital, Phila, PA*

C. Leroy James

*Rees Associates, Inc.
Richard N. Jamieson*

*Jamieson and Associates, Inc.,
Russell Johnson*

*Artec Consultants, Inc.
Joel Lewitz*

*Lewitz and Associates
Daniel Queen*

*Daniel Queen Associates
Jon Sank*

*Cross Country Consultants
Neil Shaw*

*Ozone Sound Engineering Company
William R. Thornton*

Phd, PE

Art Director
Joyce Dolce

Artists

**Alicia Celli, Janice Pupelis,
Wendy Ser, Katy Einsenberg**

Production Manager
Michelle Montoya

Typography
Diane Catanzaro

Circulation Director
Kathy Commisso

Advertising Manager
John Carr

Classified Ad Manager
Ed Long

Traffic Manager
Ron Perone

Director of Sales and Marketing
Nancy Davis

Editorial and Sales Office
Sound & Communications
25 Willowdale Avenue
Port Washington, New York 11050
(516) 767-2500
FAX: (516) 767-9335



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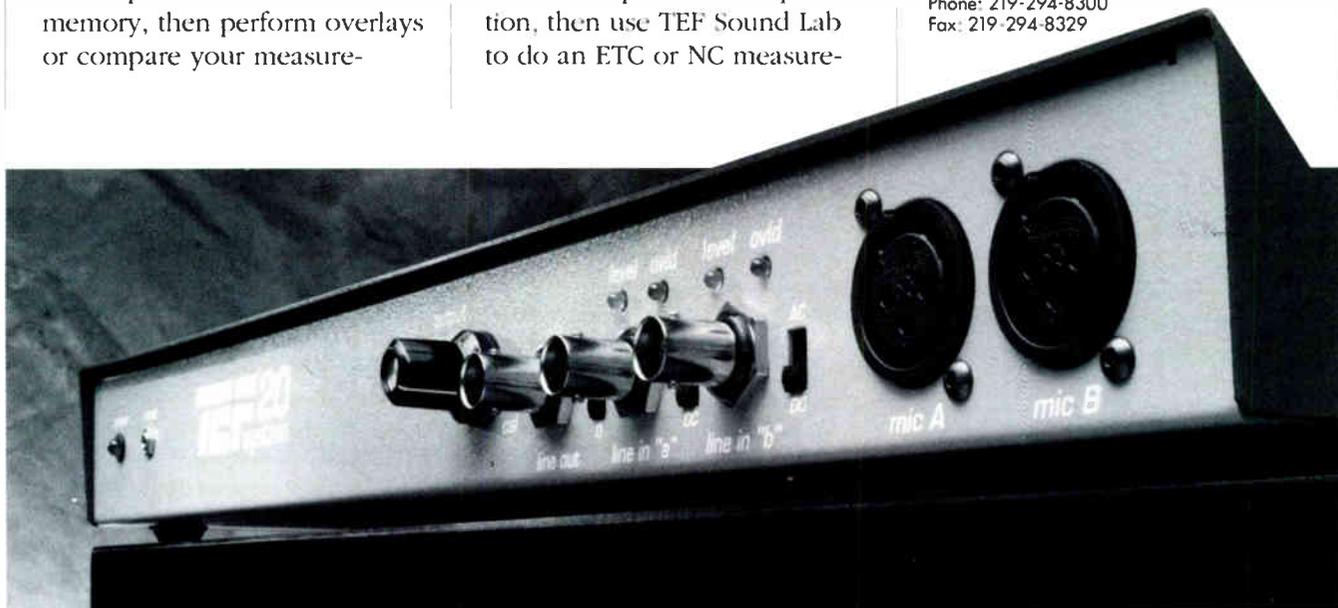
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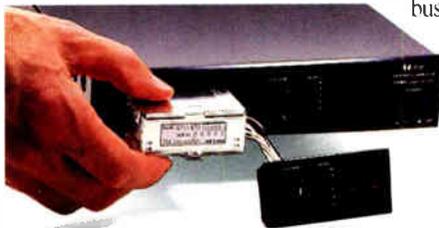
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{ A short story about inspiration and heavenly results. }

THE CHURCH WAS SMALL, MONEY WAS TIGHT, BUT PLANS WERE BIG. SO THEY BOUGHT A TOA.



To spread the word, they would need a good mic. So they bought one. A TOA wireless. They were told, and would soon learn, that because TOA had the first modular wireless ever, their system would grow right along with the congregation.



TOA's new wireless system, the modular miracle — add or change frequencies — up to four channels in one rack space.

That first system included a true diversity receiver, one that fit the new half-rack standard, and a featherweight lavalier. The Reverend noticed his new TOA mic gated silently on and off and delivered excellent field strength, up to 300', for more than 12 hours — all from a single AA battery.

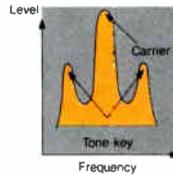
It wasn't long before the church needed a second mic. Instantly, their devoted contractor

appeared, sleek new mic in one hand, receiver module in the other. And in five minutes he was finished. But the praise was just beginning.

The next few years were busy ones for the congregation, the neighborhood and the TOA wireless. Along with a hotel next door and trucking company down the road came interference. Back

came the TOA contractor — salvation in hand. With more than twenty frequency modules — eight compatible in any area — exorcising interference was, literally, a snap.

When the congregation moved to their new building, they left everything, except their TOA wireless, behind. And fortunately so, for no sooner had the choir



In a crowded RF environment, the Tone Key is an audio companion to the primary signal — ushering only the TOA signal to the receiver.

settled into their pews when they raised their collective voices for two more mics. Miraculously, what was once just one receiver had multiplied and was now four in a single rack unit. A chorus was raised for the forward thinking contractor and the TOA wireless system.

Isn't it reassuring to know that through all the uncertainty, through



With TOA, you can assure the Reverend Parker that his service won't be interrupted by the dispatcher at Barney's Trucking.

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World Radio History

NEWSLETTER

ACQUISITION OF CELESTION

Kinergetics Holdings (U.K.) Limited, a London-based venture capital group, has signed an agreement to acquire Celestion International Ltd., pending Celestion's shareholders' approval. At the same time, Kinergetics has acquired KEF, the high fidelity loudspeaker company that had been in financial straits. Kinergetics Holdings is a newly formed investment company with three shareholders: GP Venture Capital Limited (H.K.), Kinergetics Research (U.S.A.) and a U.K.-based venture capital company. Celestion International is the loudspeaker manufacturing division of Celestion Industries plc. Stuart Harris, director of corporate development for Kinergetics Holdings (U.K.) said, "Kinergetics Holdings, with this considerable capital infusion, strategically aligns the now financially secure KEF with the equally respected and successful Celestion. In effect we have enormously enhanced the potential of the KEF acquisition by adding on Celestion." Harris said KEF and Celestion will remain independent, maintaining U.K.-based R&D and manufacturing, with "more aggressive product development programs and increased advertising and promotion planned for both brands."

According to Peter Wellikoff of Celestion Industries in the U.S., "This means that the audio division, Celestion International, will no longer be a part of Celestion industries plc, a conglomerate holding company in the clothing, textiles and (formerly) audio industries. As part of Kinergetics Holdings we will be able to concentrate more effectively on the audio industry. We in Holliston, Massachusetts and at Ipswich, England are all very excited as this represents a great opportunity for us to grow at a faster rate than before and have more adequate financial support. Celestion's business will continue exactly as before."

DJ EXPO PLANNED

The 1992 International DJ Expo will be held November 9 through 12 at the Sheraton Chicago Hotel. Exhibits will run for three days, November 10 through 12. Over 20 panels and workshops are planned for the four day convention, in addition to nightly artist showcases, and the second annual DJ Spinnoff and the annual DJ Times Awards. The DJ Expo is sponsored by DJ Times magazine, published by Testa Communications.

JAFFE ACOUSTICS REORGANIZED

Jaffe Acoustics, Inc. has been reorganized as part of a long-range strategic business plan, according to its founder, Christopher Jaffe. Dr. Jaffe's two senior colleagues, Mark A. Holden and Paul H. Scarbrough, have been named full partners in the firm, which will be called Jaffe Holden Scarbrough Acoustics, Inc. According to Jaffe, "Some of the projects we are working on now won't be completed until some time in the early 2000s. By assuring our firm's continuity, we also assure our clients that we will be there to follow through with the same dedication and depth of expertise they expect from us now." Jaffe Acoustics was founded in 1959. Among them, the three partners have been responsible for more than 200 major facilities throughout North America, Europe and the Far East.

CEDIA TO EXPAND CONFERENCE

Seeking to increase the size and broaden the appeal of its annual Management Conference and Trade Expo, the Custom Electronic Design and Installation Association has announced it is expanding by three-fold its exhibit space, removing limitations on booth size, and drastically reducing attendee registration fees. The association will also extend its promotion of the event to a greater number of industries, including lighting, security, communications, and energy management products. The conference is scheduled for October 7 through 10 at the Loews Anatole in Dallas. According to Rob Gerhardt, co-chairman of the Expo Committee and treasurer of CEDIA, the goal for the expo is an increase in attendance to 3,000 people. The pre-conference registration fee for members will be \$25. CEDIA expects to attract more than 100 manufacturers to the 73,000 square foot exhibit hall, and for the first time will allow exhibitors to have any type and size of exhibit booth. In the past, booths were limited to 10 x 10 tabletop displays. The total number of educational topics has been reduced from last year. The program will include 120 course hours covering sales, design, home theater, and other aspects of custom installation. A one-day seminar covering the nuts and bolts of design, application, and programming of

NEWSLETTER

integrated systems will be conducted by members of the Systems Integration Council, a new body within CEDIA. Additional basic courses will offer certificates of completion. A fee will be charged for education courses; panel discussions and forums will be free. A Client Day is planned, during which CEDIA members will be allowed to escort a limited number of clients to the exhibit floor to view products.

The Systems Integration Council of CEDIA has replaced the Home Automation Committee. According to Michael L. Avery of Electrocom, co-chairman of the new council, "The purpose of the SIC is to develop and promote CEDIA's involvement in the integration of all electronic systems in the home. CEDIA will move beyond Home Theater and push its leading edge posture into broader, more expansive systems applications. . . . The SIC has brought together . . . a diverse collection that is representative of the technologies that we will be integrating, i.e., security, entertainment, telecommunications, CATV, standards, HVAC, computers, energy management, utilities, controls, software and design."

VSI ANNOUNCES FUNDING

VSI Enterprises and private Belgian investors associated with CyberVision, n.v. have announced the completion of the purchase of \$500,000 of VSI's common stock and a co-marketing agreement between VSI and CyberVision which provides for the development and production of a PC-based desktop videoconference product. The company expects the new product to incorporate full motion interactive videoconferencing with interactive data exchange. The product can reportedly be networked with the installed base of larger videoconference room and rollabout systems, and will operate under Windows 3.1. Beta tests are expected by October of 1992.

GENTNER COMPLETES ACQUISITION

Gentner Communications Corporation has announced the completion of the acquisition of all products, product rights and technology of MacroMedia Inc. According to Gentner president William V. Trowbridge, the acquisition was primarily made to strengthen the company's emphasis on digital audio storage through the addition of Audisk which provides radio broadcasters with a direct replacement for carts and cart equipment in both production and master control locations. MacroMedia business and financial activities are being transferred to Gentner's corporate headquarters in Salt Lake City. Product development and customer support operations are expected to remain in Northfield, Minnesota.

DIGITAL EQUIPMENT ACQUIRES BASYS

Digital Equipment Corporation has announced the acquisition of BASYS Automation Systems from Independent Television News. BASYS is a worldwide leader in broadcast automation, and has pioneered integrated newsroom automation. "This is a strategic move for Digital as we pursue an aggressive growth strategy for the media industry and the broadcast market in particular," said Bob Farquhar, Digital's media business unit vice president. "We are sending a clear signal about the depth of our commitment to the industry." Farquhar said BASYS would be run as a wholly owned subsidiary within Digital, as part of the worldwide Media Industry Business Unit.

STEWART FILMSCREEN PURCHASE

Stewart Filmscreen Corporation has purchased the Opta division of U.S. Precision Lens, Incorporated. OptaScreen is a Fresnel/lenticular rear projection screen system. The newly acquired manufacturing facility is located in suburban Cincinnati, and will service Stewart's existing consumer and commercial world markets in the audio/visual projection business. Donald Stewart, executive vice president of Stewart Filmscreen, said that the new division "further enhances Stewart's full line of professional projection products."



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LETTERS TO THE EDITOR

Kudos, Satellites and Divisions

Either I'm getting old and senile, or you have really tuned into the crux of modern electroacoustics with your May 29 issue of *Sound & Communications*. Articles on schools, Albertville and the Neil Muncy interview are "telling it like it is."

Kudos to you!

Angelo Campanella
Campanella Associates
Columbus, Ohio

ANOTHER SUPPLIER

I enjoyed your article on ASCAP and BMI. 3M is also a supplier of satellite music and background music systems via tape, which I wish had been mentioned. In the future if possible I would appreciate it if you also could mention that 3M is also a large supplier to many chains.

If you're ever in Nashvegas give us a call.

George Degerberg
E.S.S., Inc.
Nashville, Tennessee

WHO NEEDS IT?

I would like to add a few comments to my article on specification writing that appeared in the April 27, 1992 issue of *Sound & Communications* regarding the so-called "Division 17".

The audio and video portions of construction projects are usually placed under "Division 16 — Electrical" in order to assure the architect that professional oversight will be afforded to that portion of the project. Professional oversight in this instance means the application of a stamp by a registered professional engineer, who thereby assumes the responsibility for and liabilities connected with that portion of the specification.

Attempts to promulgate the use of the fictional "Division 17" have not met with

success for this and one other very important reason. If the consultant or contractor can convince the architect that the work can be performed absent of the electrical engineers oversight, there are ample sections in the other 15 construction divisions under which a spec can be prepared. Here is a list of some of the alternatives:

- 05600 — Architectural Metalwork
- 10250 — Service Wall Units
- 10500 — Lockers
- 10530 — Protective Covers
- 10750 — Telephone Specialties
- 11060 — Theater & Stage Equipment
- 11130 — Audiovisual Equipment
- 11190 — Detention Equipment
- 11480 — Athletic Recreational & Therapeutic Equipment
- 11600 — Laboratory Equipment
- 12624 — Restaurant/Bar Furniture
- 13015 — Cable Supported & Fabric Structures
- 13020 — Integrated Assemblies
- 13034 — Sound Conditioned Rooms
- 13081 — Sound & Vibration Control Specialties
- 13152 — Swimming Pools
- 14200 — Elevators
- 14500 — Material Handling Systems
- 09500 — Acoustical Treatments
- 10416 — Computerized Directories & Message Boards
- 10501 — Locker Accessories
- 10670 — Storage Shelving
- 11020 — Security & Vault Equipment
- 11070 — Musical Equipment
- 11138 — Conference Room Equipment
- 11400 — Food Service Equipment
- 11700 — Medical/Hospital Equipment
- 12640 — Open Office Systems
- 13032 — Athletic Rooms
- 13046 — Shelter & Booths
- 13156 — Whirlpool Spas/Hot Tubs
- 14320 — People Movers

If you can't find it there, the application probably doesn't exist, so who needs Division 17?

James K. Wood
AVFM Associates
Rumford, Rhode Island. ■

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You'll also find the nation's largest stock of CCTV, intercom, access control and other low voltage systems. All computer linked for total accessibility. And backed by 16 systems specialists and hundreds of sales experts.

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THE LARGEST MEETING OF ITS KIND

By Jeff Ader

It is already famous for being the largest meeting of its kind to take place in the United States this year. The New York Times and New York Newsday reported it as the largest business meeting ever on Long Island.

I'm talking about Computer Associates' week long (April 9th-16th) Grand Opening for their new Islandia, New York headquarters and sales kickoff. Thirty-two hundred employees from all over the world attended over 40 meetings ranging from company founder-chairman Charles Wang's welcome and state-of-the-company address at the Nassau Coliseum, to technical and trends issues in the software industry.

My New York City based company's (Simultaneous Wireless Interpretations) part in this extravaganza was to provide the equipment, technicians and support personnel for interpreting these business meetings from English into four languages (French, Spanish, Italian and German) for approximately one third of the attendees.

A project of this nature requires extensive planning and team work. Our President, Lori Ungarsohn-Fagin, Engineer-

ing Manager Siu Chin and I conducted site surveys, personnel training sessions, drafted logistical timetables and oversaw a zillion details that were essential to the smooth operation of the interpreting end of the conference. We were in constant communication with Computer Associates personnel, team leaders and chief Bob McWilliams from TAVS, Atlanta,

Services to coordinate the interpreters, and a management team from Wells Fargo Guard Services to review security details at every site where equipment would be left in place for seven days of intensive meetings. All of this planning took place over a period of five weeks. We would normally need six months! It was challenging, exhilarating, aggravating and ex-



Tent for the grand opening party of CA World headquarters in Islandia, New York.

Catering and Sales Managers from these Hotels and Banquet/Catering facilities: LaGuardia Marriott, Long Island Marriott, Marriott's Wind Watch, Holiday Inn-Ronkonkoma, Huntington Towne House and Crest Hollow Inn. We also met with Mary Neubacher of Berlitz Translation

hausting, to list a few of the adjectives.

The Nassau Coliseum's very able Assistant General Manager Lance Elder and staff were more than helpful, by allowing us to come back and run equipment tests to insure complete coverage with our wireless broadcasting equipment. This

Jeff Ader is Director of Technical Services for Simultaneous Wireless Interpretations.

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Leading experts in recording, film post-production and live sound are discovering the many advantages of the Behringer 2-channel and 8-channel DeNoisers. They know Behringer takes the noise out of the dirtiest signal path without altering the audio quality. Their reactions show why Behringer is now the most talked about name in professional audio circles.

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"I have used similar 'single-ended' devices on the mixes of 'Ghost' and 'Godfather III' and found the Behringer Mark III to be superior in every category—from ease of operation to final result.

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Walter Murch—Film Editor and Music Mixer, LucasArts/Skywalker Sound

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Rigging inside
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Total AV's video
setup inside of
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was the site where CA chairman Charles Wang would speak to over 3,000 employees. It would be televised, taped and shown on a huge screen behind the podium on stage. There was no space to put our soundproof booths for the interpreters, so we had to set up in the dressing room area and have video monitors brought in. It is very important for interpreters to see what the speakers are doing. Body language and facial expressions are an integral part of simultaneous interpretation.

Because of the large number of simultaneous interpreters involved (on our busiest day, there were 80, utilizing 40 booths), we had one person on each team designated to interface with them. By keeping in close communication, we were able to provide a good sound source and more than enough receivers required for each meeting room.

Requirements kept changing until two days before the meeting started. Lori, Siu and I had to figure out how, when, what and where to move our people and equipment each day. Plus, we had to be ready for any emergencies that might arise for a meeting of this size and duration. We rented mobile phones for every site supervisor and area manager. It was very important to know that meetings were starting on time, with no problems. If something wasn't working we would know instantly and be able to shift people or equipment. We had seven sites in total over a one-week period. We had six teams

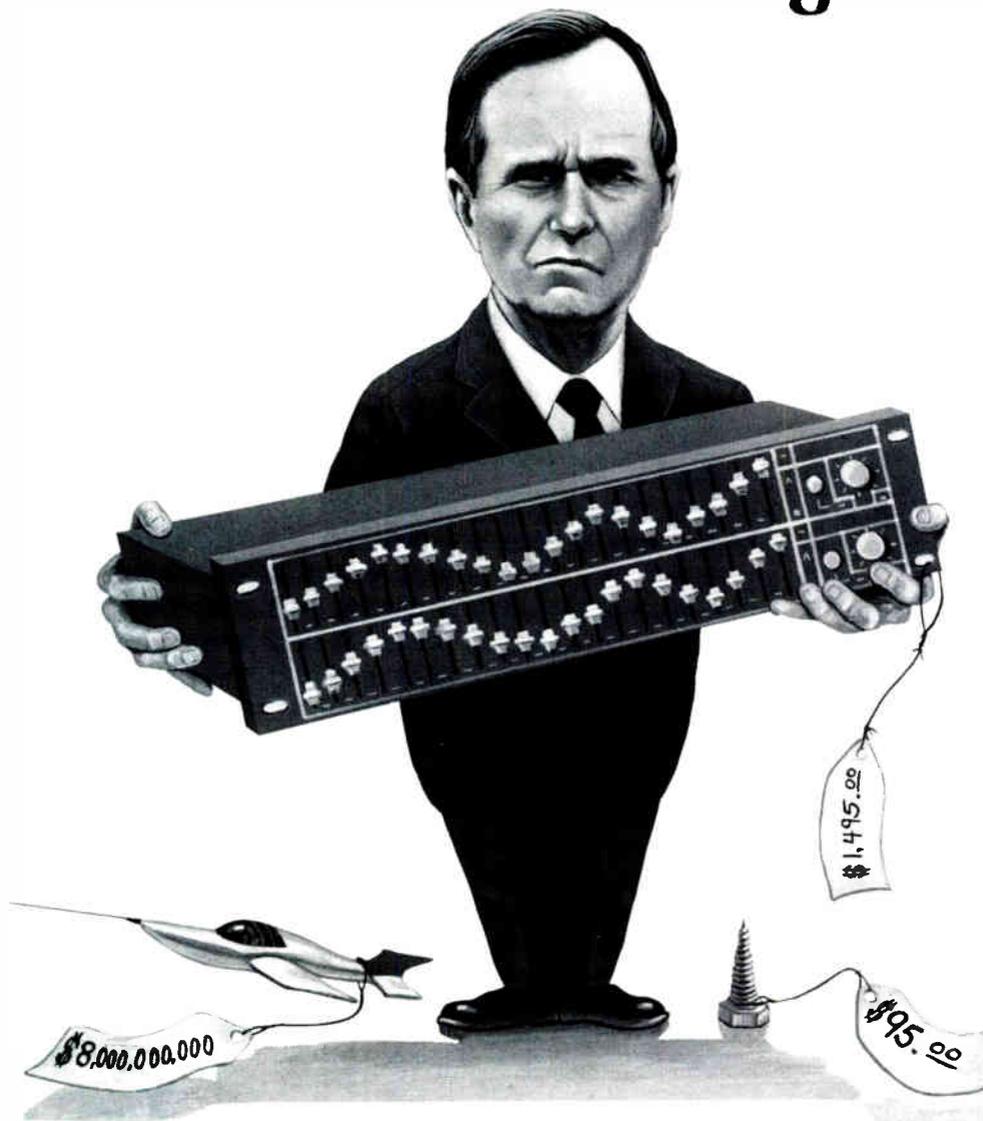
consisting of a supervisor and two or three technicians for a total of 27 people.

In order to get information out to these people, we put together flow charts for equipment and job assignment sheets for all personnel, including supervisors. Our technician's manual included travel accommodations, meal arrangements and allowances, troubleshooting tips and dress code requirements. We conducted training sessions to familiarize everybody with the equipment we were going to use, the standard for setting it up and breaking it down. Everybody got to know who their team supervisors were and how to get in touch with them if the need arose.

I must say that we did a great job of preparing our technicians, as the following story will show. This occurred at the Huntington Towne House on April 15. Ed Montalvo relates, "As the presentation began, the PA system (fortunately not ours) providing sound amplification for the audience and sound source for the interpreters went dead. Not even a hum! We had them turn the old house system on for us, but they could be heard in the next room. We were finally able to adjust the volume but were still left with getting sound to the interpreter booths. I grabbed a microphone, ran a long cable and stood on a chair in front of the speakers until the new PA system arrived during the coffee break. After that, all ran smoothly."

It was definitely an experience we'll remember for a long time. ■

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THE ANSWERMAN

In Search of . . . Manufacturers

UNDERWATER ADVANCEMENT

Dear Answerman,

Unfortunately, our country is not as advanced as yours and so most of the audio equipment is imported, with only very limited items being manufactured.

This is the reason for my letter. I am looking for the manufacturers of underwater loudspeakers as used by the synchronized swimming clubs in your country. I don't know where else to turn in looking for this equipment and thus thought that you might be able to supply me with names and addresses or fax numbers of manufacturers of underwater loudspeakers. I am particularly looking for a speaker either manufactured by a company called Lu Belle or La Bell.

**Mark Visser
Professional Audio
and Lighting
Durban, South Africa**

Dear Mark,

There are a few manufacturers of underwater speakers available to sound contractors. Typically, most underwater speakers are U.L. approved. Applications range from military, such as encoded submarine communications, to synchronized swimming, entertainment and voice warning for lap swimmers, and background music for pet fish owned by Yuppies. Underwater acoustics is actually a major field of research, and the Journal of the Acoustical Society of America usually has about 60 pages of papers specifically on this topic each month.

Pam Michael surveyed these devices last year in the May 1991 issue of *Sound & Communications*. The last time I came across the firm you are searching for was about 20 years ago in a paper in the AES Journal. If any readers know if Lu Bell is still around, let us know.

Pioneer also made underwater speakers about

20 years ago, but has since evolved from the sea to marine (salt spray resistant) speakers for boats and their "PET" Divi-

UNDERWATER ACOUSTICS IS ACTUALLY A MAJOR FIELD OF RESEARCH.

sion commercial outdoor speakers.

The best known underwater speaker suppliers include University Sound and

ANSWERMAN

Fostex. University's UM-30 uses the case's structural enclosure as the sound transducer and can be used in fresh or salt water. Fostex's US3000 can be installed temporarily, as from a float, or installed permanently as a standard pool lighting fixture. The speaker and cable are coated with plastic resin to protect against salt chlorine corrosion. Safety features include a three-wire system with a dedicated ground wire. (University Sound, 818-362-9516. Fostex, 213-921-1112.)

CAN YOU BUY AMERICAN?

Dear Answerman,

Do any American companies make a dual cassette deck? And what about an American tuner?

**Paul Johnson
Richmond, Virginia**

Dear Paul,

These days there is often no so single answer to where a product is manufactured. Buy an "American" car like a Chrysler and you will find it is assembled in Canada, four door Honda Accords are from Ohio, and Volkswagens are assembled in Mexico (I get a kick out of the line "German-engineered" in their ads).

In world class products, multi-national "content" is the rule and audio is no exception. The Answerman recently finished working on a product line for Yamaha (Japan). Certainly one would think this would be a Japanese product, but actually all the speaker and horn components are made entirely in the U.S. and the assembly is at Yamaha's factory in Georgia (which is sort of part of the U.S.). Conversely, many U.S. branded electronics are built in Japan,

THESE DAYS THERE IS OFTEN NO SO SINGLE ANSWER TO WHERE A PRODUCT IS MANUFACTURED

Taiwan, or Korea.

In any case, there are two dual-cassette decks that are assembled in the U.S. One is the Rolls and the other is the Stanton TT2200. Both offer variable speed and rack mounting. The Rolls is often used with their Karaoke front-end preamp, while the Stanton is either used directly or with one of their disco-mixers. They are popular in aerobic studios and for background music. (Stanton Electronics, 516-349-0235. Rolls Corporation, 801-562-5628.)

U.S. made tuners include a few professional broadcast monitor-grade products: Day Sequerra, part of International Jensen; Magnum Dynalab; and

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Inovonics. For more modest tuners, you will have to settle for imported units manufactured for U.S. companies, such as the products sold by Carver and Parasound. Unlike many hi-fi manufacturers, both Carver and Parasound are interested in establishing sound contractors as part of their dealer networks. (Carver, 206-775-1202. Day Sequerra, 617-821-2312. Magnum Dynalab, 815-367-3000. Inovonics, 408-458-0552, Parasound, 415-397-7100.)

BANKRUPT BELFRY

Dear Answerman,

Over the past several years I have purchased and installed belfry sound systems made by Tape-Athon of 13633 Crenshaw Blvd., Hawthorne, California 90250. Recently, when I wrote them to purchase a tape, the letter was returned. Investigating, I have found that they went bankrupt last fall.

I had been promised a schematic diagram of the newest model 2000 Soundmarker, a dual-channel unit that provides hour strike as well as chimes, as designated.

Do you have any information, or have the means of getting any information, as to who might have purchased the assets of this defunct organization in the hope that I may be able to secure the schematics needed to service this unit in the future?

The first system that I purchased from them was back around seven years ago and has been operating fine, save for a lightning strike it received. I want to be able to keep this system in full operation, and the customer desires to purchase additional tapes.

Any information that can be secured would be greatly appreciated.

**Edward Scribner
Schoharie, New York**

Can anyone help, perhaps some refugee from Tape-Athon, or someone from the service department of a Tape-Athon installer? ■

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Wooing the Retail Market

Creativity in a Contracting Business

BY MARIA M. CONFORTI

Sound professionals who want to cater to the retail market will have to shop around for clients. Given the recession's effect on retailers, wooing a willing retailer or mall developer will take some doing.

"There's going to be a contraction in the amount of retail space; everything you read leads you to believe that," says Bill Little, president of Quam-Nichols.

"In any given year, the climate is hot in one area and weak in another," says Bud Waters, national sales manager at Atlas/Soundolier. "I don't think it's ever been hot nationwide that I can remember in 16 years in the business. Currently, I can't think of a single territory where it's hot right now. The areas that generally seem to be almost recession-proof — southern Florida, southern California — are down. And when they're down, you can pretty well imagine what the rest of the country's doing."

Imagine, indeed. "Retail sucks!" says Andy Musci, VP, Altel. "Everything's going down the tubes, and nobody wants to spend any money."

Still, 10 to 15 percent of the business at Associated Sound in Sacramento has always been for retail clients, says Anthony Brown, production manager, add-

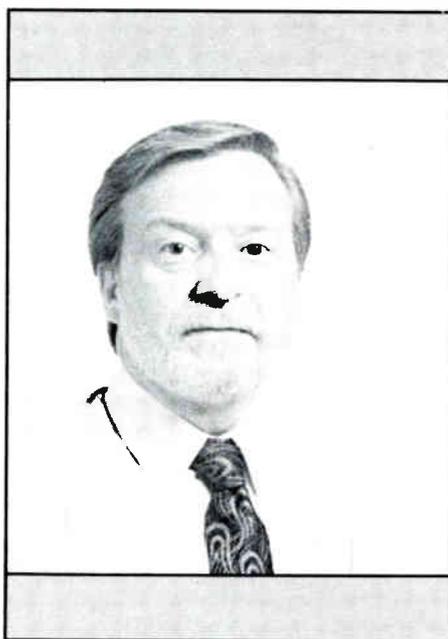
ing that those the numbers are steady even now. Though GMF Sound Inc. in Orange, California has contracts with several discount and upscale chains, its executive VP, Dennis Bethune, notes that market growth has — at least — stagnated. "We haven't seen too much [retail growth] at all," he says. "In terms of the markets where we get a service call, it has died out. It is certainly not expanding in the existing market. The only markets where we see any development at all are the markets outside the

[Los Angeles/Orange County] area."

"The end-users are more into simplicity, and higher-end products, but they still want to pay a low-end price; that's a lot more apparent," says Waters. "We do a lot more negotiating than we ever did before as a result of the competitive market. On the manufacturing side, there are more and more players. At NSCA five years ago, there were 150 exhibitors; now there are 300 and a waiting list, so the pie is being divided up by more participants. The retail user is quite a bit more demanding on the systems integrator, that's for sure. It's more competitive, and they realize they have a greater opportunity to go out there and negotiate. And people expect more for their money nowadays because money's tighter."

Given the volatile nature of retail today, is it worth the risk? "Although I'm very optimistic because my company's going gangbusters, I'm still on the pessimistic side about getting paid, quite frankly," Musci says. "Even [a national chain], which is a hot retailer — I'm still waiting for money 120 days later. So I think that anybody's got to be concerned with the financing picture of any retail. I think there's some comfort in dealing with [healthy national chains], but your average retailer is trying to save every nickel he can, and hold onto the money as long as he can."

Most of the retailers that are in place right now are pretty solid and are willing



Bud Waters, national sales manager at Atlas/Soundolier.

Maria M. Conforti is a freelance writer in the New York area and a frequent contributor to Sound & Communications.

to make the investment for a system, contends Carl Gebhardt, vp/sales for Sound Products Inc. The Minneapolis firm installs systems for 3M background music. "I see it getting more price-competitive," he adds. "The people who are purchasing systems are going to have to take a look at their vendors to make sure that they have the capability to do what they say they're going to do. Everyone I talk to generally does a good job of shopping around."

Competition is stiff, Brown says, from other contractors and "especially corporate retail folks. And then other folks — speaker manufacturers, amplifier manufacturers — corporate manufacturers are trying to get in the door. Manufacturers and rep firms get the

retail clients so confused that they don't know what to do."

Not to mention the rivalry between sound pros and electricians. "A lot of electrical contractors are doing this work and are not even taking bids from sound contractors on the real basic sound systems," Bethune notes. "They know that they can go to various supply stores and buy cable, horns, and amplifiers without going to the sound contractor. Or they can just buy the equipment from the sound contractor and install it themselves. You really can't [combat it]. I think you need to still service your electrician. As times are tough, they're going to want to keep their people busy, so what you could do is suggest that you'll sell the electrician the equipment and

do some final termination and hook-up for them. So at least you get a part of the market versus losing out on all of it."

Much contracting and consulting for retail is renovation work, Little says. "As one chain takes over the locations abandoned by another one, they often put in their own sound systems. I don't think that there's a lot of new construction, but I think that the business continues."

"We've been involved quite heavily with completely new installs," Bethune reports. "We haven't been involved too much with retrofit. Some of the stores have sized down a little bit, reduced some of their space. In cases like that, we've had to rearrange their system a little bit to account for their reduction in retail space." Similarly, Brown notes that

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While Soundsphere Loudspeakers have been utilized in Cub Foods stores in Eden Prairie, Cottage Grove, Bloomington and Plymouth, Minnesota, the most recent installation has been at the newest 120,000 sq. ft. store in Apple Valley. Twenty-five Soundsphere #110A speakers with transformers tapped at 75 watts were installed to gain quality music and voice page.

Craig Streich, the Store Manager, takes advantage of the music quality and added efficiency of clear voice page when reassigning workers to various tasks in the expansive store.

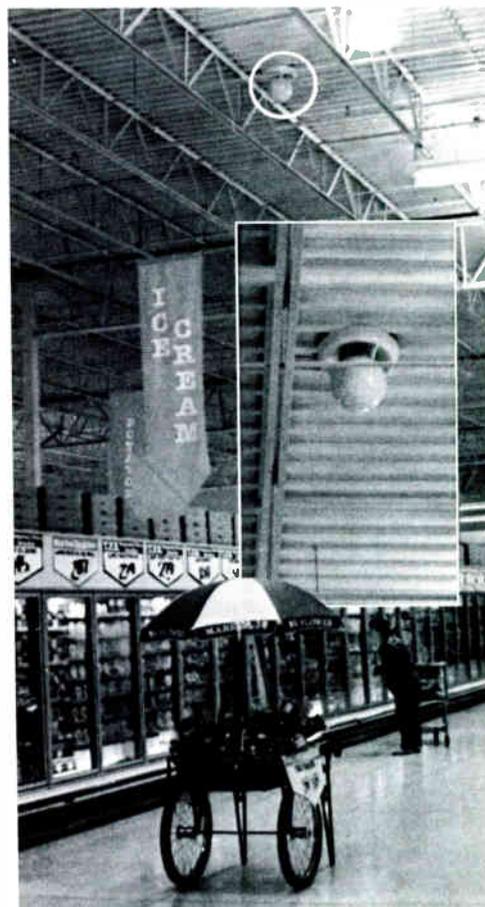
Scott Miller, Manager of Pro Sound at Muzak of Minneapolis, notes that the Cub Foods executives selected parchment-colored #110 Soundspheres to meld with the ceiling color and felt that the shape and color were highly compatible with the contemporary interior design esthetic.

Write or call direct for further information.

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about 80 percent of Associated Sound's retail work is new installs, and the rest is retrofits.

"Unfortunately," Bethune says, "some of the smaller retail companies have gone bankrupt or out of business. We've been working with leasing companies, leasing equipment to these people. We go in and demo the equipment and take the equipment out. So that's been another extra source of work."

Maybe because they have the most to lose, smaller retail businesses are very concerned with aesthetics, Bethune states, "and they want something easy to use, because at one time or another, one of their employees is going to have to use it. They don't have one person to

maintain a lot of their equipment . . . They're more concerned in terms of how it sounds, how it looks, and how it blends in with the surroundings. If you get into a bigger facility, they basically have some parameters, and they want some background music. Chains pretty much . . . maintain the same level at all their stores."

Stores and malls are most concerned with design and cost, Gebhardt states. "More of the national account retailers like the convenience of a satellite distribution system," he continues. His firm provided systems for common areas for the Mall of America, the country's largest mall. Sears is another client of SPI. "Satellite systems can also deliver data

and video, and the cost is dropping on transmitting those types of signals."

"A lot of retail folks are going to satellite downfeeds," Brown concurs. "There doesn't seem to be any one item that anybody's looking for in retail. They're looking for price."

"They're trying to have their own source in terms of background music, more and more," Bethune says, "in terms of having their own CD player versus having taped music by Muzak. What we're trying to do is put that all toward the satellite music, because we don't want to get involved in the ASCAP or BMI fees. Other than that, we're getting a lot of calls where they want to have their own music [source]. In terms of

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cutting money, they're trying to cut a few dollars where they can, and they're saying, 'Instead of leasing music we want to provide our own.' Of course, we have to educate them in terms of the risks they're going to have. If they suddenly cut off their BMI fees, they're going to come exploring and wondering why."

At any rate, contractors and consultants who want to keep their hand in the retail bowl have quite a challenge in front of them. "To offset [competition,] we try to maintain a good relationship with the client," Brown states. "We've been doing a lot of computer modelling, and that helps our credibility. And we show them other stores we've done." Maintain consistency in the contact, Brown stresses. "If the contractor made

the initial contact, leave the contractor alone. Don't screw up the process. Whoever made the initial contact, keep them in the loop: Don't try to cut them out."

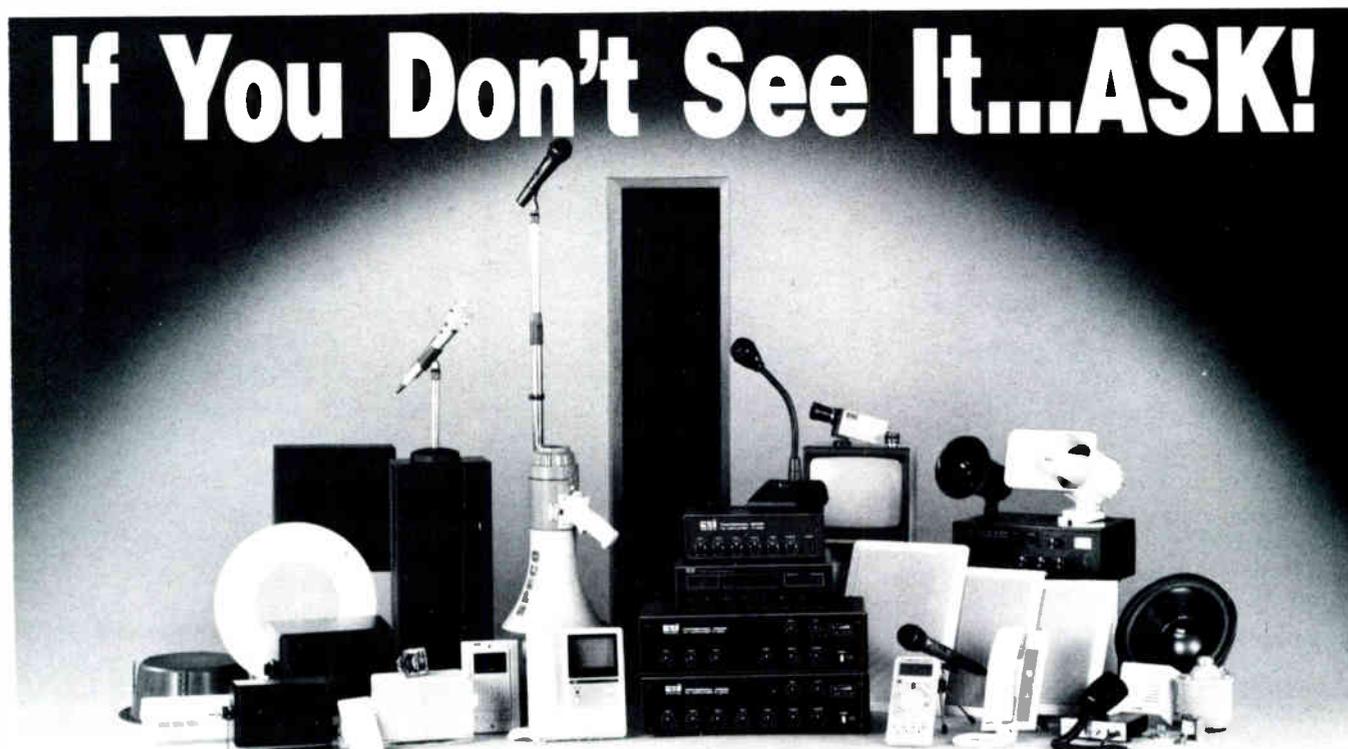
The key to finding new work is the ability to get a product to market that's

"When the economy gets to this point, the cash flow slows down."

less expensive, Brown says. "There are a lot of applications that don't require top-of-the-line stuff. Folks can't afford it, and they're not going to pay for it."

Sound pros are in a vulnerable position right now if they deal primarily with retail clients. "Systems contractors are typically small businessmen, and in their situations, cash flow is a real issue," Waters says. "When the economy gets to this point, the cash flow slows down. It makes it harder to pay their vendors, it makes it harder for them to get credit from their vendors. Everything seems to tighten up; it's kind of a vicious circle."

"Providing support with demo equipment is important for the manufacturer [to do]," Brown advises. "Make sure the manufacturers are liberal with letting the stuff out, so people can try it. Otherwise, they don't have a clue, and we don't use the stuff. Be sure they can ship the stuff. The worst thing is not being



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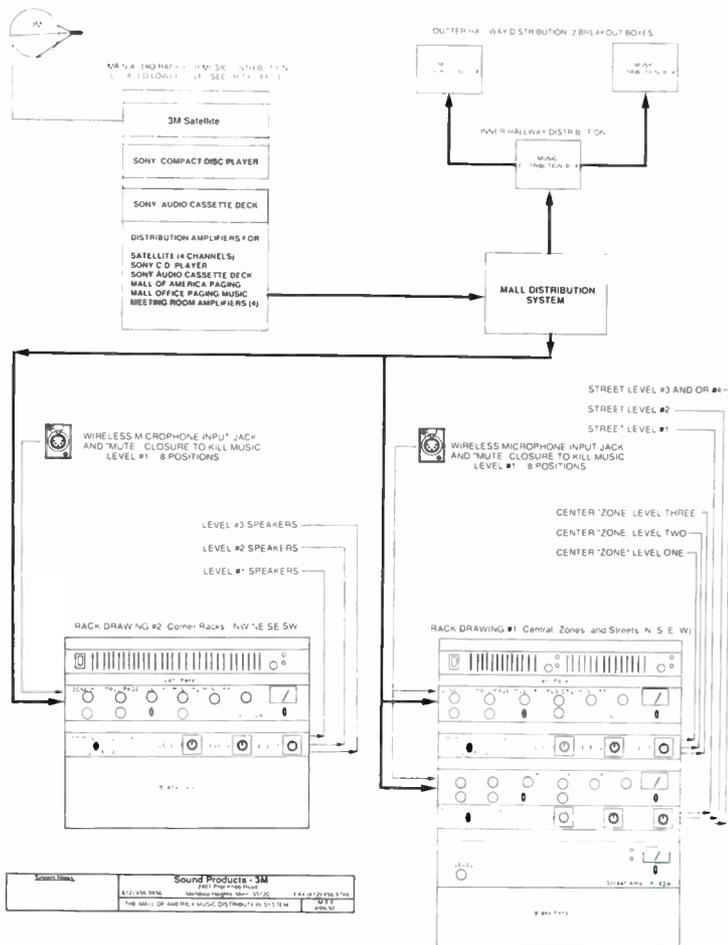
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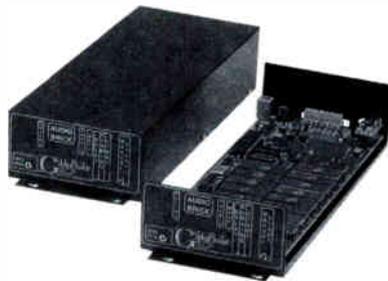
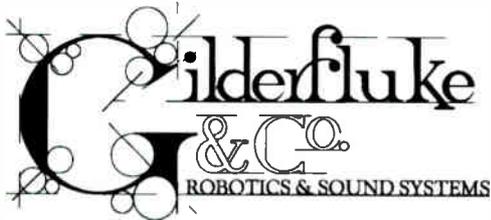
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able to ship the product. Manufacturers: if you're behind on the product, then don't promise it. As a contractor, that's one thing we go through on a daily basis: Trying to figure out who has got what in stock that we can sell... My main point is better support of the contractors by the manufacturers," he continues. "I think contractors have the ability to sell more stuff. Contractors throughout the country could find new clients or do better for existing clients if they had better support and more options from the manufacturers."

"What it comes down to at this point, when the economy is real slow, is if you've done a good job over the past years, hopefully that will carry you through these slow times," Bethune states. "When it is slow, you go back through your past accounts, your big installs that you did three to five years ago, and call them and see if they have a need to go through the system, readjust the system, check it out. That would be a source of picking up some added business. If you're not getting those calls, then you might want to contact the architects. No real earth-shattering information here, but you've just got to explore all avenues." ■

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CCTV Security

Retail Applications

BY ROBERT WEGNER

Advancements in video technology have made a significant impact on CCTV security systems over the last few years. Developments like Digital Signal Processing (DSP) and signal multiplexing have dramatically increased performance levels while reducing costs. As a result, more market opportunities continue to surface where CCTV can be employed with a unprecedented level of efficiency and effectiveness. The retail market is one area that represents tremendous growth potential for CCTV security.

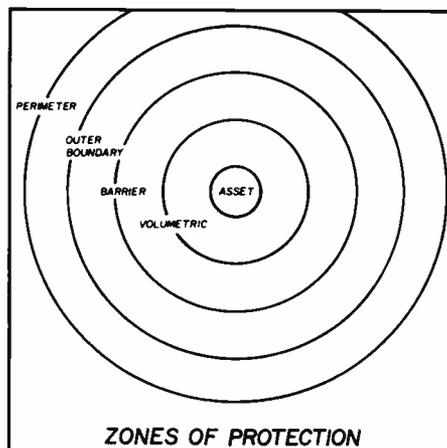
A retailer will be able to identify the "zones of protection" at the retail location.

Numerous CCTV system configurations are available to accommodate the various levels of retail applications. By matching specific system capabilities to a defined retail application, CCTV security provides a highly effective method for retailers to keep a close watch over their business and to deter shoplifting, robbery, burglary and employee pilferage. Retail management and law en-

forcement officials can utilize CCTV cameras and recorders to apprehend and prosecute criminals. In addition, CCTV security systems provide both customers and employees with a safer environment to shop and work in.

IDENTIFYING SYSTEM PARAMETERS

There are several factors to consider before specifying a CCTV security sys-



Zones of protection.

tem that will help the installer and the retailer define the criteria for the system. The first step is to identify specific areas of concern that CCTV can potentially alleviate for the retailer. Here are a few key questions that you should have retailers ask themselves to help get this process started:

- Are there areas of the store that are obstructed from clear view, such as

stockrooms or multiple levels?

- Are there areas outside of the store, like parking lots or merchandise pick-up areas, that require surveillance?

- How many entrances/exits are accessible to the public?

- Where do transactions take place and in how many different locations?

- Does the location require 24-hour

As you move closer to the center of the zone (where the cash register is located) security measures should become more concentrated and intensified.

CCTV security, or can it be limited to certain hours of the day?

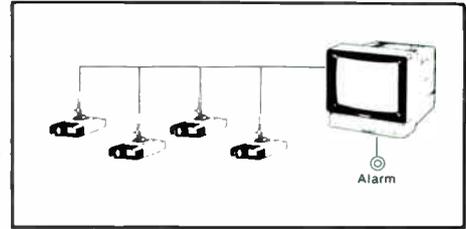
- How large an area needs to be covered, and if there's more than one area, how far apart are they?

- Are there any other security systems or devices, including guards, mirrors and/or an alarm system, that the CCTV system should supplement?

After analyzing the answers to these questions, a retailer will be able to identify the "zones of protection" at the retail location. These zones will help set the

Robert Wegner is Systems Sales Engineer for Panasonic Broadcast & Television Systems Company, Closed Circuit Video Equipment Division.

System diagram showing four cameras connected to monitor with alarm output indicated.



parameters for specifying the appropriate CCTV system.

In a small grocery store, for example, the cash register would be identified as the central point within the zone of protection. The perimeter of the zone is where security begins, whether it be in the parking lot or front door of the store. As you move closer to the center of the zone (where the cash register is located) security measures should become more concentrated and intensified. In large facilities, it is not uncommon to have more than one zone of protection.

There are many types of CCTV systems available to fulfill different security objectives, applications and budgets. To help illustrate the diverse number of CCTV systems available, we will detail five general applications based upon the

size of the retail location for reference.

FIXED ZONE COVERAGE AREAS

For small stores that require "point" or "lateral surveillance" of fixed areas, there are a number of CCTV mini systems on the market.

These systems now provide small retailers with versatile operation at an affordable price.

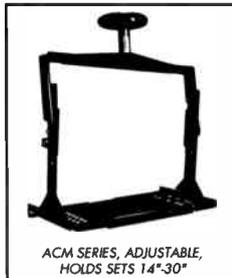
These systems now feature some of the latest developments in CCTV tech-

nology and provide small retailers with versatile operation at an affordable price.

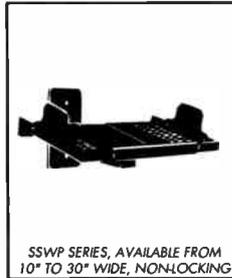
(Panasonic's Video Watchdog system, for example, is available in three different configurations. You can select from tube type, CCD or color CCD camera systems. They come equipped with monitors that feature built in switchers to accommodate multiple camera systems.)

Because these systems feature built-in sequential switchers, they can be set to automatically switch from one location to another without operator supervision. Store owners/managers have the flexibility to view images on the monitor and record them on an optional time lapse recorder for later review. Mini systems, like those offered by Panasonic, can also be connected to the retailer's

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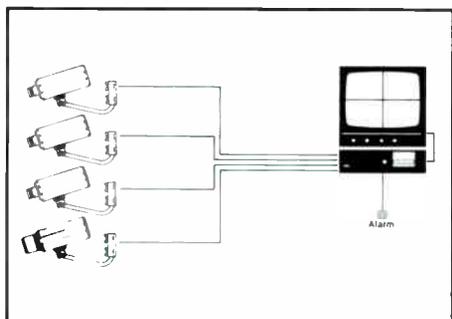
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alarm system and be automatically activated when an alarm is triggered. Such mini systems can provide 24-hour surveillance.

This ease of installation eliminates the need for a separate power source at the camera location.

In most instances, CCTV mini systems can be easily installed since the cameras are connected to the monitor by a single cable. This ease of installation eliminates the need for a separate power source at the camera location



System diagram — basic system with alarm output.

and helps keep the initial purchase price low by minimizing installation wiring and labor expenses.

Quad system technology presents another option for small to medium size retail operations with fixed zone applications. Essentially, a quad system divides the viewing area of a monitor into four screens so you can simultaneously monitor four different camera locations. Full screen images are viewable on demand in most systems. The quad images displayed on the monitor can also be recorded on an optional time lapse recorder to maintain an uninterrupted visual log of each camera. As a result, these systems do not require operator

attention and are ideal for retail locations with limited space.

Many quad systems also feature alarm input capability making them ideal for retailers that require multiple camera systems and 24-hour CCTV security.

WIDE ZONE AREA COVERAGE

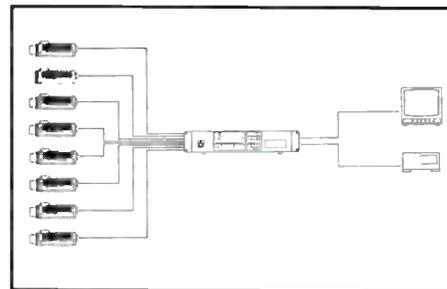
By outfitting cameras with remote controllable pan and tilt mechanisms and zoom lenses, one camera operator can cover a wide surveillance area by placing a limited number of cameras in strategic locations throughout the retailer's facility. Automated pan/tilt mechanisms enable such systems to function without operator supervision.

Multiple camera coverage of fixed zones can be accomplished cost effectively through the use of programmable sequential switchers.

Specifying such a system can require a significant amount of planning to insure component compatibility and proper installation. (Panasonic's Proteus System 100 combines a Digital Signal Processing (DSP) color CCD camera with a pan/tilt mechanism, 10X zoom lens, signal receiver and camera housing into a fully integrated unit. The WV-CS304 integrated camera device connects to its remote control unit by means of a single cable to minimize installation requirements with power supplied through a separate connection. The integrated camera device can be located up to 3000 feet from the remote control unit.)

MULTIPLE ZONE COVERAGE

Retailers needing to monitor multiple zones have several options at their disposal, depending on the degree of so-



System diagram of basic eight camera system with alarm output.

phistication required and budget limitations. Multiple camera coverage of fixed zones can be accomplished cost effectively through the use of programmable sequential switchers. These devices permit installers to connect multiple cameras to a single monitor and VCR. (The Panasonic WJ-FS10, for example, merges up to eight cameras and allows the operator to view any single camera without interrupting the record sequence of the unit. Images from any camera in the system can be played back continuously without traditional time lapse sequence gaps. Sequential switchers may also feature a time/date character generator for camera identification as well as alarm activation and memory functions.)

CCTV security systems built around sequential switchers are comparatively inexpensive compared to traditional multi-camera, multi-monitor systems because they require fewer components for operation. They are ideal for multiple camera monitoring from a single supervised or unsupervised location such as a security or management office.

MULTIPLE ZONE COVERAGE OF WIDE AREAS

To effectively cover a large retail operation such as a department store, the CCTV security system should provide the ability to monitor large areas in multiple zones. In many instances, the coverage zones would be divided into satellite monitoring stations located throughout the store, which are connected to a central security station. Ideally, each of the satellite stations should

have complete control of the cameras and pan/tilt mechanisms in its zone.

These functions provide the security staff with a greater concentration of surveillance by dividing the store's coverage areas into smaller and more easily managed zones of protection. Systems of this magnitude have provided numerous challenges for installers due to their complex configurations.

New developments in signal multiplexing have greatly reduced the cost and complexity of such systems by minimizing the wiring and labor intensive installation requirements. (The Panasonic Proteus System 200 and 300, for example, feature advanced sequential switching control over as many as 64 camera locations. They provide complete control of camera functions and peripherals, bidirectional audio capability at each camera site and complete system status indication from any monitoring station in the system. Camera locations are connected to the monitoring stations by means of a single coaxial cable that multiplexes all video, audio and control signals.)

In addition to providing comprehensive area coverage during store hours, these large scale systems also accommodate alarm sensor inputs that allow 24-hour security.

Panasonic has developed a software package to assist installers and dealers with the design and specification of multiple camera security systems. The program, called Panaspec, contains detailed information on the hundreds of system components available in the Panasonic product line. It allows system designers to easily match and cross reference the best combination of system components based upon the specifics of the installation.

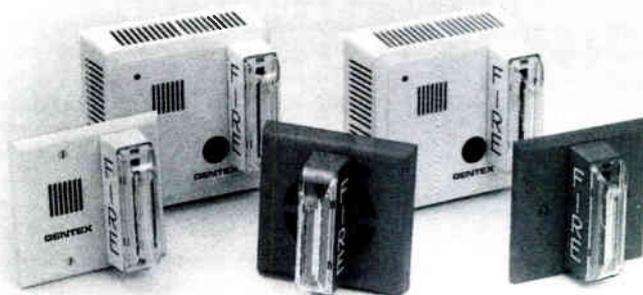
WHAT'S IN STORE FOR THE FUTURE

As CCTV technology continues to

progress, we can anticipate new developments in systems technology for retail applications. Intelligent system control technology is an area of particular concentration. The comprehensive in-

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College Auditorium Upgrade

Touring Artist and Meeting Improvement

BY LON BRANNIES

Unlike most small college auditorium facilities, the Herral Memorial Auditorium at Wayland Baptist University is both a college and a civic auditorium facility. To emphasize its importance for musical performance, the auditorium also contains a pipe organ.

One of the primary University uses of the facility is to provide a suitable stage for the musical performance of the touring contemporary Christian artist. As a civic auditorium, its use is typically for a meeting facility.

THE NEED

The existing house sound system was basically adequate for meeting purposes although the electronics required some intermittent repair. For musical performance, the system lacked bandwidth, dynamic range, adequate mixing capability, stage monitoring and intercommunications. Audio feed for broadcast or teleconferencing was almost nonexistent. A phased system replacement was decided as the course of action given the inadequacies extant.

Instructors Steve Long and Jay Sawyer were charged by the University with the



Inside of the Herral Memorial Auditorium showing Yamaha PM1200 24-channel console.

responsibility of soliciting, collecting and evaluating the bids. With both having substantial touring and broadcast experience, the University was in good hands.

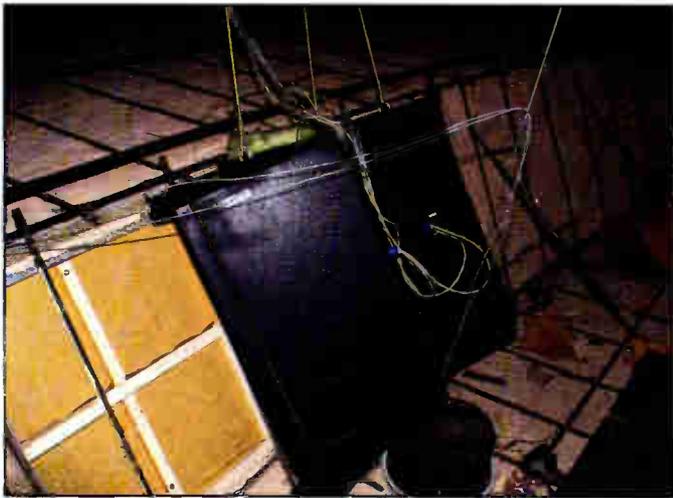
They had the vision to see the requirement for a high performance system and had the hardware experience to know what it would take to do the job and choose a reputable contractor with the requisite experience. They knew that whatever evolved, good or bad, the Uni-

versity would be married to the system for a long time to come. Consequently, they also wanted major equipment manufacturers with proven stability.

PROJECT CONCEPTUALIZATION

Larry Bell, with Revelation Sound Inc., had met with Steve and Jay, knew their needs and concerns and felt that a processor controlled system would be most ap-

Lon Brannies is a manufacturer's rep for Yamaha.



The delayed cluster in the proscenium.



The stage with the delayed cluster.

appropriate for their needs. Larry, having heard some demonstrations, knew this type of system would have adequate bandwidth and dynamic range. He also knew the main problems with this type of system are mediocre speech intelligibility, a heavily "processed sound" quality and finding a system in which the processing would permit room equalization. Finding a system with reasonable horn geometry for the room might also be a problem.

The mixing requirements: mute groups, fully modular construction with stereo input capability, pre/post aux buss switching, outboard power supply, fully balanced

input/output, would be met by only a fully featured mixing desk. Finding such a console at a reasonable price would be the challenge.

The broadcast audio side of things would require a full microphone splitter system and separate mixing capability. With the budget rapidly evaporating, all thought to broadcast/teleconferencing facilities would have to be left to future phases of the project.

ENGINEERING DESIGN

Initial modeling of the room with the Renkus-Heinz EASE room modeling pro-

gram showed a number of lower midband problems in the rear of the room from the main cluster location. Various choices of horns could improve it but only by sacrificing other requirements. At this point, a delayed cluster system was added and the anomalies disappeared. Yamaha's new 2-way speaker system, the S1520S, was the leading contender for the installation. Yamaha provided polar data in tabular format to plug into the design program, including multiple box arrays to show artifacts of arraying. During the final product development stage Yamaha had this data prepared by Summit Labs and now is

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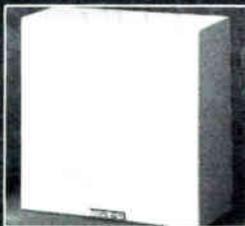
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in the process of providing this data for the various sound system design programs. Speech intelligibility with or without the delayed cluster system would be excellent according to Joseph Thomas, project engineer for Revelation Sound.

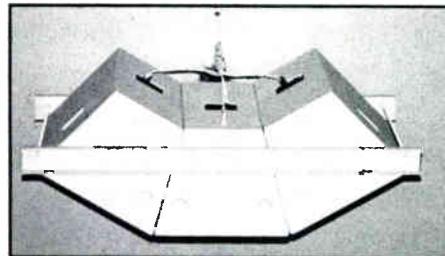
Thomas felt that EASE suitability as an engineering design program was very good due to its intuitive nature and the ability to look at various points in question (frequency response, reverberation time, etc.) microscopically, that is, at any seat in the room.

The S1520S is available as a 100 degree and 60 degree horizontal pattern and both versions were selected for the job. Additionally the C20, the digital signal processor for the S1520S, is a very cost effective design and allowed some latitude for additional amplifier power. The C20 incorporates variable crossover slopes and filter topologies, delay for both cluster delay and signal time concentricity, separate compressor/limiters for bass and high frequency outputs, user adjustable parametric EQ and some special purpose equalizing to compensate for bass buildup with clusters and high frequency compensation for air absorption with distance. In addition to the C20, Yamaha's dual channel $1/3$ -octave equalizers as well as notch filters were used. The notch filters had $1/10$ -th-octave filter sections, and a $1/6$ -th-octave notch filter is patchable at the mixing console's insertion points.

The S1520S system also includes the Y20, a servo-controller for the bass, which incorporates YST, a sophisticated negative impedance converter. A simplified explanation of the concept is that amplifiers with low source impedance have a high damping factor, which provides enhanced control of the speaker. If the amplifier's source impedance could be zero, then the control would be greater, and if the source impedance could be less than zero, the amplifier (in this case the Y20) could electronically synthesize Theile-Small parameters that could not easily be obtained through mechanical speaker construction. The overall benefits include extended low frequency output and superior transient response from a small vented enclosure. From a practical perspective, the Y20 amplifier interface helped with wiring requirements to both clusters and gave some flexibility to rack locations. Due to wire run lengths, a

split rack system would have been required with a more conventional design. The speakers were driven by Yamaha P2350 and P2700 power amplifiers. The mixing board was a Yamaha PM1200 24 channel.

The consensus on rigging hardware was to not use the loudspeaker's existing portable flying hardware and to use a system for permanent installation. The clusters are bolted to steel "C" channel at



The main cluster.

the required geometry. The channel is then tied with hardened thread which also creates the lift points with a forged eye nut.

The stage mic lines consist of Whirlwind 2x24 channel snakes. One is on each side of the stage and both come to a transformer splitter box. The patch bay system is designed such that the 48V phantom power is isolated from the jack field and therefore has "dry" contacts to prevent arcing in the jack as a patch cable is inserted or removed. The cable to feed the broadcast system was left disconnected and laying in the bottom of the rack.

INSTALLATION

The equipment racks were loaded, wired and tested in the shop. Jobsite exigencies necessitated their unloading, movement into place and reloading.

The delayed cluster was shop fabricated and lifted into place at the site. The main cluster, due to close confinement by the stage proscenium, was fabricated in place piecemeal.

Each 24 channel mic stage box has a wall hanging point from which it can be removed. Long tails allow the box's location anywhere on its respective side of the stage. All microphones ingress the system from these stage boxes. There is a pair of microphones hung from the ceiling below the main cluster in a stereo x-y configuration.

These mics feed the house console only and are not incorporated in the splitter/patch bay system.

Millwork for the mixing console and console effects rack is owner provided. The owner also provided 120 VAC power changes as recommended.

TESTING

House equalization was somewhat unusual in that the EQ facilities in the C20 Signal Processor permitted ± 1.5 dB 80 Hz — 10kHz before the $1/3$ -octave graphic equalizer was adjusted on the main cluster. The delayed cluster required more effort on its graphic equalizer.

The factory preset time delay for the woofer is 56 microseconds. Other than listening to it *on* versus *off* and noting considerably fewer comb-filter effects with it on, the time delay was left at the preset setting.

The design criteria for sound pressure level was 95 dB(A) SPL. After installation, it was found to be >101 dB(A) SPL for the main cluster and >106 dB(A) SPL for the delayed cluster. The delayed cluster amplifier outputs were then reduced 5 dB.

A live vocal music source, Mike Hill of RSI's installation crew, was enlisted to test system gain before feedback. With

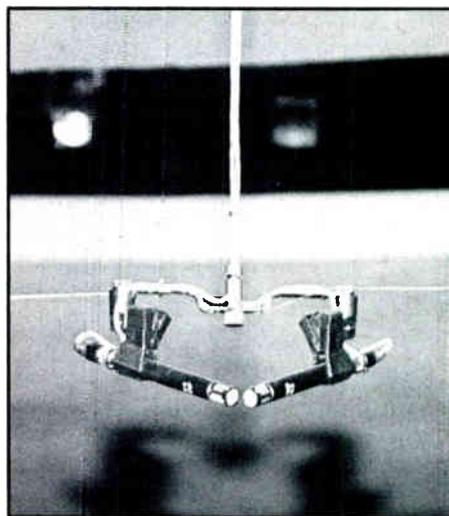
the microphone positioned in the main cluster's pattern and held at full extended arm length, the console level was advanced to maximum and a song was sung to tape accompaniment. SPL was intense to say the least, and the system was stable with no feedback.

Steve Long marveled at the "phenomenal gain before feedback" and the evenness of coverage with almost no comb filter effects. Sound was very natural in the rear of the room, with superb highs.

Speech intelligibility, as predicted by EASE, was excellent throughout.

RETROSPECT

The major design problem (remember that the SPL design criteria was far exceeded) was the large difference in output level between the main and delayed clusters. The system was designed based on horn coverage angles for the room. For this criterion, the system was correct as done. Not taken into account was the fact that the main cluster is loaded by the whole room and should have higher Q horns. The delayed cluster, since it is loaded by roughly the back 40 percent of the room, should have lower Q horns. As designed and installed, the main cluster had the lower Q (100-degree) horns and

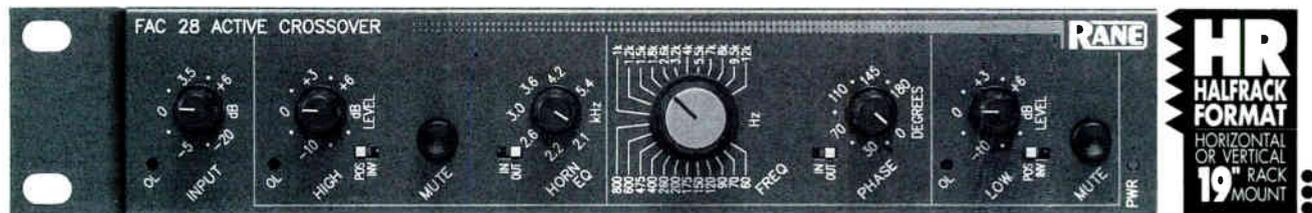


Microphones set up in a stereo x-y pattern beneath the main cluster.

the delayed cluster had the higher Q (60-degree) horns. This also forced more devices into the delayed cluster. To negate this, the clusters should have been reversed. Had this action been accomplished, the speech intelligibility should have changed little.

All in all the room equalization was very satisfactory. The delayed cluster might have had some small benefits from added effort on the graphic EQ. The extra equalization facilities in the crossover were considered a send from the sound gods. ■

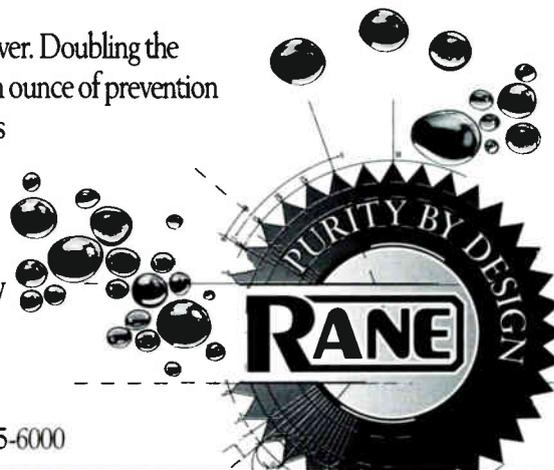
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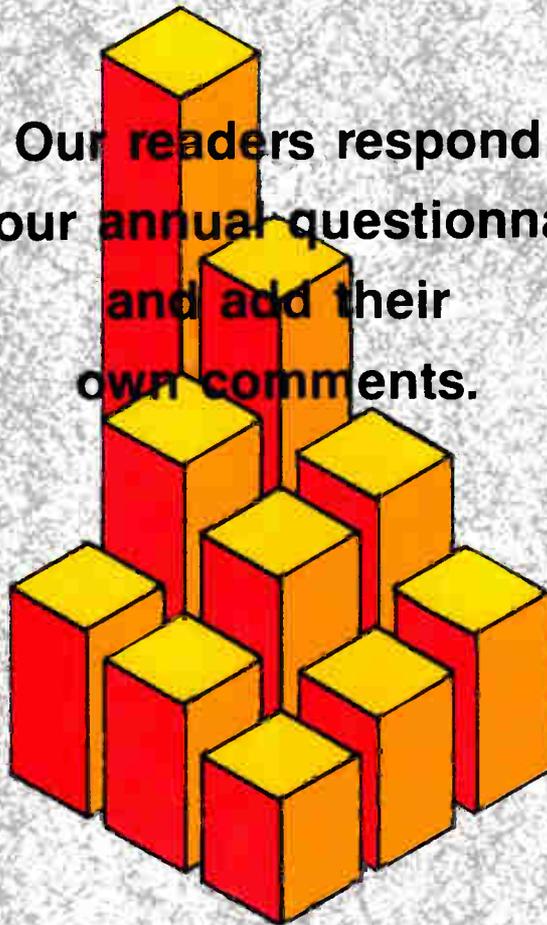
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SOUND & COMMUNICATIONS

1992

CONTRACTORS SURVEY

Our readers respond
to our annual questionnaire
and add their
own comments.



Most Important Markets For 1991

- Commercial Sound
- Entertainment Sound
- CCTV
- Factory Paging
- Non-Security Video
- Alarm/Security/Life Safety
- Wired Intercom
- Pro Sound
- Business Music Hardware

Markets to Expand Into

- Teleconferencing
- CCTV
- Nurse Call
- Schools
- Hospital/Health Care
- Business Background Music
- Telecommunications
(Telephone Systems)
- Access Control
- Clubs
- Residential
- Churches
- Rentals

Projected Importance to Sales For 1992

- Commercial Sound Systems
- Alarm/security/life safety
- Entertainment Sound
- Non-Security Video
- Residential
- CCTV
- Nurse Call
- Factory Paging
- Business Music Hardware

The most important criteria for getting most jobs

	PERCENT RESPONDING	
	1991	1992
Low bid	11.9	18.1
Fair price	16.4	16.9
Service & maintenance availability	10.3	20.3
Installation availability	4.3	6.8
My company's presentation	23.3	23.7
Equipment carried	2.6	1.7

THE SEVENTH ANNUAL

Survey of the Sound & Communications Contracting Business

By Judith Morrison

Don't look to these pages for any statement on revolutionary changes in this business during the past year - because there weren't any. There have been some shifts, however, towards interest in new technology, and towards a litany of complaints and plans that has changed subtly. We're hearing more complaints now about distribution, and more concern for licensing, training and specialization. We're seeing new excitement over core businesses, and less over glitzy new markets. Actually, we're seeing a lot.

The Seventh Annual Sound & Communications Survey of the Contracting Business shows a sober business community diversifying into sensible places and creating more depth in its home base. That's not to say that things aren't lively.

As always, the comments from the contracting community make for interesting reading: "Too many unqualified people doing too much work." "I can't get no respect." And so on. But more of that later.

Once again, Sound & Communications magazine sent questionnaires to its readers asking four pages worth of questions on their businesses and how they run them. The results were tabulated by Survey Analysis, an independent market research firm. And some of those results are printed here as a service to the industry as a whole.

Who are our respondents? Ninety-two

percent of them are engaged in equipment sales; 94.8 percent provide system design, 96.6 percent provide system installation, and 88.8 percent repair and maintenance.

What are they working on? The dollar value of installed system jobs has steadily increased over the last three years, with the average dollar size of this year's systems coming in at \$35,200 (versus \$21,400 last year). Not surprisingly, larger companies had a larger average (\$61,400 for companies doing over \$5,000,000) and smaller companies had a lower average. And once again the time taken from order to finished system has increased - to nearly four months for this year's results.

And once again we asked some open ended questions about our readers' relationships with their suppliers. We asked five questions in total on this subject: What are your best selling lines, which manufacturers do you have the best relationship with, which three brands you find the most reliable, and which brands you find are the best value. We also asked which brands our readers are least likely to use.

Once again JBL and TOA placed within the three top selling lines. Biamp and Sony made it to the top ten for the first time. Since Rauland-Borg has consistently scored in the top ten selling lines, we might ascribe some of Biamp's ascendancy to the purchase of Biamp by Rauland-Borg, and a new insurgence of

distribution power and/or cash to Biamp's merchandising. Sony's placement may correspond to other results we found on this survey; projected growth is seen by a large percentage of our readers in the "non-security video systems" arena. Since the monthly Product Check of Sound & Communications magazines sees Sony as one of the top three suppliers of video equipment whenever our questions touch on that equipment, we're willing to suggest that a growing interest in combining audio and video has added to Sony's clout within this business. Unfortunately, we didn't ask our survey respondents which equipment of which manufacturers they sold, so we can only guess.

Projected growth is seen by a large percentage of our readers in the "non-security video systems" arena.

Top sellers don't necessarily mean best relationship, although the two often correlate. The top ten manufacturers in terms of relationships with their contractors were: TOA, JBL, Crown, Atlas/Soundolier, Dukane, Electro-Voice, Biamp, Altec Lansing, Shure, and West Penn Wire. Similarly, the most reliable equipment turned up some entries that were not on the other lists: Peavey, Quam and Bose. And the best value included Aiphone, QSC and Rane.

We asked our contractor readers what brands they were least likely to use. The answers were mixed, with some of the least likely to use also showing up on the top three sellers list. That becomes problematic, since we have to ascribe some of the response at least to the fact that some people want a particular line, can't get it and so are not likely to use it. Conversely, a brand may be a top seller yet have too many dealers. Reasons

Actions Manufacturers Should Take

- "More useful products."
- "Better terms on display units."
- "More and better sales aids — literature, mock-ups, catalogues."
- "Continuing to keep out the low ball sales houses."
- "Without doubt, ship on time! And don't advertise products that aren't in stock, nor in production!"
- "Provide more sales/marketing information."
- "Provide samples for evaluation."
- "Unique products."
- "Shorter delivery times."
- "Show a little faith in the economy and increase inventories."
- "Equipment to match needs — not create equipment, then find a need."
- "Not selling direct. Limiting sales to companies technically capable of supporting product."
- "Print real specs — provide alphabetized price lists."
- "Do not do to the commercial market what manufacturers/ reps did to pro and music. Sell . . . sell . . . sell . . . The market needs nurturing, not flooding."
- "Better product support. More available literature and catalogues."
- "More timely release of equipment after initial announcement."

**DOLLAR SALES
(in thousands)**

	Percent of Contractors		
	1989	1990	1991
\$100 & Under	11.9	20.3	12.1
\$100-\$500	36.5	23.7	24.1
\$500-\$1,000	17.6	22	15.5
\$1,000-\$5,000	24.5	30.5	37.1
\$5,000-\$10,000	6.9	3.4	6.9
Over \$10,000	6	1	2.6

Total Dollar Sales for 1991 (Compared To Last Years' Response)				
	PERCENTAGE			
	1988	1989	1990	1991
Under 100,000	18	11.9	20.3	12.1
100,000-499,999	38	36.5	23.7	24.1
500,000-999,999	13	17.6	22.0	15.5
1 Mil.-4,999,999	23	24.5	30.5	37.1
Over 5 Million	8	7.5	3.4	9.5

Installed System Jobs (Dollars In Thousands)			
	1990	1991	1992
Average size of systems	15.8	21.4	35.2
Largest size of systems	96.0	170.4	245.7
Typical time from order to finished system (months)	2.6	3.3	3.9

Average Percent of Sales			
	PERCENT RESPONDING		
	1989	1990	1991
SOUND REINFORCEMENT			
Commercial sound reinforcement (installed)	24.8	29.8	32.2
Commercial sound reinforcement (portable)	2.3	1.4	3.0
Entertainment sound reinforcement (installed)	6.5	2.2	4.2
Entertainment sound reinforcement (portable)	2.5	2.0	2.6
Sound service (rental & operation)	5.5	4.3	4.3
Pro sound equipment	4.8	3.7	3.3
MI/musical instrument	0.9	2.5	0.4
INTERCOM (Non-telephone)			
Office-to-office	1.0	1.1	0.8
Nurse call	4.0	5.6	4.0
Other Hospital/health care intercom	1.0	1.4	1.8
Factory paging/talk back	2.5	2.4	4.6
Other wired intercom	3.7	1.3	2.5
BUSINESS MUSIC			
System hardware sales/installation	3.6	2.1	2.9
Sales of tape/cartridge	0.7	0.2	0.2
SCA/Satellite	1.6	5.4	2.2
Music library rental/programming	1.0	0.3	0.5
INTERCONNECT			
Keyphone sales/installation	4.4	5.0	2.0
PBX sales/installation	1.0	1.5	0.5
Hybrid sales/installation	1.4	2.2	1.4
Support & peripheral equipment	1.5	0.8	0.4
OTHER			
Video systems (non-security)	3.3	5.2	6.3
CCTV	2.8	6.8	4.3
Alarm/security/life safety	6.1	6.2	7.0
Sound masking	0.8	1.2	0.5
Teleconferencing	0.6	2.2	1.3
Residential systems	1.7	5.5	6.6

given for not using a particular brand are: "too expensive to repair," "poor reps," "cannot meet volume dollars," "reliability," "too many dealers," "unprofessional product" – and, in one succinct entry, "junk."

Just as "poor rep" causes a line to be ignored, a good rep can close the sale. We asked an open ended questions to elicit write-ins on the manufacturers' reps "with whom you have the best relationship." Since this was not a multiple answer question, and required some

time to respond to, we think any rep getting any votes in that column deserves special commendation. We've printed the names of as many of those listed as we possible can elsewhere in these pages. The top three vote getters, for your information, were Sigmat, Secom, and John B. Anthony.

Organization membership seems to be slightly up, with 59.5 percent of our respondents belonging to NSCA and a full quarter belonging to AES. For the first time, we asked who belonged to CEDIA, and nearly nine percent of our respondents report themselves CEDIA members. Fewer people, however, actually attended the CEDIA convention (6.9

Organization membership seems to be slightly up, with 59.5 percent of our respondents belonging to NSCA.

percent), as was true of AES (22.4 percent). However, nearly 63 percent of our respondents attended the NSCA expo (although only 59 percent belong to the association). Larger companies had higher attendance rates at NSCA and at Infocomm. Smaller companies had higher rates of attendance at NAMM and at CEDIA, and to a slight extent at AES.

How much money do people make, and how do they make it? Total dollar sales have seen an increase in the midrange of \$1,000,000 to \$5,000,000, with an increase in the core business of commercial sound reinforcement. Over 86 percent of our readers report commercial sound reinforcement (installed) as contributing towards more than one percent of their sales in 1991. Non-security video systems were reported by 33.6 percent, CCTV by 45.7 percent. Yet in

projections for 1992, the projections in percent of sales contributions remains about the same as last year - 32.1 percent for installed commercial sound reinforcement (versus 28.9 percent last year), 6.2 percent for non-security video systems and 5.4 percent for CCTV. An upswing was seen across the board for alarm/security/life safety with projected percent of sales next year up from 6.6 to 8.3 percent, and 19.8 percent naming it as an important market for next year.

Although teleconferencing was named most often as a market our readers would like to expand into, only 8.6 percent named it a most important market of 1991, although 15.5 percent called it an important market for 1992; 16.4 percent reported it as contributing at least one percent of 1991 gross sales, but that translates into only a little over two percent of the projected sales for 1992.

Factory paging and satellite business music showed large increases in interest.

Similarly, there was some change in thoughts on residential work this year. Percent of projected sales was down to 5.8 percent, although nearly 13 percent reported residential work as a projected most important market (up from 8.5 percent last year and 5.7 percent the year before). Caution may be taken in the write-in comment of one of our respondents: "Lots of people getting into complex residential A/V custom installations will regret it; they will find it is far more complicated and time consuming than it looks."

More large companies expect more business in CCTV and teleconferencing. More small companies expect more business in residential work.

Factory paging and satellite business

Top Selling Lines

- JBL
- T.O.A.
- Crown
- Altec Lansing
- Electro-Voice
- Dukane
- Bogen
- Rauland-Borg
- Biamp
- Sony
- Shure Bros.

Manufacturers With Best Relationships

- TOA
- JBL
- Crown
- Atlas/Soundolier
- Dukane
- Electro-Voice
- Biamp
- Altec Lansing
- Shure Bros
- West Penn Wire

Average Projected Percent of Sales

	1990	1991	1992
SOUND REINFORCEMENT			
Commercial sound reinforcement (installed)	28.4	28.9	32.1
Commercial sound reinforcement (portable)	2.1	1.5	2.3
Entertainment sound reinforcement (installed)	6.0	3.2	4.9
Entertainment sound reinforcement (portable)	3.4	1.1	1.8
Sound service (rental & operation)	4.7	3.5	3.2
Pro sound equipment	4.0	3.5	3.5
MI/musical instrument	0.9	—	.4
INTERCOM (Non-telephone)			
Office-to-office	1.5	1.2	1.0
Nurse call	4.1	5.7	4.9
Other Hospital/health care intercom	0.6	1.8	2.2
Factory paging/talk back	1.8	1.6	4.3
Other wired intercom	4.4	3.0	2.2
BUSINESS MUSIC			
System hardware sales/installation	3.7	1.5	3.2
Sales of tape/cartridge	0.5	0.3	.3
SCA/Satellite	2.7	5.8	2.8
Music library rental/programming	1.5	0.4	.5
INTERCONNECT			
Keyphone sales/installation	4.0	3.2	2.2
PBX sales/installation	0.9	1.5	.6
Hybrid sales/installation	1.5	2.5	1.5
Support & peripheral equipment	0.7	1.2	.5
OTHER			
Video systems (non-security)	4.5	6.2	6.2
CCTV	3.0	9.0	5.4
Alarm/security/life safety	6.3	6.6	8.3
Sound masking	0.7	1.5	.7
Teleconferencing	0.7	2.4	2.1
Residential systems	2.5	6.2	5.8

Venues of Concentration

	PERCENTAGE	
	1991	1992
Worship houses	50.8	50.0
Schools	40.7	37.9
Boardrooms	20.3	18.1
Auditoriums/concert halls	33.9	35.3
Offices/factories	44.1	44.0
Hospitals	20.3	25.9
Clubs/restaurants	30.5	22.4

More Time Should Be Spent With...

	PERCENTAGE		
	1990	1991	1992
Architect	27.7	22.0	19.0
General contractor	4.4	1.7	2.6
End user	20.8	25.4	25.9
Electrical contractor	5.7	5.1	.9

Most Important Markets Projected

	1990	1991	1992
SOUND REINFORCEMENT			
Commercial sound reinforcement (installed)	47.8	52.5	56.9
Commercial sound reinforcement (portable)	7.5	5.1	14.7
Entertainment sound reinforcement (installed)	17.0	10.2	18.1
Entertainment sound reinforcement (portable)	6.9	3.4	5.2
Sound service (rental & operation)	10.7	16.9	16.4
Pro sound equipment	12.6	11.9	19.8
MI/musical instrument	1.3	—	1.0
LOCAL WIRE INTERCOM (Non-telephone)			
Office-to-office	9.4	8.5	8.6
Nurse call	13.8	13.6	19.0
Other Hospital/health care intercom	6.9	5.1	12.9
Factory paging/talk back	10.1	8.5	15.5
Other wired intercom	13.8	5.1	15.5
BUSINESS MUSIC			
System hardware sales/installation	9.4	10.2	15.5
Sales of tape/cartridge	3.8	3.4	4.3
SCA/Satellite	6.3	6.8	11.2
Music library rental/programming	5.7	1.7	5.2
INTERCONNECT			
Keyphone sales/installation	8.2	6.8	6.9
Support & peripheral equipment	3.8	5.1	3.4
OTHER			
Video systems (non-security)	14.5	15.3	21.6
CCTV	11.3	16.9	19.8
Alarm/security/life safety	11.9	8.5	19.8
Sound masking	6.3	10.2	10.3
Teleconferencing	2.5	8.5	15.5
Residential systems	5.7	8.5	12.9

music showed large increases in interest, as did "other hospital/health care intercom." This last may be due to higher technology. Where "nurse call" suffered some reduced interest, new technology may be putting the whole health-care industry into a different plateau and terminology.

More of our respondents use IBM clones and compatibles than any other computers, more of them use AutoCad and JBL CADP than any other kind of software. Testing equipment most men-

THE BEST REPS

Manufacturers' rep/distributors with contractors.

Sigmat
Secom
John B. Anthony
Hudson Marketing
Palmieri Ass.
Ziskind Ass.

Other companies receiving

Meyer Marketing
Torbett-Keiser
Image Marketing
Graham/Davis
Williams
C.L. Pugh
PRI
SK McDonald
ICI
Warren Ass.
Cordial/Riley
AMI
Star Entertainment
Ouzenoff Ass.
Piper Ass.
W3 Marketing
Radio Comm.
Miller Electronics
Eaton Marketing
Murphy & Cota
KBZ Communications
PASS Ass.
RJ Marketing
Specialty Marketing
Monfort Electronic Mktng
Dimension Point IX
LCA
Sound Sales
Barry Evans
Conneen Ass.
Relco
Eakins-Bernstein
Derek Allen
New West Audio
AVCOM
STA-IN Marketing
Edwards
Silver Peak Marketing
Pacific Audio Group
Famous Tele Supply
EESCO
MJA
Muzak
Jones Audio Sales
Dan Speegle
Richardson
Worldwide Productions
Taub Sales
Dave Bros Organization

having the best relationship

Caffe and Ass.
Bencsik Ass.
Audio Marketing
AV Marketing
Metropolis
Pusecker Ass.

a sizable number of votes.

Pierce Phelps
Darmsteddar
Jarmac Marketing
Lucas Sales
MetroRep
Target Dist
Peregrino Reps
Taub
Wally Wilson
ASR
Sound Marketing
Westeca Marketing
New Horizons
Sound Marketing
Audio Biz
FCI
PEPCO
John Humble
Lowell Kansas
J Y Shoemaker
White and Ass.
Arius
Perpetual Marketing
Crescendo Ass.
JW & Ehner
KBL
WJ Ray
WA Hendrickson
Associated
Hutto, Fredrickson
Pete Schmitt Co.
Pro Audio
Applied Audio
ADI
Wayne Wyche
Cuffey & Assoc.
Rancilio
Leslies
Audio Resources
Pyrotronics
CB Electronic Marketing
AMW
Vicon
CB Electronic Marketing
Electro-Sales
Dick Bellew
Audio-Video
Riley/Petchel
FC Hayer

Best Value

- TOA
- Crown
- Bogen
- Biamp
- Atlas/Soundolier
- Electro-Voice
- Shure Bros.
- Quam-Nichols
- Dukane*
- QSC*
- Aiphone+
- Rane+
- * tied + tied

Most Reliable Brands

- TOA
- Crown
- JBL
- Altec Lansing
- Shure Bros.
- Biamp*
- Electro-Voice*
- Dukane*
- Peavey
- Quam-Nichols
- Sony
- Bose
- * tied

Markets with 1 percent of Sales

	PERCENT RESPONDING		
	1989	1990	1991
SOUND REINFORCEMENT			
Commercial sound reinforcement (installed)	85.5	79.7	86.2
Commercial sound reinforcement (portable)	26.4	20.3	28.4
Entertainment sound reinforcement (installed)	37.1	27.1	37.1
Entertainment sound reinforcement (portable)	20.1	8.5	17.2
Sound service (rental & operation)	36.5	33.9	28.4
Pro sound equipment	40.9	27.1	36.2
MI/musical instrument	1.9	1.7	6.0
LOCAL WIRE INTERCOM (Non-telephone)			
Office-to-office	31.4	27.1	24.1
Nurse call	23.9	33.4	22.6
Other Hospital/health care intercom	21.4	20.3	22.4
Factory paging/talk back	49.1	40.7	37.9
Other wired intercom	34.6	20.3	33.6
BUSINESS MUSIC			
System hardware sales/installation	27.7	28.8	27.6
Sales of tape/cartridge	8.8	11.9	8.6
SCA/Satellite	11.3	13.6	19.8
Music library rental/programming	11.3	5.1	12.1
INTERCONNECT			
Keyphone sales/installation	18.9	20.3	14.7
PBX sales/installation	8.8	11.9	6.9
Hybrid sales/installation	9.4	5.1	9.5
Support & peripheral equipment	11.3	15.3	2.8
OTHER			
Video systems (non-security)	32.7	37.3	33.6
CCTV	39.0	49.0	45.7
Alarm/security/life safety	19.5	25.4	28.4
Sound masking	22.0	20.3	22.4
Teleconferencing	10.7	22.0	16.4
Residential systems	13.8	27.1	22.4

ATTITUDES

	PERCENTAGE	
	1991	1992
VERY POSITIVE	40.7	29.3
POSITIVE	39.0	54.3
NEUTRAL	10.2	10.3
NEGATIVE	5.1	2.6

tioned includes the TEF, Tektronix oscilloscopes and Ivie spectrum analyzers.

A little over a quarter of our respondents want to spend more time with the end user, about the same as last year. Fewer people want to spend more time with the architect, far fewer with the electrical contractor. Yet the average amount of time spent interfacing with the end user now is 44.6 percent of the time. Electrical contractors come in with 14.3 percent of the time, architects with

7.5 percent. The figures for last year were: 49.3 percent of time with end user, 12.4 percent with electrical contractor, and 7.2 percent with architect.

Attitudes towards business as a whole saw far fewer people feeling "very positive," but far more feeling "positive." "Neutral" came in for just about the same number of votes as last year. And "negative," happily, was less negative. (Only 2.6 percent of our respondents feel "negative" about business.) More people with smaller businesses felt very positive. More people with larger businesses felt positive. As with previous surveys, almost no one felt very negative.

Despite the low negative response, when we gave our respondents free rein to "make any comments about the sound and communications industry," they found plenty to complain about. Here is some of what they said:

"Progress is important, but changing models because there is a new grille is not productive. New models should come out when there has been a real technical advance."

"Consultants' specs are often equipment lists and not performance specs."

"Manufacturers, to supposedly gain market share, are being less selective in who they appoint as distributors."

"We need technical assistance with new-type equalizers and wireless systems."

"There is a need to take electrical contractors out of the loop."

"Let's see more high quality coaxial systems developed that work in the 120 Hz range and up, with consistent control."

"Too many players carving up a small market. Just what we need - new builders of modular amps." "Manufacturers should stay out of contracting."

"Exclude the contractor who does not have a contractor license."

And - for our favorite comment: "Listen to contractors." And for our very favorite: "It's great to be here, I guess."

Research assistance for this article was provided by Mark Baard.

Most Important Markets

	PERCENT RESPONDING		
	1989	1990	1991
SOUND REINFORCEMENT			
Commercial sound reinforcement (installed)	60.4	61.0	63.8
Commercial sound reinforcement (portable)	12.6	10.2	16.4
Entertainment sound reinforcement (installed)	21.4	15.3	18.1
Entertainment sound reinforcement (portable)	10.7	5.1	6.9
Sound service (rental & operation)	16.4	22.0	18.1
Pro sound equipment	23.9	11.0	19.8
MI/musical instrument	1.3	1.7	3.4
LOCAL WIRE INTERCOM (Non-telephone)			
Office-to-office	14.5	13.6	13.8
Nurse call	13.8	22.0	12.2
Other Hospital/health care intercom	10.7	10.2	13.8
Factory paging/talk back	22.6	18.6	23.3
Other wired intercom	17.0	10.2	19.8
BUSINESS MUSIC			
System hardware sales/installation	13.8	20.3	17.2
Sales of tape/cartridge	5.7	5.1	3.4
SCA/Satellite	6.9	10.2	13.8
Music library rental/programming	8.2	1.7	6.9
INTERCONNECT			
Keyphone sales/installation	12.6	10.2	7.8
PBX sales/installation	5.0	3.4	2.6
Hybrid sales/installation	5.0	1.7	4.3
Support & peripheral equipment	5.0	5.1	5.2
OTHER			
Video systems (non-security)	14.5	22.0	22.4
CCTV	21.4	27.1	26.7
Alarm/security/life safety	10.7	11.9	21.6
Sound masking	7.5	11.9	9.5
Teleconferencing	3.1	10.2	8.6
Residential systems	5.7	13.6	14.7

If you like what you see, you'll definitely like what you hear. They're the

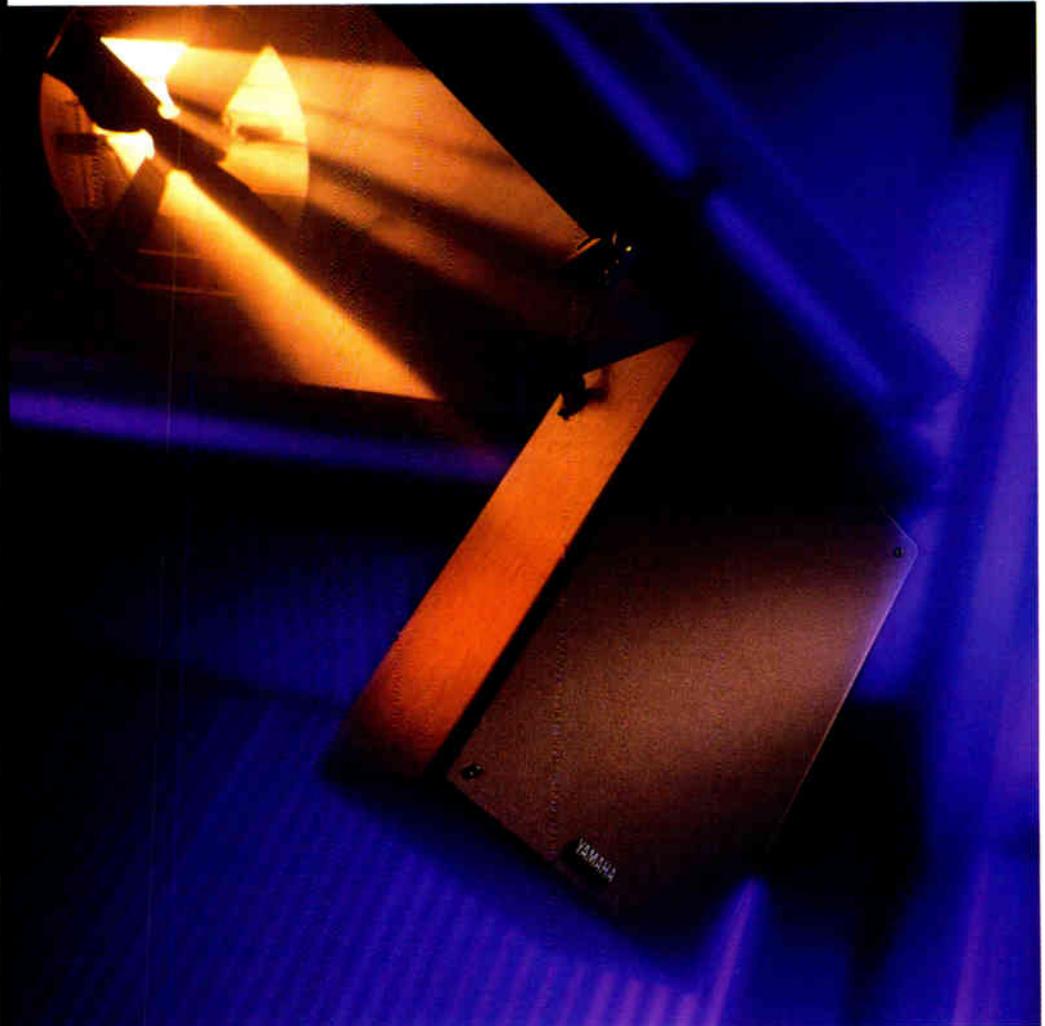
Oak Series speakers from Yamaha.

If you could see the inside, you'd know why the outside deserves to look this good. Their compression drivers have rugged titanium diaphragms and they keep distortion to a minimum, even at high power levels. They have a constant directivity, high frequency horn so dispersion and pattern control is optimized. And whether it's music or speech, you always hear smooth clear sound.

You can choose from front-of-house or stage models. Each available in versions with 10, 12, or 15-inch woofers.

They're the Oak Series speakers. Beautiful sound quality. And just plain beautiful.

Contact your local Yamaha dealer or sound contractor for more information.



When you hear them, they look even better.

The Oak Series[™]
YAMAHA[®]

Optional rigging hardware available from third party suppliers. © 1991 Yamaha Corporation of America, Professional Audio Products, P.O. Box 6600, Buena Park, California 90622-6600

Circle 203 on Reader Response Card

Back to Basics

Everything You Always Wanted To Know About Loudspeakers

BY MIKE KLASCO

Most discussions on loudspeakers relate to systems rather than the nitty gritty of the components. In this article we will take a close look at woofers and cone speakers, compression drivers and horns.

WOOFERS

Almost all commercial sound and pro-audio speakers consist of a motor, cone assembly and frame. The elements of the motor typically include a ferrite ring magnet sandwiched between a back plate and a top plate. A rod of steel is centered inside the ring magnet and the top plate, forming the voice coil gap.

A coil of wire is located in this gap, with a cone attached to one end. A compliant suspension is used to control the movement of the cone. Both the magnetic system and the cone assembly are attached to the frame.

Let's start our examination of the woofer at the cone. Most cones are formed from a stirred and beaten paper pulp that has been mixed with many additives. Pulp fiber length, density,

and secret sauce are factors that separate speaker cones intended for subwoofers, midranges, high efficiency or high output, or somewhere in between. For woofers, the pulp is deposited on a heated perforated metal cone shaped form. The water drains out of the pulp and the dried carcass is then removed from the tool.

For higher efficiency and more extended midrange output, the cone can be pressed on both sides. A lacquer dip was also common on extended range cone speakers, but with CFCs, and the ozone layer, this technique is out of favor with the EPA.

Although many of you may think that speaker companies build cones, in actuality, paper cone companies build speaker cones. If you are a speaker engineer designing a woofer and need a cone, then you probably have catalogs from Rapid Die and Molding (RDM), Hawley, LCC, NewWay, Donel, and Kurt Muller on your desk.

The speaker cone is a critical factor in the sound quality and performance of the speaker. If the cone is straight sided it will be strongest at very low frequencies. You will also probably see ribs molded in the cone body in

subwoofer cones.

For woofers that must have a response that extends into the midrange, a curvilinear cone body shape is common. Cone body weight is important — too light and the cone will distort, that is, produce “cone-cry” at high sound levels or high excursion.

Too heavy and mid-band efficiency will suffer. A recent trend has been toward adding carbon fibers to the pulp, reducing the cone body weight yet retaining high strength. These superior carbon fiber paper cones are a real improvement. They have lower acoustic distortion, extended top end response, and are physically stronger than identical pulp (less the carbon fiber) for the same mass and cone shape. While a decent 15” cone may normally cost \$5, the same item with carbon fiber added to the pulp will cost about \$15 from the same supplier. It is not that the material is so expensive, but it is a pain to work with, being tough on the machines and hard to clean up.

Polypropylene cones are popular in auto sound and hi-fi, as they do not absorb moisture and can have low distortion. Poly's acceptance in pro sound in the past has been limited as it was

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

hard to get strong glue joints and tends to be a little heavier than paper cones, which reduces efficiency. Recent advances in poly primers and adhesives will permit speaker engineers to take advantage of poly's qualities in pro-sound applications.

The big supplier of poly to the speaker industry is PPI/Transilwrap.

The suspension is another key element in the speaker's operation. A foam, or the less common rubber, edge will provide high compliance resulting in an extended bass response. Treated fabric edges are also popular, with the M surround providing good control of the cone, good compliance and low distortion. The larger the diameter of the roll, the greater the excursion. But the downside is that the edge resonance will drop

in frequency. Edge resonance usually shows up as a notch in the response and is caused by a standing wave in the surround. Sound travels up the cone, reaches and excites the surround, and,

The water drains out of the pulp and the dried carcass is then removed from the tool.

especially over a narrow frequency range, some energy reflects back into the cone out of phase. This causes cancellation and results in the notch. Big surrounds have notches lower in frequency than small surrounds — a five-

inch cone speaker may have an edge resonance at 2 kHz, while a woofer may have its edge resonance at 500 Hz. There are various ways a speaker designer may attempt to minimize this problem, including putting damping glop on the surround, using an adhesive between the edge and cone with damping characteristics, selecting a heavier, more highly damped cone that will absorb more of the highs before they reach the cone termination, and so on.

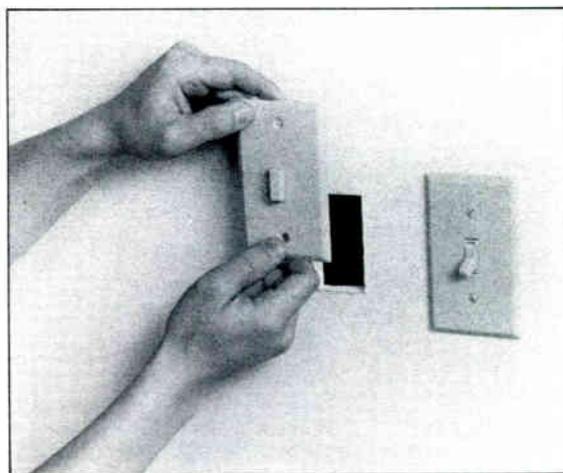
THE SPIDER

The spider or damper is the part of the suspension at the apex of the cone, where it meets the bobbin. This is called the neck joint. The spider is usually made of treated woven linen. Under heat, the spider's contours are formed.

These walls have ears.

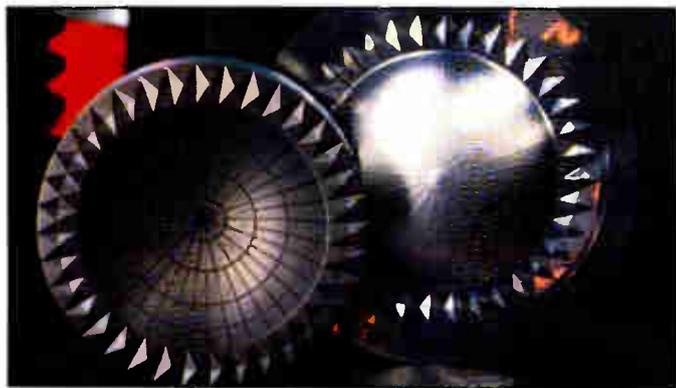
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Titanium dome and surround.

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Loudspeaker assembly.

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The spider is a key element in keeping the voice coil centered.

BASKETS

The frame of the speaker is either stamped steel or cast aluminum. Stamped steel is common on all but the most expensive speakers. The appeal of steel frames to speaker manufacturers is that they are readily available. Tru-Die, U.S. Speaker Basket, Sundstrum, Alden

and others have tooling readily available to bang out all sorts of sizes and shapes, with many options. The gauge of the steel is an important factor in the baskets's strength. Cheap 5-inch midrange speaker baskets might be only 20 gauge, while a typical 12-inch frame is 18 gauge, and a heavy 15-inch frame from Sundstrum is 16 gauge.

Aluminum baskets are associated with professional speakers. Aluminum

baskets are light, strong, and sexy. Another appealing factor is that aluminum, unlike steel, is non-ferrous and does not drain away the magnetic force from the magnetic system (maybe 1/2 dB). Very few sources exist that sell raw cast frames. Most manufacturers that offer cast frame speakers have had to pay for the tooling. The least expensive tooling is for sand castings. For small quantities of speakers this is the most practical

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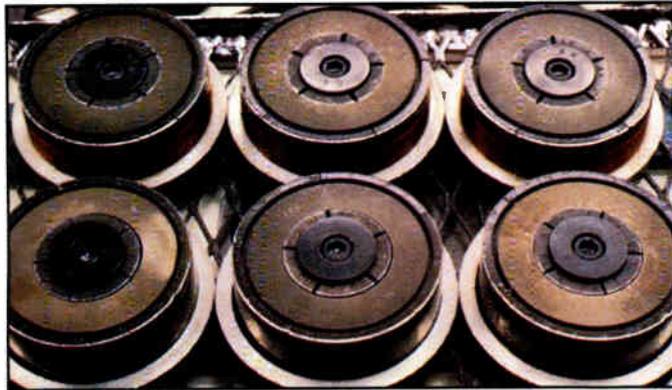
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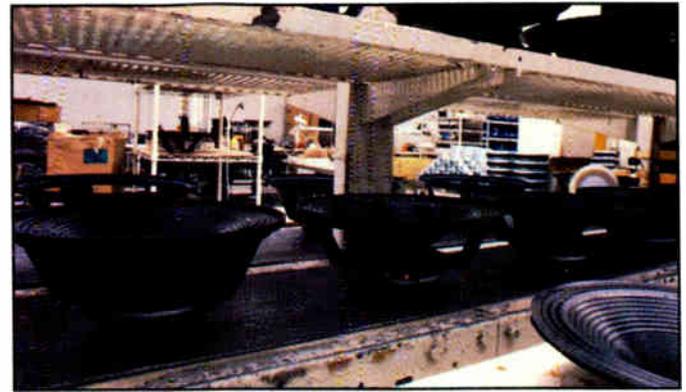
fields. In distance mode, there's even a temperature compensation facility.

What's more, you can save frequently used set-ups in 64 user memories - each storing the settings of every single parameter. And there's no need for security covers - a control lock-out system and password protection prevent unauthorised access.



Voice coils on baking fixtures.

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approach, but a sand cast frame is rough and requires a number of finishing operations, so the final part is more expensive than die casting.

A die cast frame is not unlike a plastic injection mold, but with aluminum. Tooling can cost \$40,000 or more per frame.

THE VOICE COIL

Besides the cone, the voice coil is the most critical element in the speaker. The voice coil assembly consists of a

coil of magnetic wire wound on a former. Magnetic wire may be a conductor of copper, aluminum, copper clad aluminum.

Aluminum is lighter than copper, but copper is stronger. Aluminum is awkward to solder to. Copper clad aluminum has many of the benefits of both types of conductors. The wire may be round or have been flattened and wound on edge.

Edge winding flat wire puts more con-

ductor in the magnet gap and provides slightly higher sensitivity and is typical on the higher grade speakers.

Wire insulation is another consideration. Wire insulations can operate as hot as 200 degrees Celsius to 220 degrees C. Some manufacturers use 180-degree C insulation because it is easier to work with or adheres better to the bobbin. Typically, voice coil wire insulation and glue coatings are B staged thermoset. This means that the adhe-



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World Radio History

sive must be baked or cured to achieve its full strength. Thermosets reach a snapover temperature where they molecularly crosslink. As the temperature rises, thermosets will not melt, but eventually will carbonize—that is, burn. Thermoplastics do not crosslink, and when they heat up, they melt and re-flow.

High performance speakers use 180 C to 220 C class magnet wire insulation. The entire coil assembly is then baked at a slightly higher temperature for approximately a half hour to cure the thermoset adhesives.

The cheapest speakers use a low temperature thermoplastic wire insulation that is not baked or cured at the factory, but instead is cured in the field. The assumption is that as when the speaker is operated, the voice coil will heat up,

and the wire adhesives will cure. This technique is popular today in low grade OEM car speakers.

While some speaker manufacturers wind their own voice coils, most buy coil assemblies from Precession Econowind, Precision Coil, Acousta-Coil, A-Ton, and Krienz.

The voice coil is wound on a former, otherwise called a bobbin. Kraft paper formers were popular 30 years ago, as the paper fibers were an easy material to glue to. As temperature capacity increased, Nomex paper from DuPont was commonly adopted for both cone speakers and compression drivers.

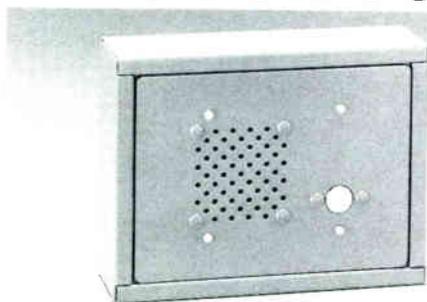
About 20 years ago, speaker manufacturers desperate to reduce coil burn-outs started to turn to aluminum bobbins. Aluminum offered high tempera-

ture operation and thermal conductivity to pull the heat off the coil and transfer the heat to the pole piece. But aluminum also is electrically conductive. This results in high eddy currents, which increase distortion and inductance. The higher inductance drops top end response and creates a self-heating phenomenon in the bobbin. Aluminum is still a common bobbin material.

One of the most common bobbin materials today is DuPont Kapton, a high tech film which is strong, light, free of eddy currents. Recently DuPont has introduced a high performance edition of Kapton called Kapton MTB which is thermally conductive and black for improved heat transfer off the bobbin.

Tweeter bobbins are typically 1-2 mil thick, midranges are 2-3 mil, and woofer

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bobbins are 3-5 mil.

The collar is a strip of Kraft paper, Nomex, or even aluminum that is glued in between the coil stack and the cone. The collar strengthens the coil, helps keep it round, holds the lead wires down, and when the cone ID is too large for the bobbin, the collar can be used as a way to build up the bobbin to the cone so you will have a friction fit (some glues require this).

Getting the heat off the bobbin to the top plate and pole piece is very important. It is not power that burns out speaker coils, it is high temperature on the voice coil. The key to high output operation is to be able to pull heat off the coil. We will take a look at this a little later after we have covered the magnetic system.

MAGNETIC SYSTEM

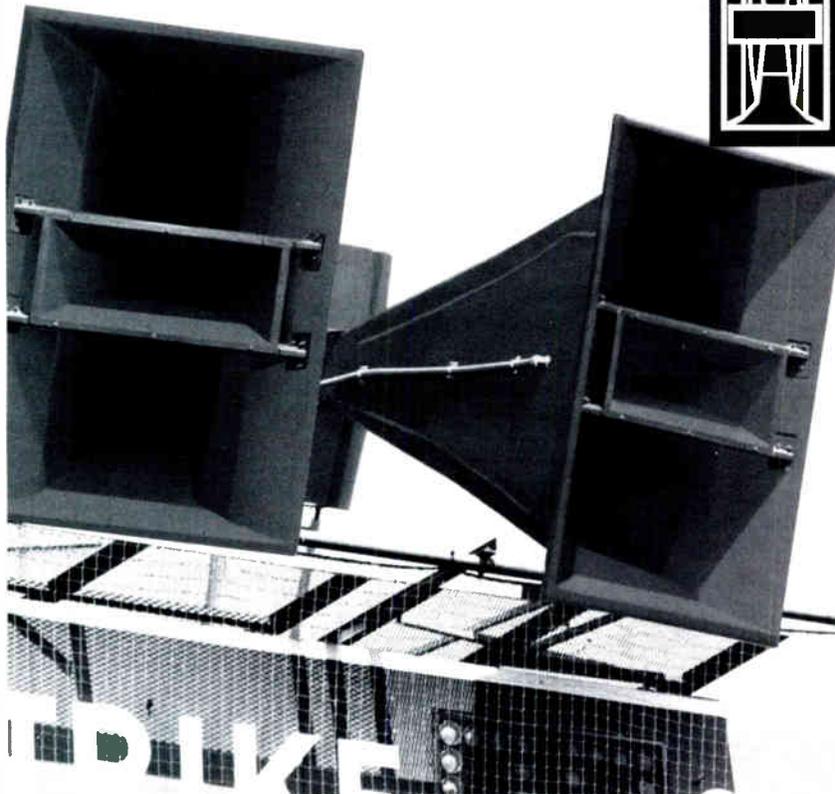
Before WWII, speakers were electro-magnetic, using field coils to create the magnetic field. The power supply of the radio would be used to create an electromagnetic field. But as the first cheap Alnico magnetics became available, it was curtains for the field coil speaker, which as cheaper to fabricate. In the 1950s Alnico was king.

During the late 1960s the supply of Alnico became scarce and eventually the speaker industry switched over to ferrites. Ferrites offered some benefits to Alnico, including less vulnerability to heat, as well as requiring a magnetic system that had higher mass. While speakers got heavier, they also were able to better dissipate the voice coil heat better due to the larger mass and heat sinking due to

the larger surface area of the magnetic system. Early ferrite magnets were dry pressed into their final form. A higher performance process, known as wet press, established itself. Although the tooling costs were higher for magnetic suppliers, wet pressed magnets offered higher energy for the same size and weight magnets. Big suppliers for wet pressed ferrite magnets are General Magnetics, Sumitomo, TDK, and Hitachi.

Aside from the magnet, the magnetic system consists of a steel magnetic circuit. The typical speaker magnetic circuit consists of a donut or washer shaped top plate and a back plate, with the magnet ring sandwiched in between. The top plate and backplate are connected by a pole piece, except that the pole piece is separated by a tiny radial

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gap from the top plate. The magnetic force jumps this gap. Inside the gap is an intense magnetic field. This radial gap is a good place to locate the voice coil.

Sometimes the back plate and pole piece are cold forged as a single piece. A large diameter steel rod is cut into slices. Each slice is placed in a knuckle press, about the size of a room, but four floors high. The disk is then bashed, and by the sheer force of the press, the metal flows and a cold forged back plate/pole piece is formed.

Top plate thickness, chamfering of the tips of the top plate, pole piece shape — such as under cutting the pole piece — will all have significant effects on excursion linearity, distortion, power handling, sensitivity.

Often you will see a hole down the pole

piece. This is for cooling. The dust cap will pump air down the pole piece which will reduce its temperature. But what really must be dealt with is the voice coil

Sometimes the back plate and pole piece are cold forged as a single piece.

temperature. We will take a look at this after we finish up magnetic circuits.

The steel used for magnetic circuits must be soft — that is, have a low carbon content. Japan and Taiwan are main suppliers for low carbon magnetic circuit steel, and big suppliers are Pien Ching and Chainxen. The

mottled gold finish you sometimes see is the cadmium plating, while the black finish is black zinc. Aside from looking better, the black offers better heat emissivity.

Neodymium was first introduced to audio a few years ago by Electro-Voice in a compression driver. Neodymium waspaker industry, as well as Alnico. Neodymium is a very potent magnetic material and promises lighter and more efficient speakers. Different grades exist, but even the lowest grade exceeds the capability of the magnet steel for transferring all the flux. Early formulations were extremely expensive and were too sensitive to temperature, but all aspects of this material have improved. This magnet is popular in auto-sound tweeters, and JBL has introduced

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ASHLY

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a woofer with a Neodymium magnet.

One solution to the thermal resistance between the coil assembly and the magnetic system is to replace the air in the gap with a thermally conductive fluid. Ferrofluids, developed by NASA and licensed to Ferrofluidics Corporation, are magnetic fluids that are thermally conductive. The magnetic fluid is held in the gap by the speaker's intense magnetic field. The thermal resistance of ferrofluids is four times lower than the air it replaces thereby allowing the heat to leave the voice coil. Ferrofluids have other benefits, such as a liquid bearing effect that keeps the coil centered, as well as being a lubricant, so coil rubs are less damaging to the wire insulation. While ferrofluids have been used in speakers for well over a decade, they have only become viable for pro audio applications in the last few years. For example, stable operation at elevated temperatures and woofer grade ferrofluids have only been commercialized during the last two years. Peak power handling of ferrofluid treated woofers typically increases by a factor of five (at frequencies above the excursion limited range). Apogee Sound was one of the first pro-sound speaker companies to use ferrofluids in subwoofers a few years ago. Many auto-sound manufacturers have also introduced ferrofluid-cooled woofers. Quite a few high power speaker manufacturers are now going through testing, and ferrofluid in woofers will be the norm in the next year.

COMPRESSION DRIVERS AND HORNS

Using horns for sound reproduction goes back to the first Victrolas. Early sound systems for movie theaters using compression drivers coupled to horns date back to the 1930s.

The compression driver is essentially a dome tweeter facing a phase plug, although the compression driver actually pre-dates the dome tweeter by 25 years.

Like the woofer, a compression driver has a magnetic system and a voice coil. Instead of a cone, the diaphragm is typically dome shaped. The most popular sized compression driver dia-

phragms are 1.75 inches to two inches in diameter and mount to one-inch diameter horn throats. Also popular are three-inch and four-inch diameter diaphragms and these typically mount to

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two-inch diameter horn throats. Of course there are a number of examples that are larger, smaller, and in between.

The compression driver is the component most sensitive to designs. Very slight changes in just about any specification result in shifts in almost every other performance parameter.

If you want more power handling and switch to heavier wire, you can end up losing a lot of top end response. Open the voice coil gap tolerances a little to improve production yield and you get a big drop in sensitivity as well as loss of top end response. Your domes are punched a little more shallow to reduce tears and rejects and they do not exactly match the contour of the phase plug — and your upper mid-range response droops. Even the cumulative

tolerances of the glue joints of the magnetic system — which affect the spacing between the diaphragm and phase plug — will significantly contribute to production variations in the high end response.

So anyway, what is inside a compression driver, and what is this compression anyway?

The magnetic system in the less costly compression drivers consists of a ferrite ring magnet sandwiched between a top plate and back plate. Often the top plate Internal Diameter, called the pole tips, are tapered. This will focus the flux into a more intense flux field.

Expensive compression drivers often have cast and highly machined steel magnetic systems to attain high flux fields in the gap. While an expensive

woofer might have a flux field of 10,000 or 12,000 gauss in the gap, some compression drivers have 18,000 to 20,000+ gauss. The steel magnetic return circuit generally costs more than the magnet in a compression driver.

As with woofers, very early compression drivers that were used in movie theaters used field coils instead of permanent magnets. By the early 1950s Alnico was universally used in compression drivers. Alnico's high energy made it very attractive for compression drivers, and most transducer engineers were dragged kicking and screaming into using ferrites by the purchasing departments. The resulting ferrite compression drivers of the 1970s were much heavier and larger than the Alnico equivalents they replaced.

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World Radio History

DIAPHRAGMS

The dome or diaphragm traditionally has been either aluminum alloy for extended range or phenolic for high output mid-range applications. Aluminum diaphragms are famous for shattering, and we will take a look at this later. Fancier metals have come into use, including Titanium and Beryllium. Titanium is attractive as it is very rugged and reliable, compared to aluminum. But Titanium is heavier than aluminum, and hard to punch or otherwise form into a dome without tearing. Beryllium is super hard and can result in very extended response. But Beryllium is a dangerous material to work with, especially to machine or even just to solder to, and most manufacturers

(and humans) would rather avoid this substance (good highs or not). Berylliosis is a fatal lung condition, caused by breathing in Beryllium particles.

Cone body weight is important — too light and the cone will distort, that is, produce “cone-cry” at high sound levels or high excursion.

Future diaphragm materials include carbon fiber and Kapton.

Fabrication of diaphragms is consid-

ered an art, and each manufacturer has its trade secrets. Some form the diaphragms under water pressure, others punch the material, or heat and then punch, while a few form the diaphragms by spun metal techniques — using ice cream sticks!

The shape and deepness of the dome is a factor in the sound quality. Drivers known for their superior sound quality have all had deeper domes. If the dome design is too deep, then the reject rate goes up, and if the dome is too deep then rocking becomes a problem. Most classic designs, such as the Altec Lansing 288, had soft aluminum domes that were deep.

The most common size compression driver diaphragm is 1.75 inches diameter with a 1-inch diameter exit. It is not

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The Newsday corporate offices and printing plant are in a large building in Melville, N.Y. It contains the largest color offset operation in the country with ten printing presses. While they operate at the highest efficiency, the collation and inserting operations could not be stopped quickly when problems were encountered. The insert machines could not be turned off resulting in improperly collated newspapers.

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Patrick O'Hanlon, Production Maintenance Electrical General Foreman at the site states, "The area in question is a high density noise area and communication is difficult. When Bernie Lory of Craftsman Sound talked about Soundsphere speakers in airport terminals, I knew it was the system for us. The even distribution allowed us to maintain a volume level that would not be overbearing, to permit quick quality control adjustments in the insert area and to still be heard in remote corners of the room."

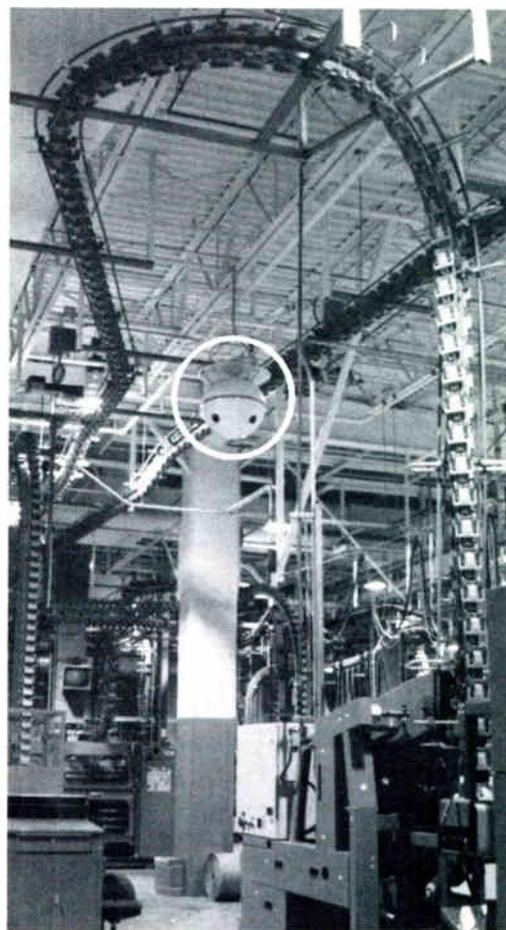
The installer, Bernie Lory has also put two Soundsphere #2212-2 speakers in the stacker area to improve the efficiency of that portion of the operation. He is planning to use more Soundsphere loudspeakers at this site to solve other operational problems.

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so hard to design this size driver with smooth extended top end response, but at high sound levels these drivers have high air distortion. Alternatively, 4-inch diameter compression drivers either have limited or rougher top end response, but can attain higher sound levels and can be used down to a lower crossover frequency. For high output levels, but with high crossover frequency (say 1 kHz and above), the 3-inch diameter diaphragm drivers are a good compromise.

Diagram edge design is another wisdom-and-witchcraft topic. Most drivers once had the compliance molded into the dome material. The edge compliance often took the form of a 1/2 roll, like a woofer. Tangential edges became popular. Some drivers use different materials for the compliance than they use for the dome. Kapton, Mylar, silicon, and other materials have all been used, in some cases with very good results — both in reliability and in performance. One development has been the use of tuning the edge to peak up the top end response.

PHASE PLUGS

The term compression driver can be confusing. Where is this compression? If you look at the phase plug it will become apparent. The phase plug consists of openings that link the sound radiation of the diaphragms to the throat of the horn. Typically, the area of the dome to the phase plug open area is about a 10 to 1 ratio, which is what the compression refers to. There are many similarities between mic input transformers and phase plugs. The higher the ratio (turns ratio, compression ratio), the greater the transformer gain. But distortion always accompanies this gain. And if the compression ratio is not high, it is hard to peak up the top end response of the compression driver. But not all compression driver engineers follow this approach and there are a few that use lower compression

ratios and avoid resonance tuning. Examples are Community's big M4, and their more modest M200, or the U.S.

Sound speakers that were used at the Winter Olympics, or the new Tannoy coax product line. ■



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DATA PROJECTION AND VISUAL INTELLIGIBILITY: PART ONE — BACKGROUND

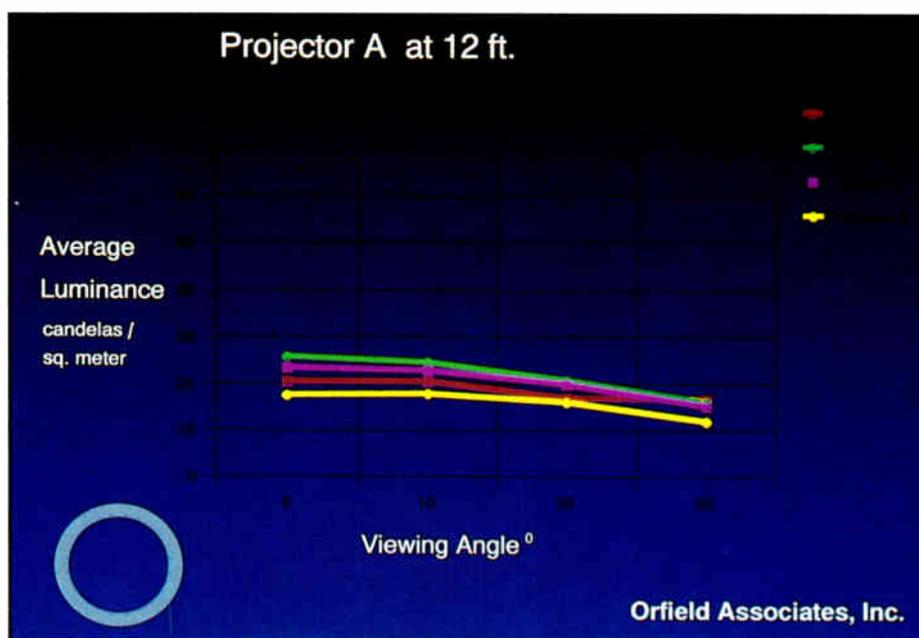
By Steven J. Orfield

Increasingly, the video image is gaining attention due to the leaps in technology within that field. This is particularly true when the video image provides written information by such means as the computer screen or the video teleconference.

While the computer screen is generally regarded as "clear" for reading purposes, other subsets of computer images have achieved far more controversy. Examples of these more questionable images include LCD, EL and other low contrast display types, along with larger format displays such as the data projector. In addition to their current quality levels, all displays are affected by the environment via veiling reflections on the displays which reduce display contrast and provide color shifts.

In the evaluation of computerized displays, it is common to consider descriptions of display technology, display luminance, display contrast and display color. Unfortunately, there is no term in visual evaluation which is parallel to

Steven J. Orfield is the President of Orfield Associates, Inc. in Minneapolis, Minnesota.



Typical Luminance data.

that of intelligibility in the communications field. While descriptions of visual display systems are device dependent, descriptions of audio systems can be user (listener) dependent.

This series of articles is intended to begin a discussion of the need for a new metric in the display field, and "Visual Intelligibility" (VI) is suggested along with an initial definition. VI is intended to be a percentage indicator of change in word and sentence recognition rates presented on a visual display system (VDS).

BACKGROUND

Visibility as a concept in the vision and lighting fields has long been a subject of serious study; there are a number of metrics in current use such as Visibil-

ity Level (VL) and Relative Visual Performance (RVP) (See *Sound & Communications*, February, March 1990).

The principal variables in the consideration of visibility are:

- Task size
- Task contrast and color contrast
- Task luminance
- Speed of task viewing

There are a number of other variables which can be added to this list that are viewer dependent, and these variables change with age:

- Visual acuity
- Relative Contrast Sensitivity
- Luminance Sensitivity
- Transient adaptation

Visibility has generally been experimentally based on the ability of the subject to see a circle with one side open

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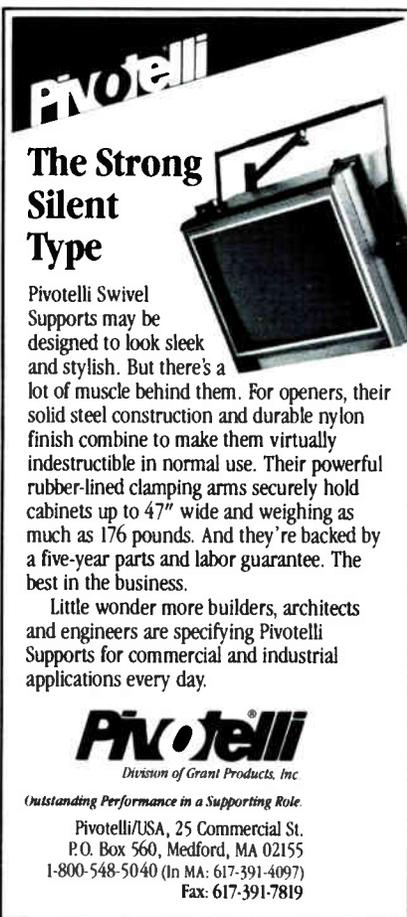
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(termed a "Landolt C"). Thus it is not so much a measure of information transfer as of basic vision process. The VI concept takes into account that information transfer.

In the consideration of VI, other fields and issues are also helpful, and among them are these:

- Screen format design
- Legibility research
- Complexity of information
- Level of comprehension
- Information Theory

The science of screen format design is based on the knowledge that the organization of the information display can significantly affect the resulting visual performance. Legibility or the selection of type style has a similar significant effect. The complexity of the information presented can also significantly affect performance results. Thus, there are many variables involved with the process of using a visual display system, and very few of these are taken into account in the selection of current systems for use. A better metric for evaluation of these variables is clearly needed.

With this in mind, Orfield Associates recently solicited support from the video and rear screen industries for a preliminary study of user-based perceptual performance on rear screen video systems. The purpose of this study was not the evaluation of specific products but rather an initial look at the state of the art with regard to measurable quality variations in video data reproduction for users under given circumstances such as distance, angle of view, etc. with various types of projectors and screens. Thus this study has supported development of both physical and psychophysical measurements. Each of the manufacturers was asked to support this research as a basis for the possible development of a user-based visibility metric. Additionally, it was as-

sumed that these manufacturers would find this first step in perceptual evaluation to be helpful as a partial definition of future research emphasis regarding video quality.

The participants selected for this study for conventional data projection were Sony, the dominant manufacturer in the field, and Barco, who has long had a reputation for projection quality. For LCD projection, Sharp was selected. With regard to rear screens, participants included Da-Lite, Draper and Optixx. (Front surface mirrors were provided by Viratec.) Orfield Associates stipulated to all manufacturers that specific data on individual products would only be given to the respective firms and not

These room pairs established two viewing conditions.

released to the public. (The intent of this study was research rather than product ratings). This group was formed under the description of the Video Visibility Working Group (VWVG).

THE EVALUATION PROCESS

The evaluation process began with the construction of two rear screen rooms, one adjacent to an auditorium and one adjacent to a boardroom. These room pairs established two viewing conditions, the large, wide-angle view and the narrow typical axial teleconferencing view. The rear screen rooms were provided with adjustable front surface glass mirrors of high (94 percent/97 percent) reflectance, and one of the rear screen rooms was built with a door in the rear for non-mirrored direct projection.

Screens were provided in two sizes, custom-framed for the openings of the two rear screen rooms:

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World Radio History

Room	Framed Screen	Nominal Diagonal
Auditorium:	60 1/4" x 78 5/8"	91"
Boardroom:	47 1/2" x 61 5/8"	70"

—The generator for visual signals was a Macintosh IIcx with a Rasterops 264 color board, and a Rasterops Video Expander was used to feed RGB signals to the composite LCD projector. Images

were created within a Persuasion presentation program.

The experimental design was based on objective measurements with a CapCalc video photometer (see *Sound & Communications*, February, March 1990), a Bruel and Kjaer one-third degree luminance photometer, and a jury test with viewers sitting at predefined standard positions. For the objective tests, a set of patterns were developed for measurement with the CapCalc video photometer.

For the subjective tests, alphanumeric (letters) of different types, colors and contrasts were placed randomly on the screen.

During the objective tests, the CapCalc system was set up at the same positions identified for later viewer studies, and multiple images were captured using different screens and projectors for later data reduction and analysis. Some analyses possible were contrast and luminance measurement, RVP (relative visual performance), image contouring and statistical analyses such as histogram images and files.

In addition to these measurements, additional measurements were taken with a Minolta CS-100 Chroma meter to analyze color shift due to screens, angle of view and multiple lens projection.

ACTUAL MEASUREMENTS

These screen types were installed in each of the rooms under test:

Room	Rear Screen Type
Auditorium:	Diffusion Optical - Lenticular & Fresnel
Boardroom:	Diffusion Optical - Lenticular & Fresnel

CapCalc images were taken of each screen with five different images from four positions in the auditorium and nine positions in the boardroom. These images were then analyzed for the following variables:

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But the biggest challenge we threw at our dealer was getting the job completed in one week. He said he could do it. “The Jumbo® Mount is American made and Peerless will ship within 48 hours,” he told us.

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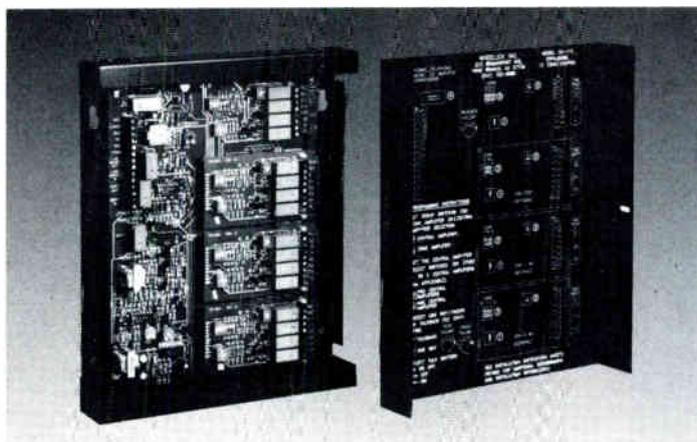
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At your command is a universe of central control, switching and signaling capabilities. Selective zone paging, group zone paging, all call, talk back, background music with mute, and page tone signaling to name just a few. And each time you add a ZEM-3, you add 3 more page zones, one more group page, and one more music input.

Also at your command:

- A built-in talk back control which uses conventional transformer-equipped 25V/70V speakers and horns.
- A built-in preamplifier which transmits a line level, 4 ohm signal for up to 150 amplified speakers and horns, or multiple amplifier inputs.
- Music inputs with music muting during a page.
- Switching up to 150W of audio from a central amplifier's 70V output.

And when it's time to expand or for those larger systems, the sky's the limit! Up to 3 ZEM-3 modules expand the ZC-312 up to 12 zones, 4 zone groups,

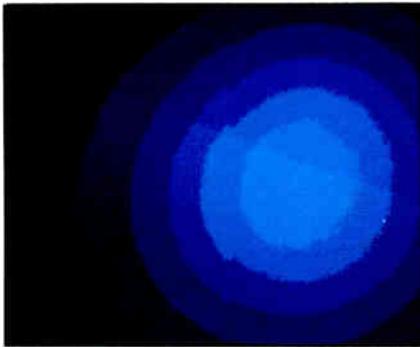
and 4 music inputs. And then you have the flexibility to stack ZC-312's providing up to 144 zones, and 48 zone groups. Because the ZC-312 is modular, you only buy what you need.

Field programmable for a variety of system configurations, the ZC-312 can mix central amplifier (25V/70V) and amplified speaker (line level) paging in the same system. It's compatible with touch-tone, rotary or pulse dial telephones. And hookup is easy, with built-in barriered clamp type screw terminals... so you don't have to be a rocket scientist to install it.

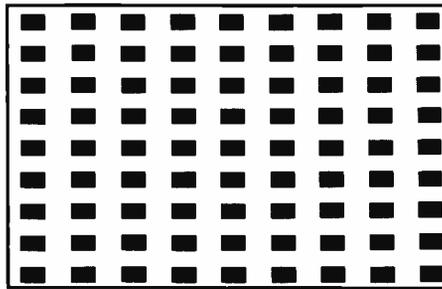
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Luminance contours.



Visual Target.

- luminance
- contrast
- color shift
- veiling reflections

Next, a jury of viewers was assembled, and these viewers were presented the same projector and screen system combinations with alphanumeric image detection and recognition stimuli (letters of varying size, contrast and color) over

VI is very media dependent, suggesting some need for standardization of projected data.

a three week period. This data was then processed directly for the percentage of errors and converted into a Visual Intelligibility Index based on the percentage of correct answers.

The final analysis was the development of a correlation between the objective and the subjective data to determine the validity of specific objective measurements and to assess the initial sen-

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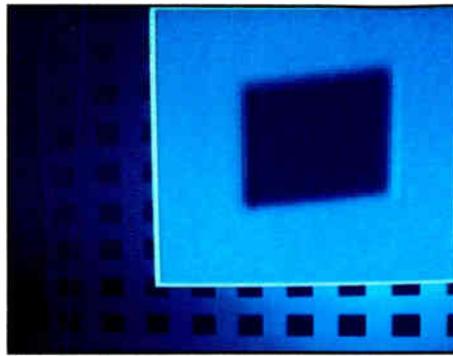
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*Target on
Photometer on the
CapCalc system.*



sitivity of the testing protocol.

A meeting of the Video Visibility Working Group was held in Minneapolis on February 27, 1992, and in attendance were representatives of Sony, Sharp, Da-Lite, Optix and Draper. The Phase I study process was discussed in detail, measurements were demonstrated, and each of the participants experienced the subjective jury testing process as an experimental subject.

SUMMARY

In Part One of this series, it has been our intent to demonstrate the need for

media dependent, suggesting some need for standardization of projected data. It is also noted that specific screens sometimes tend to work better with one projector than another. Overall, the results to date suggest that there is some clear potential for development of better total systems and projection environments. At this time, members of the VVWG are dis-

*Video Visibility
Working Group.*



VVWG test.

consideration of a new standard for subjective video task performance (data) quality. "Video Intelligibility" has been suggested. Some initial findings of our work to date suggest that visibility (VI) is quite distance and viewer position dependent. VI is very

considering potential industry sponsorship and support of additional test development. In our next article, the general results of this first study will be discussed with an eye toward the most interesting findings and potential future directions. ■

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NEWS FROM AROUND THE INDUSTRY

Sound for Mall of America; Consumers for CES

Satellite Music in Malls

3M Sound Products has secured a contract to install 3M's Direct Broadcast Satellite music in the Melvin Simon malls across the United States. The contract includes the Mall of America, which will be the nation's largest covered shopping and entertainment complex. Melvin Simon, one of the largest mall developers in the country, has more than 70 malls currently in operation. Sound Products will provide four Starchannels of music to each Melvin Simon mall via a dish antenna and receiver. The local 3M Sound Products dealer will lease music to each individual business in the mall. The Network also has the capability of delivering audio advertising, electronic mail and business video to each mall.

Summer CES Attracts Consumers

The 1992 International Summer Consumer Electronics Show, held in May, was opened to end users for the first time in its 25-year history, and attracted 98,720 consumers. Trade attendance was 51,850. Total net square footage was 628,698, and there were 984 exhibitors. In the face of sinking trade attendance at previous summer shows, CES was opened to the public to increase awareness of consumer electronic products. According to Gary Shapiro, group vice president of the Electronic Industries Association's Consumer Electronics Group, "The success of this Summer CES bodes well for the 1993 Chicago SCES. Considering that this was a first time event, it went extraordinarily better than we had hoped or imagined." Preliminary research by Sound & Communications showed that there was in fact some positive fallout from the show to sales. Gary Gand of Gand Sound in Chicago reports a flurry of calls immediately following the show from customers who attended CES and were interested in products from such CES exhibitors as Roland and Monster Cable. Gand had personnel manning the Roland booth during the

consumer days of CES (the first two days of the show were opened to the trade only).

CES-TV News, a television news program produced by Testa Communications, found in its roving reporter segments that most adult consumer attendees were most interested in "home theater," and citing that product classification as the reason for coming to the show. Wide-screen television, video games, and Sharp's LCD televisions were other frequently mentioned favorites. The "hit of the show" promotion, however, was probably the RCA booth which had a live Nipper and Nipper puppies with whom one could be photographed. The RCA booth was, predictably, crowded with consumers — who also stood on line to watch 16 x 9 television.

Console at Covenant Church

Rolling Hills Covenant Church in southern California has installed a 40 input Soundcraft Europa console with output matrix as the front of the house console for the church's sanctuary. The board was specified and sold through VJ Electronics of Torrance, California. The church is



Europa console at Rolling Hills Covenant Church.



Summer CES was for the trade only for the first two days, and was then opened to the public.

regularly attended by 2,500 people a week.

New Curriculum at Miami

The University of Miami's College of Engineering and School of Music have formed a new undergraduate curriculum option for students wishing to study audio engineering. The Department of Electrical and Computer Engineering will administer the degree program providing a Bachelor of Science in Electrical Engineering degree with an emphasis in Audio Engineering. The University says this is the first degree program of its kind in the United States. Students enrolled in the Audio Engineering option will have access to two facilities on campus: The Gusman Concert

Hall, which contains a professional recording studio with automated console and multitrack recorder; and the L. Austin Weeks Center for Recording and Performance to be constructed. The new facility will feature a second professional recording studio with a 56 input automated console and multitrack recorder.

Trionics Graduates Dealer Program Training Class

Trionics Corporation has graduated its first Authorized Dealer training class at its headquarters in Miami Lakes, Florida. The course is part of the recently announced Authorized Dealer program in which Trionics has been recruiting alarm dealers in select geographies to directly sell the firm's Infinity product line. The two-day class included programming, hardware training and marketing and sales techniques. The Infinity is a security control product integrating home and business automation, access control, intercom and digitally recorded speech into one programmable unit.

ICIA Book for Moving

The International Communications Industries Association has published "Putting the Move on a Small Business" by Ellis Stackfleth. The book prepares the business owner for all steps needed to plan and execute a move with minimal impact on the business. The book is available from ICIA in Fairfax, Virginia.

Meyer Sound Installations

Meyer Sound has announced several installations using the company's products. The multi-use Kennedy Center's Eisenhower Theater in Washington, D.C. has upgraded its sound system. The theater has a plaster ceiling covered with fabric, so a steel grid work with catwalk was built and installed. The center cluster and support loudspeaker systems are now all flown. The center orchestra cluster consists of three Meyer UPAs hung center, left and right. Outboard left and right are two pairs of UPA speakers for balcony coverage. Two 650 subwoofers are mirrored left and right, and a pair of UM1s are used for effects. Four UM1 monitors are installed on either side of the proscenium and two additional subwoofers in the orchestra pit complete the installation. Additional equipment, according to Meyer, includes a 40-input Soundcraft Europa console and Crown amplification. John Burke of Milon Systems in Alexandria, Virginia, worked with Ken Persson, sound engineer at the Eisenhower Theater, to design the system. Greg Lukens of Washington Pro Audio in Wheaton, Maryland handled sales and service of the installation.

Fiesta Texas, the new \$100 million theme park, has used the Meyer SIM System II in six of the seven theaters on premises. The seven theaters have seating capacities from 600 to 4,000 in the 200-acre theme park. Six of the seven theaters were measured and aligned using the SIM System II.

The Fiftieth Anniversary Memorial Event commemorating the bombing of Pearl Harbor used Meyer speakers to cover a specially constructed venue, as well as for the overflow crowd behind the reserved seating area. Sound director David Scheirman of Concert Sound Consultants worked with Randy Bauske of Baus Engineering. The main event took place in a parking lot in which a portable stage and seating, as well as a canopy cover, had been set up to accommodate 5,000 people. Four 16-foot scaffold towers were erected,

two left and right front and two left and right rear (at about mix position). A broadcast quality wireless link was used between a transmitter at the console and a receiver at the towers several hundred feet away. According to Scheirman, because this was a family event, "we needed to keep sound pressure at very moderate levels." Roger Gans, sound designer for the San Francisco Opera, was brought in as a certified operator of Meyer Sound's SIM acoustical measurements and sound system alignment instrument.

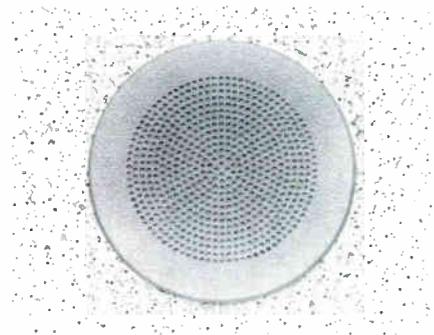
Neotek Additions

Neotek has announced the addition of Joe Hebert as manufacturing director and Mark Smithivas as sales coordinator. Tom Lay, Neotek marketing director, said, "In a matter of weeks, Joe has improved our manufacturing processes. [And] Mark is becoming a master at expediting orders." In addition to new personnel, Neotek has added new distributors. Neotek's distributor for eastern Europe is Centron Slovakia, Ltd. The company's representative in Japan is Nissho Electronics.

Lowell Moves

Lowell Manufacturing Company has built a new factory/warehouse with 100,000 square feet of space. The plant is occupied by a multi-stage thermal system and dry powder coating line that the company says imparts a finish with more depth of color and durability than conventional wet painting methods. New computer driven metal-punching and forming machinery provides close tolerances. Production capacity is expected to increase by half. The plant is located 24 miles from Lowell's former quarters in St. Louis. The address is 100 Ingram Drive, Pacific, Missouri 63069.

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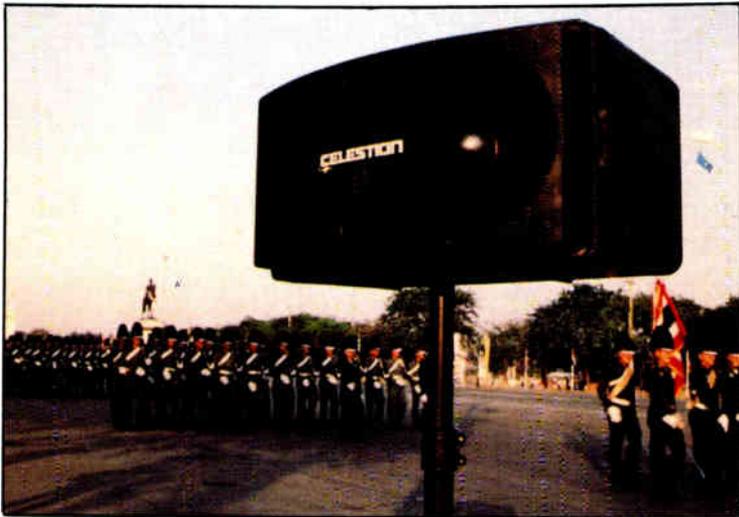
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Royal Guards Parade

Celestion Installations

Thada Research, Celestion International's distributor in Thailand, has completed two installations in Bangkok, one at the Nuclear pub, and one for the Royal Guards Parade. The Nuclear pub has a capacity of 1,500 people and features a total of 16 Celestion SR1 and 10 SR2 sub-bass enclosures with an SRC1 con-

troller. Thada Research has also installed a live keyboard monitoring system. Celestion enclosures were used exclusively for the Royal Guards Parade celebrating the King of Thailand's birthday. Troops dressed in ceremonial uniforms and plumed hats paraded past the King who addressed them over a sound system comprised of 140 SR1 full range cab-

inets installed in batches of eight, mounted on lamp posts around the parade ground. Thada Research says that three general of the country's armed forces will be placing orders of their own after hearing the sound at the ceremony.

REP NEWS American Dynamics Restructures

American Dynamics has restructured its sales representative network. The new network is as follows: R&D Sales Associates for Massachusetts, New Hampshire, Maine, Connecticut, Vermont and Rhode Island; Thomas Corr Associates for New York (excluding Rochester and Buffalo), New Jersey, Delaware, eastern Pennsylvania; Robert St. John and Co. for Maryland, Virginia and Washington D.C.; Murphy & Cota for Georgia, Alabama, central and eastern Tennessee, North and South Carolina; Florida/Caribbean Marketing for Florida and Puerto Rico; R.P. Sloan Associates for Michigan; Keith Parker & Associates for eastern Wisconsin and northern Illinois; LMS Marketing for Ohio, West Virginia, western Pennsylvania and western New York; Bruce Dawson & Associates for Indiana and Kentucky; Capco Associates for Louisiana, Arkansas and Mississippi; Kodo Associates for North and South Dakota, Minnesota and western Wisconsin; Summit Sales & Marketing for Iowa, Kansas, Nebraska, Missouri, and southern Illinois; the Crockett Sales Co. for Oklahoma and Texas (excluding El Paso); Intermountain Marketing for Colorado, Utah, Wyoming, Montana, Idaho, New Mexico and El Paso; Seevid for California, Nevada, Arizona, Hawaii, Washington, Oregon, Alaska. The international representative is Ronald Boes & Associates.

Bag End Rep

Roger Ponto Associates has been named to represent Bag End in the Pacific Northwest, including Washington, Oregon, Idaho, Montana, Alaska and Hawaii. Roger Ponto was with Shure Brothers for over 20 years. The sales effort for Bag End is being spearheaded by Gary Ponto, whose experience includes 10 years as technical director for the Ziegfeld Theater in the MGM Grand Hotel in Reno. In other news, Bag End has added Musik & Sound

of Oldenburg, Germany to its list of distributors.

Symetrix Rep of Year

Symetrix, Inc. has named John Amstadter of JAMM Distributing its Rep of the Year. JAMM handles the Symetrix line for Illinois, Michigan, Minnesota, Kentucky, Wisconsin and Indiana. Cambridge Marketing was also recognized for exceeding its sales quota and was presented with the Symetrix Quoyota Buster award.

Control Cable Appointed

Perma Power has appointed Control Cable Inc. of Baltimore as an authorized distributor for Perma Power's line of power protection products.

EAW Names Reps

Eastern Acoustic Works has appointed First Choice Marketing to represent it in the northwestern United States. "First Choice Marketing will be in charge of contractor/consultant relations, rental company sales and other marketing functions throughout Washington, Oregon, Montana and Alaska," according to EAW vice president of sales Frank Loyko. "They will also handle western Idaho." Tony Tudisco is the founder of First Choice.

Robert Louis Associates has been named by EAW to represent it in Ohio, Kentucky, West Virginia, Indiana and western Pennsylvania.

In other news, EAW has appointed Audium S.R.L. of Milan, Italy its distributor throughout Italy.



Tony Tudisco

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LITERATURE

LCD from ICIA; Crest Health Care

Projection Panel Guide

The International Communications Industries Association (ICIA) has released the LCD Projection Panel Selection Guide.

Written by Joe Hallett, the guide's contents include: applications for LCD projection panels; uses for features that are coming into the marketplace; interpretation of product specifications; hints for selecting, using and troubleshooting these products; and standards for evaluating image quality.

Circle 16 on Reader Response Card

Health Care TV

Crest Electronics, Inc. has released a catalog of health care television equipment and parts. Zenith television receivers (closed-captioned), mounting system equipment and hardware for wall and ceiling in-

stallations, wall arm mounting and various wall plated and accessories are available.

Circle 17 on Reader Response Card
DSP Publishing

Spectrum Signal Processing, Inc. has issued its March 1992 product catalog for single- and multi-processor DSP solutions. The 100-page catalog is the sixth published by Spectrum and contains boards, software and peripherals as well as new products.

Circle 18 on Reader Response Card
Catalog of Catalogs

AMP is offering its "Masterlog" that contains a variety of AMP product and interconnection system catalogs. Product categories include terminals and splices, pin and socket connectors, networking products, fiberoptic products, and coaxial and flat coaxial cable products.

Circle 19 on Reader Response Card

CALENDAR

Upcoming Events

AUGUST

NESDA/ISCET (Nat'l Electronics Sales & Service Dealers Ass'n/Int'l Society of Certified Electronic Technicians): Fort Worth, Texas. Contact: (817) 921-9061. August 3-9.

Image World: Los Angeles, California. Contact: (800) 800-KIPI. August 10-14.

National Hardware Show: Chicago, Illinois. Contact: (203) 964-0000. August 16-19.

International Security Conference (ISC) East: New York, New York. Contact: (708) 390-2436. August 25-27.

SEPTEMBER

Surface Mount Technology: San Jose, California. (800) 223-7126. September 1-3.

Piezoelectric Devices Conference: Kansas City, Missouri. Contact: (202) 457-4930. September 15-17.

Image World: New York, New York. Contact: (800) 800-KIPI. September 21-25.

RF Technology Expo East: Tampa, Florida. Contact: (303) 220-0600. September 22-24.

OCTOBER

Audio Engineering Society (AES): San Francisco, California. Contact: (212) 661-2355. October 1-4.

Custom Electronic Design & Installation Association (CEDIA): Dallas, Texas. Contact: (800) CEDIA-30. October 7-10.

Int'l Business Music Association (IBMA): Ponte Vedra Beach, Florida. Contact (816) 444-3500. October 14-17.

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PRODUCTS

Big Sound, Small Space

By Steve Jacobs



Small Sub

Tannoy has introduced the CPA 5 SB subwoofer. The CPA 5 SB is a passive, bandpass subwoofer designed for use with small, high-powered monitors and measures 21.6 inches x 11.8 inches x 7.8 inches.

The sensitivity of the unit is rated at 93 dB — 1w/1m, while it handles

150 watts of power. When hooked up to satellites the working load impedance is rated at 6 ohms. The frequency response is from 46 Hz — 210 Hz.

Interestingly, home surround entertainment systems (as well as other contractor systems) are mentioned by Tannoy as being an ideal application of the CPA 5 SB.

Circle 1 on Reader Response Card

Home Speaker Expansion

AAMP of America has expanded its home speaker line. Included are an in-wall subwoofer and outside speaker line called Wall Sound.

In addition, the CL3 wire line is available. The AAMP Wire by Stinger includes 16-gauge and 12-gauge (two and four conductor) as well as infrared remote wire and coax cable.

Circle 2 on Reader Response Card



TOA's BA-823 dual-cassette player.

Foreground/Background Dual-Cassette

TOA Electronics has introduced the BA-800 series of dual-cassette players designed for foreground/background music applications. The BA-800, BA-806 and BA-823 each include two auto-reverse cassette player modules and Dolby B noise reduction. For continuous play, each unit can run automatically or can be controlled by an external timer.

The BA-800 is an unpowered dual-cassette player that can be operated in either stereo or mono. The monaural BA-806 is the first of two amplified units within the series. The speaker out terminal has taps for 25- and 70-volt operation. The BA-823 is a stereo version without the taps.

Circle 3 on Reader Response Card



Fiberoptic Transmission

Fiber Options, Inc. has released the Series 123/VDA (Very Diverse Assemblies) System. The system consists of a powered card cage that may be loaded with combinations of video, data and audio fiberoptic transmission modules.

Modules for the system are grouped according to the type of communication. The 1V group covers video transmission products, the 2D covers data transmission and the 3A group covers audio. The 123/VDA System can include modules from each group. Bidirectional and mixed data transmission can also be carried on the system.

Circle 4 on Reader Response Card

Steve Jacobs is the Associate Editor of Sound & Communications.

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Table Mic

TAI Industries, Inc has announced a table microphone for use with the company's audio teleconferencing and voice reinforcement systems. The microphone is built into a black onyx-like base for use in situations where ceiling microphones aren't what the doctor ordered.

The mic uses the table surface as an extension of its boundary for sensitivity purposes and has an integrated 20-foot cable that terminates in a TA3F plug.

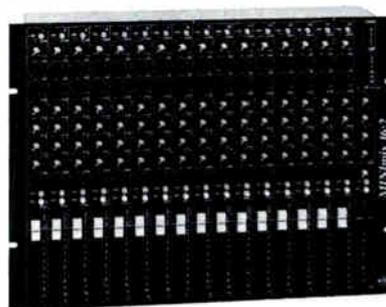
Circle 5 on Reader Response Card



Neon Mic Stand

Konig & Meyer has introduced the KM26080 neon mic stand. The stand is being offered in blue, red, yellow and green. Three different stand sizes are also offered. Konig & Meyer claims a 5000-hour neon tube life for the 26080.

Circle 6 on Reader Response Card



Minimixing

Ross Systems has introduced the Minimix mixing console. The Minimix is a 19-inch rackmountable console with 16 selectable mic line inputs, two bandshaped shelving EQs, four Aux sends, +48V DC phantom power on mic inputs, PFL headphone 'Q', channel mute switch, peak +10 dB headroom indicator and 100 mm channel faders.

Circle 7 on Reader Response Card



Voice Storage and Playback

Wheelock's VoiceLink is a microprocessor-based voice storage and playback system that provides voice reproduction for automatic announcement and voice information systems. Up to 256 messages can be played with contact closure initiation and "hundreds" of additional message files with standard digital data commands through an RS-232 interface can be addressed.

The system is designed for repetitive voice announcing for building evacuations, store sales, machinery shutdown, and transportation shutdown.

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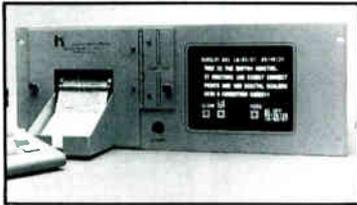
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Circle 263 on Reader Response Card



Alarm Monitors

A series of U.L.-listed, field-programmable alarm monitor/receivers has been introduced by Kelson Corporation. The units interface with other alarm systems equipment — new, old or hybrid — for fire and security requirements.

The Kelson DMP703 and DMP704 alarm monitors handle from less than 100 protected zones to 20,000. The microprocessor-based units allow dealers and installers to prepare the custom database off-line and download it from a diskette to the system's internal microcomputer.

Circle 9 on Reader Response Card



Wireless Systems Control

AMX has introduced the SoftKey transmitter; a programmable, menu-driven wireless systems control. Ten user-defined function keys rest along a backlit vertical LCD display. Each key's task is spelled out by up to two lines of eight-character text on the screen. A menu key returns the user to the primary list of control pages.

Circle 10 on Reader Response Card



Shotgun Tradition

Audio-Technica has introduced the AT835a Condenser Shotgun Microphone. An update of the AT835, the AT835a can be powered from an AA battery or a phantom power source of 9 to 52 volts.

Recommended applications include distant miking and video.

Circle 11 on Reader Response Card



Mic Stand

Quik Lok has introduced the A-300 Microlite tripod boom microphone stand. The A-300 weighs four-1/2 pounds and is made of steel tubing.

The boom arm can be raised to a height of 60 inches while rubber gaskets are designed to keep the 30-inch fixed length boom vibration free and in place.

Circle 14 on Reader Response Card

Automatic Mic Mixer

Altec Lansing has introduced its Model 1684A automatic microphone mixer. The unit comes standard with four channels and can be expanded up to eight channels by adding individual 1681A input modules. Each input channel has mic/line input capability, preamp gain control, line output, logic output, high pass filter, phantom power and automatic or manual operating modes.

Flexibility in sound system design is emphasized by Altec through the unit's two modes of operation. The 'live' mode allows for automatic mixing without gating, while the 'mute' mode is for applications where individual mic attenuation is necessary.

Circle 12 on Reader Response Card



Dimming Module

Crestron has introduced the network dimming module control CLI-120N-4 that is designed for lighting dimming, especially with the Cresnet IIP media control system.

The CLI-120N-4 is a four-channel dimmer module that controls low wattage 120VAC incandescent, low voltage, neon, and cold cathode lighting loads. Each channel is rated to control up to a 1.0 kW load, with a module capacity of up to 1920 watts.

Circle 15 on Reader Response Card



Rubber Necks

Rubber-Neck, a gooseneck from Ac-cetera, Inc. is available with XLR connectors (the X Series) prewired for existing XLR mounts, threaded for podium use (the L Series) with locking XLR and with a hollow center (H Series) with male to female threading.

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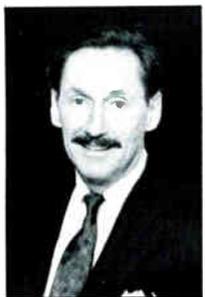
Meyer and Aiphone Marketing

Johnson Promoted

Mark Johnson has been promoted to acting director of sales and marketing at Meyer Sound. Johnson had been responsible for the company's technical marketing, advertising development and placement and technical sales support for the past five years.

In his new position, Johnson is responsible for sales and marketing of the company's line of professional sound reinforcement loudspeaker systems and studio recording products. Additionally, Johnson is overseeing the sales and marketing of Meyer's SIM System II Source Independent Measurement System.

Kohagen at Aiphone



Kohagen

Aiphone Corporation has appointed Stan Kohagen as Marketing Manager. Kohagen is responsible for advertising, publicity, trade shows and literature development for commercial and residential markets. He is also working with Aiphone sales representatives to provide promotional support.

Kohagen has worked with Aiphone as both advertising agency account executive and as in-house marketing manager. Prior to rejoining Aiphone Kohagen had nearly 20 years of experience at advertising agencies

Marketing at MultiLink

MultiLink, Inc. has named Stephen J. Hopkins as senior manager of marketing. Hopkins has more than 15 years of experience in marketing and product management companies such as Xerox, TriTech, Wang, VoiceTek and Burroughs Corporation.

Riebe at B.E.S.T.

Bertagni Electronic Sound Transducers, International Corporation has appointed R. Randal Riebe as the

company's Business Development Specialist.

Riebe's responsibilities include: direct representation and communication with consultants and architects; technical assistance and training for dealers; and new product development.

Riebe joined B.E.S.T. International Corporation after nine years with Ford Audio Video Systems, Inc. where he was Vice President.

Dugdale Joins Acoustical Design

Acoustical Design Group, Inc. has added Dave A. Dugdale to its staff as an associate. His area of expertise is in electroacoustic design. He comes to the acoustical consulting firm from Cofeen Fricke & Associates.



Dugdale

Wolpert at Javelin



Wolpert

Mike Wolpert has joined Javelin Electronics as Vice President, Domestic Sales and Marketing. In this capacity, Wolpert is responsible for overseeing component and systems areas and marketing for North America.

Wolpert has been in the security industry for more than 15 years and has been Vice President of Marketing and Sales for Rusco Electronic Systems, and served in a similar capacity with American Magnetics Corporation.

Burle Appoints Duck

Burle Industries, Inc. has appointed Janet M. Duck to the Employee Relations department as Administrator, Employment and Training for Burle Worldwide Headquarters. In this position, Duck is responsible for hiring, promotions and analysis of training needs. She is also the primary contact for schools, and employment and government agencies dealing with Burle.



Duck

Graven at Salter

The consulting firm of Charles M. Salter Associates, Inc. has announced the appointment of Kenneth W. Graven to the position of Senior Consultant. Graven supports the firm's audio/visual system design services. He has been the project manager for the GSA Federal Building Courtrooms audio/visual design project in Oakland, and for the Hewlett-Packard paging system design project at its Santa Clara campus.

He also coordinates the audio production for acoustical simulations in the Salter Associates' Presentation Studio.

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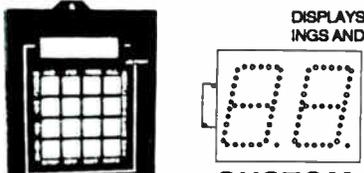
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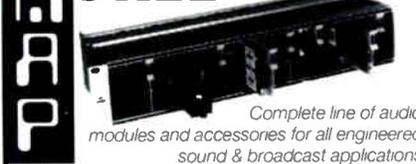
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Amplifiers	ALTEC LANSING	DUKANE/TOA*	CREST
Loudspeakers	ATLAS/SOUNDOOLIER	ALTEC LANSING	DUKANE
Telephone Systems	TOA	AIPHONE	RAULAND-BORG
Intercoms	AIPHONE	TOA	RAULAND-BORG
Alarm Siren Systems	RAULAND-BORG	NOTIFIER	THORN
Access Control	THORN	INTELLIGENT CONTROL INC.	GALAXY

* Indicates tie

SURVEY METHODOLOGY

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

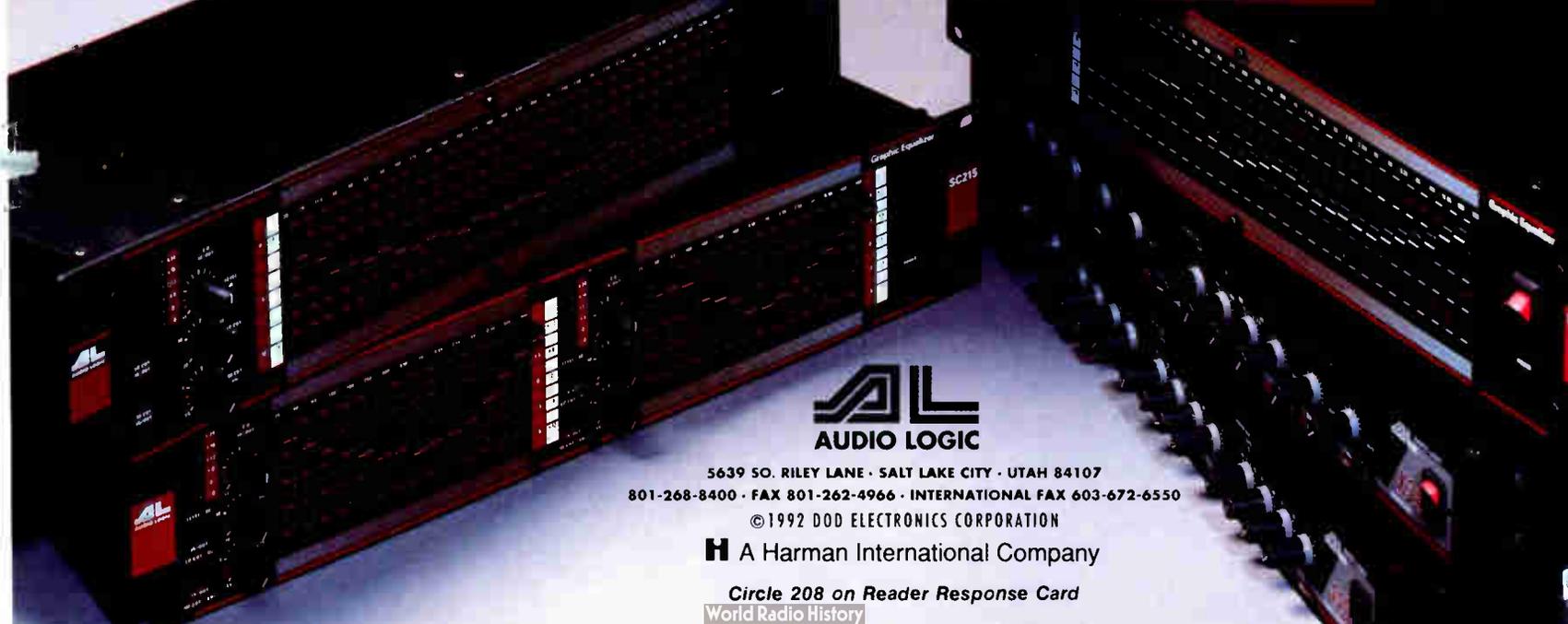
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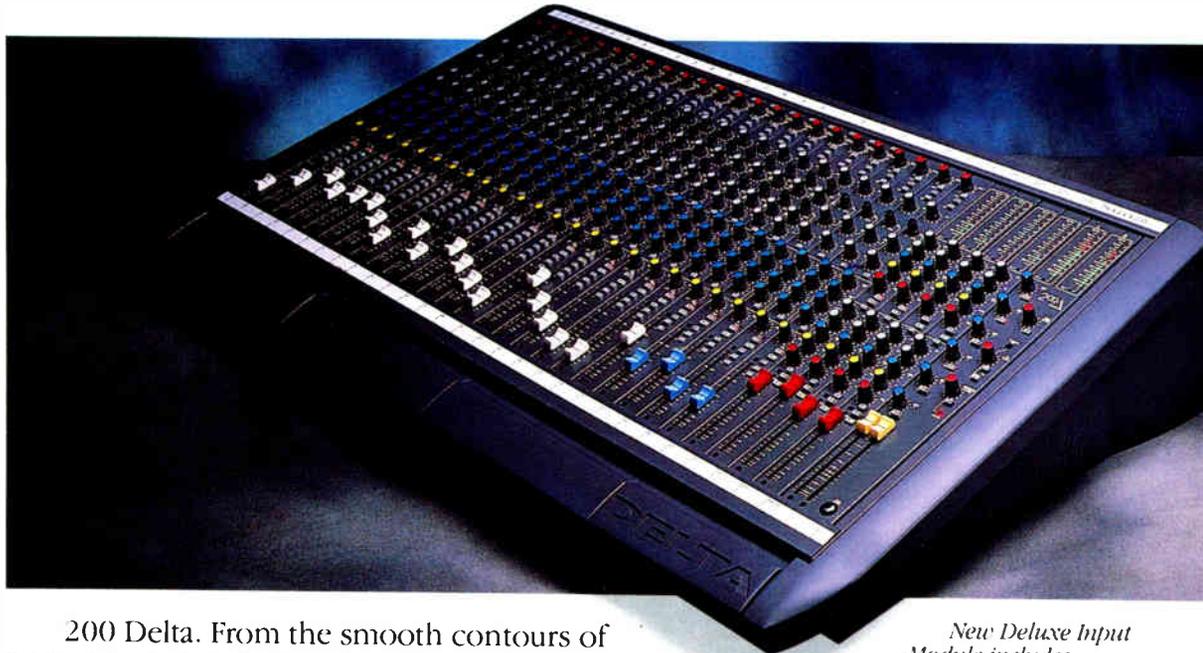


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