

# SOUND & COMMUNICATIONS

Volume 35 Number 11

November 20, 1989

## WIRELESS SYSTEMS

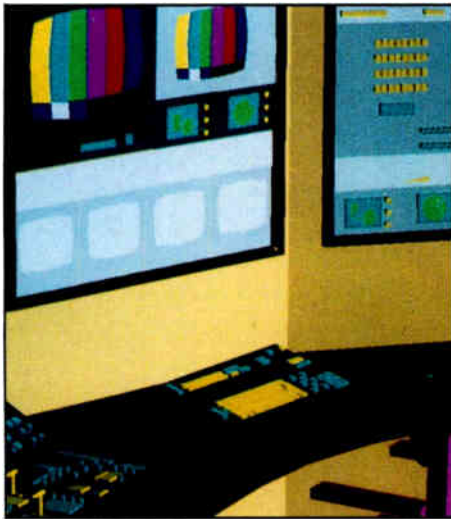
For years wireless had a bad rap. Now things are better, and basics are essential. The best of wireless depends on attention to essentials. New products abound; new interest is widespread. **22**

## DRIVE-THROUGH INTERCOMS

The drive-through communications market is thriving and striving. With fast food saturation approaching, there are still upgrades and innovative new markets. What's the state of the market? We'll tell you. **46**

## ASSISTIVE LISTENING SYSTEMS

The hearing impaired are a special market. Sound design for assistive listening systems requires more than black boxes and headsets. There's a passel of parameters to meet and to consider. Assistive listening and sensible sound design. **38**



## Software Review

What about non-computer aided design? What's the latest in the development of predictive techniques and what should you know. Our software review this month talks about systems you might not have thought of. **56**

## Center For Multiple Performance

A multi-use theater complex was the challenge. Phoenix was the location. The Herberger Theatre the venue. The system required several interrelated installations, a hearing assistance system, and full blown electronics. The center is being used by a varied group of performing arts organizations, and it had to be made fit for all. **40**





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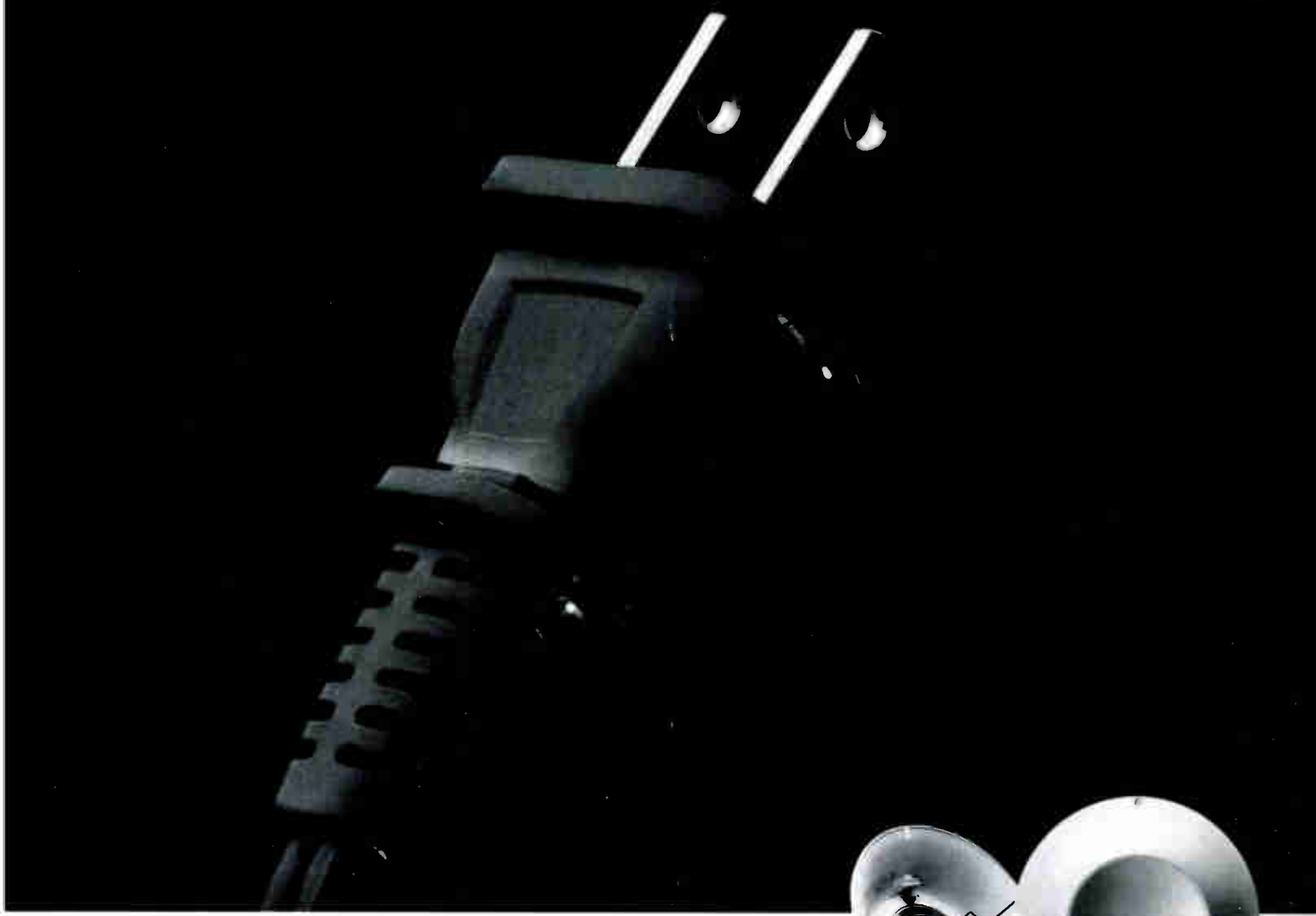
Other high-end wireless microphones may cost more than a Vega, but that doesn't guarantee they'll deliver the performance you paid for.

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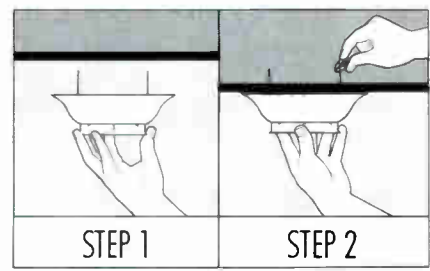


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World Radio History



# LETTER FROM THE EDITOR

At press time, AES and an earthquake had coincided. We're not making a connection, but the quake did unsettle what was otherwise an unshakeable show. There is a large contingent of manufacturers, press people, and show attendees from northern California. And, as the network TV people put it, there's a ripple-stress-factor involved in any disaster, even if it's a continent away from a major industry gathering.

Disasters have been too close these past few months. The earthquake struck while we were still all talking about Hurricane Hugo, the disastrous storm that struck our southern coast. And no one in the path of the storm was immune from its effects, not even the sound contractor, as you'll read in the article in this issue by Evelyn and Buck Perry, who strove mightily to install a paging system in the emergency evacuation center in Charleston, while the emergency work went on around them.

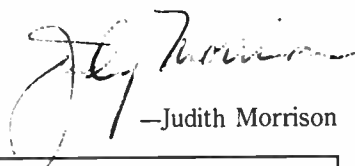
In this issue of Sound & Communications, we also focus on three separate topics that are somewhat related: wireless systems, assistive listening systems, and drive-through communications. Driving all these subjects is the concept of intelligibility, ease of use, and cleanliness of signal and installation. Basic design and clear understanding are the source from which good sound flows.

Good sound was the selling point of any of the booths at the AES convention. Despite the earthquake, despite the torrential rains that were unleashed on New York for the week, and despite the talk of major pieces of equipment stolen from exhibits at the Hilton, the mood was upbeat and the interest was high at the exhibits, the paper presentations, and the field trips sponsored by the AES (Radio City Music Hall, the Botanical Gardens, etc.).

Testa Communications expanded its video presentation of "Crosstalk at AES," a television broadcast of seminars and newsbreaks that was available on televisions in all the convention hotel rooms and on large-screen monitors on the convention floor.

Apparent throughout the exhibit floor was the growth in what can only be called conglomerates in this business. Mark IV Audio exhibited for the first time as the umbrella for Electro-Voice, Altec Lansing, University, Gauss and Ivie (and of course the company has recently acquired Electro-Sound). AKG exhibited at its first AES as the parent of Orban and dbx Professional. This was the first AES for Sound Workshop as a division of Otari. And of course JBL exhibited its JBL products along with its Soundcraft and Urei products. Klark-Teknik showed its wares along with the wares of DDA, Turbosound and other companies which it distributes. Add to this the recent news that Rauland Borg has essentially acquired Biamp, and now Dukane has acquired Poetker Communications, and one meets with the unassailable fact that what was once a small entrepreneurial business has matured and enlarged. One must pay attention to the suppliers who control, in many cases, entire lines that can be had. Soundcraft's new design, by the way, takes into consideration the optimum compatibility with JBL speakers — a tactic that makes business sense for JBL.

At any rate, that's where things stand on deadline. In the next issue of Sound & Communications, we'll present a full wrap-up of the AES convention, and let you know what we saw upon reflection.



—Judith Morrison

## LATE NEWS

At press time, it was learned that Deane Ellsworth Jensen of Jensen Transformers died suddenly in his laboratory in North Hollywood at the age of 47. His family requests that contributions be sent to the Richard C. Heyser Memorial Scholarship Fund, c/o the Audio Engineering Society. Details next month.

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# SOUND COMMUNICATIONS

Publisher/Editorial Director  
**Vincent P. Testa**

Editor-in-Chief  
**Judith Morrison**

Assistant Editors  
**Maria Conforti**  
**Steve Jacobs**

Contributors  
**Tayaniti Durr, Mike Klasco,**  
**Steven J. Orfield, Charles "Buck" Perry,**  
**Evelyn Perry, Suzan Prince**

Technical Council  
**Dr. Mort Altschuler**  
Professor Audiology, Hahnemann University,  
Chief of Audiology, V.A. Hospital, Phila, PA

**Mike Biegel**  
EPD Technology Corporation

**C. Leroy James**  
Rees Associates, Inc.  
**Richard N. Jamieson**  
Jamieson and Associates, Inc.

**Russell Johnson**  
Artec Consultants, Inc.  
**Richard Negus**  
Purcell Noppe Associates, Inc.

**William Parry**  
Maryland Sound Industries, Inc.

**Daniel Queen**  
Daniel Queen Associates

**Jon Sank**  
Cross Country Consultants  
**William R. Thornton**  
Phd, PE

Art Director  
**Gerard Caramannello**

Staff Artists  
**Steven E. Ingram**  
**Germaine Egan Cassidy**  
**Ellen Bader**

Typesetting  
**Leo Ancona**

Circulation Director  
**Robert Evans**

Classified Ad Manager  
**Rich Kobel**

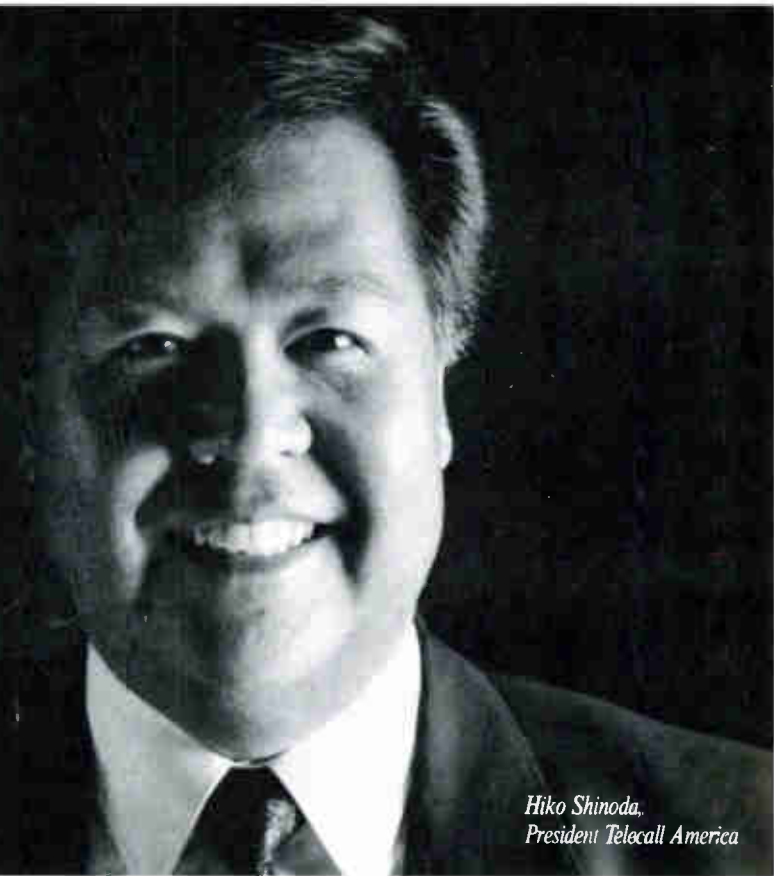
Advertising Director  
**Nancy Davis**

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



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# Why Is This Man Smiling?



Hiko Shinoda,  
President Telecall America

Hiko Shinoda has been a major factor in the U.S. intercom market for 18 years. He knows the industry's many trends and individual desires. He is very aware of the need for immediate response and supply.

So why is he smiling? Mr. Shinoda has just become president of Telecall America. Now he directs the resources of a corporation with 40 years of experience designing and manufacturing intercom systems.

Telecall is leading the intercom industry with new products such as the three on this page. They are also renowned the world over for their consistently prompt customer response.

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Telecall's TD Video Entry Security System gives you exactly what its name says—security. The door station has an MOS chip camera which prevents ghost images and flare on the monitor's 5" LCD black & white screen. The monitor has an alarm built-in which can be connected to various types of sensors. Communication is through the handset-type intercom. This system is complete as it stands; but, you can also add the optional security sensor panel which allows monitoring of fire, gas and burglary.



Telecall's MN-70 built-in micro-processor system gives you the ability to know who is calling with its digital display feature. Other features include hands-free reply, group paging, all call and conference call. With three communication channels, there is very little chance of a busy line, even at the system's maximum of 70 units.

Telecall's MF-20 System is a micro-processor based system, without the costly expense of a CEU, it's built-in. The MF-20 demonstrates its versatility with functions such as All-Call, Conference Call and Door Station Communication. The system can be expanded with single line telephone interconnect, and can be integrated into our TD Video Entry System.

Circle 212 on Reader Response Card

World Radio History

# AKG's C 562. The Mic That's Out of Sight.

Take its size. Just over 6 inches wide, and only  $\frac{1}{4}$  inch thin, this pre-polarized, condenser, boundary layer mic looks nothing like a mic. So it tends to disappear into the background. On the floor at the stage apron, on a wall, on a ceiling at a conference— or wherever you don't want a mic showing, you need a C 562.

How does it sound? Amazingly natural...high SPL capability, low rumble and wind noise and no disturbing comb filter effects. It's hemispherical polar pattern is designed to pick up sound with incredible presence for a mic that's practically invisible.

And its ultra-widefrequency response doesn't miss a nuance. When all you need to "see" is the sound— all you need to use is the C 562.



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## FEATURES



40

### 22 Special Section: Wireless Technology

Today, the sound contracting industry wouldn't exist without wireless. A tutorial by some of those involved in wireless installations.

### 38 Hearing Assistance

*By Steven J. Orfield*

The phenomenon of hearing loss and language understanding. A discussion of some of the relevant concepts in this area.

### 40 Installation in Phoenix

*By Tayaniti Durr*

An intimate, modern, theater designed for plays and dance, The Herberger Theater Center is spearheading a cultural rebirth in Phoenix.

### 46 Thriving Drive-Thru

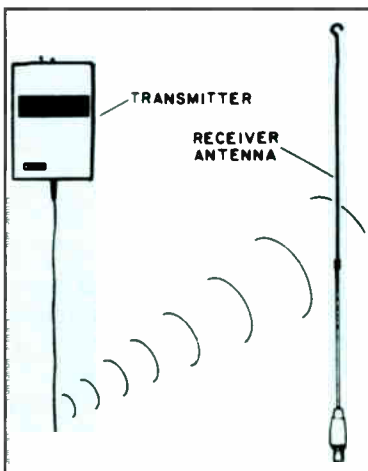
*By Suzan Prince*

Business is booming in the drive-through segment — and it isn't just fast food anymore.

### 56 Software Review

*By Mike Klasco*

A look at the choices for preparing the mechanical design and working drawings of the speaker cluster.



22

## COLUMNS

- 4 Letter from the Editor
- 12 Sales & Marketing
- 17 First Person: Hurricane Sound  
*By Evelyn & Charles "Buck" Perry*
- 44 Book Review  
*By Steven J. Orfield*
- 68 30 Years Ago  
*By Steve Jacobs*

## DEPARTMENTS

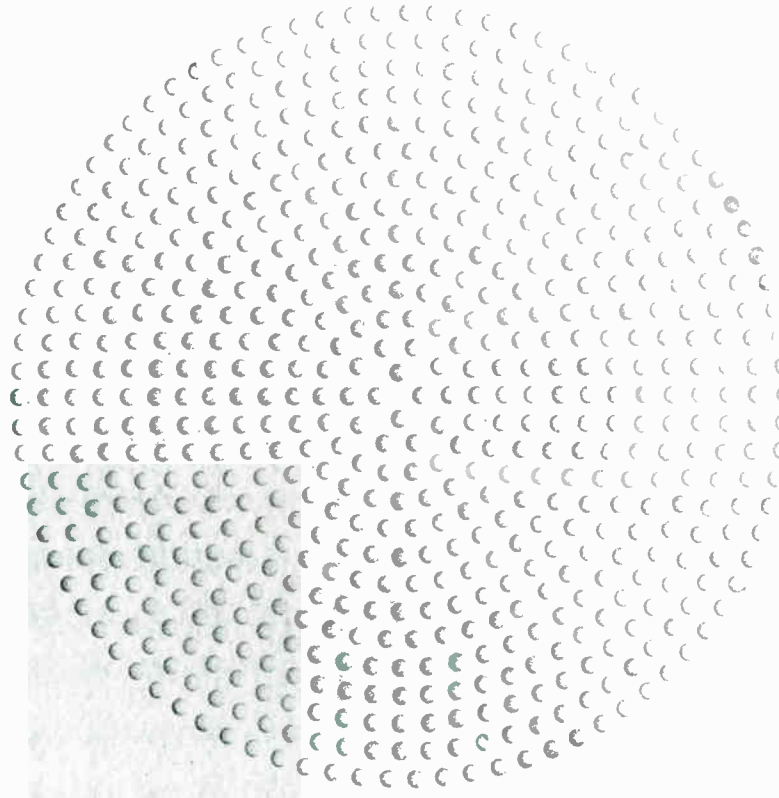
- 9 Newsletter
- 62 Update
  - News of the Industry 62
  - Products 64
  - Literature 66
  - People 67
  - Calendar 68
- 68 Ad Index
- 69 Marketplace

# SOUND COMMUNICATIONS

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Annual Economic Survey — Nightclub Sound — Foreground Video — AES Wrap-up —  
... and much, much more.

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**Call today for your free copy of the Quam Commercial Sound Catalog and Tech Spec 33 on the new BR8-10WS unobtrusive baffles.**

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# NEWSLETTER

## **NEW LEASING PROGRAM**

JBL Professional has implemented a major leasing program for its products, with terms up to 60 months. The program, available to end users, can provide 100 percent financing at "very competitive" interest rates for JBL, UREI, Soundcraft and Seck products.

## **INFO EXCHANGE**

The Virtual Array Technology Association has been formed, made up of dealers, installers and users of EAW's Virtual Array System, and is dedicated to providing information on installation, rentals and design; and to promoting standardization of ancillary components.

## **OTARI JOINS IN JOINT DEVELOPMENT**

Otari and DigiDesign have signed a letter of agreement to jointly develop a disk-based audio recorder/editing system to be marketed exclusively by Otari.

## **EIGHT-TRACK 20-BIT BY YAMAHA**

Yamaha has developed the DMR8X digital multi-track mixer/recorder, an 8-track 20-bit digital recorder, 24-bit digital mixer, time-code/locator, and automated mixing system integrated into one desktop-sized unit. The unit can be operated with up to two companion digital recording units, so that it becomes a 24-track system.

## **DIGITAL ANNIVERSARY SAYS MITSUBISHI**

The tenth anniversary of digital recording was celebrated by Mitsubishi, who in 1979 first showed a prototype of a digital professional recorder at the AES convention that year.

## **NEW WORKSHOPS PLANNED**

Syn-Aud-Con is preparing a workshop on speech intelligibility, with some major participants soon to be announced. Also in the wings for Syn-Aud-Con is a workshop with panelists from the major touring sound companies.

## **DUKANE MAKES ACQUISITION**

Dukane has acquired Poetker Communications Limited, the Canadian manufacturer of communications products for the institutional market. Steven Deppe, General Manager of the Communications Systems Division of Dukane, has management responsibility for the acquisition. Deppe and Bernie Poetker, Chairman of the Board and President of Poetker, both indicated that the agreement will enhance the positions of both companies.

## **MESSAGE ON HOLD**

Over 95 Muzak dealers have signed agreements to become dealers for Interludes Productions Corporation, a division of Audiocom, Inc. Interludes provides customized messages-on-hold programming to be sold by participating Muzak dealers as a result of an exclusive distribution agreement reached between Interludes and the International Planned Music Association, which is made up of Muzak dealers. Under the agreement, Interludes provides services including copywriting, voice talents, production, playback equipment, and marketing and sales support.

# NEWSLETTER

## **DIGITAL MICROPHONE**

Ariel Corporation has introduced the model DM-N digital microphone using two Motorola 56ADC chips and "proprietary technology" according to the company. The initial version of the microphone works exclusively with the NeXT computer System, "turning the system into a digital recording device for voice recognition, music and data acquisition applications." The microphone captures stereo analog signals and digitally encodes them for analysis, modification and storage on a disk. It's produced in a hand-held black aluminum casing. Ariel Corporation was founded in 1982. Among its principals is President Anthony Agnello who was previously vice president of engineering for Eventide.

## **WORLD WIDE GETS LINE**

Gauss Loudspeakers has appointed World Wide Electronics of Fort Lauderdale its representative in Florida for Gauss Loudspeakers. Bob Gale and Dick Havill, owners of World Wide Electronics, have been in the pro sound industry for over 15 years. Paul V. Hugo, national sales manager of Gauss Loudspeakers, said the appointment of World Wide "strengthens the Gauss commitment in a very important market."

## **INTERSONICS REPS**

Intersonics has announced their "newly aligned representative network" to handle field sales of the company's ServoDrive subwoofers. Reps include: Sigmet Corporation, Audio Marketing, Innovative Sales and Marketing, Rep Tech, Ludwig Marketing, Sherwood Associates, New England Technical, Innovative Audio Sales, Professional Sound & Lighting, World Wide Electronics, R.J. Throckmorton/Centurion, and El Rep Sales. Intersonics' foreign representation is handled by Preh Electronics.

## **FRAZIER REPS**

In rep news: Frazier has announced the appointment of Lowery Associates to represent the company in eastern and southeastern Pennsylvania, Delaware, southern New Jersey, Virginia, and Maryland. Personnel include William Sylvester, Charles Samual, Don Bretherick, David Diehl, Donna Ploppert and Mary Kay Kenney.

## **EDS SHOW IN APRIL**

Space applications have been processed for the 1990 Electronic Distribution Show and Conference (EDS '90) to be held April 23 through April 26, 1990 at the Las Vegas Hilton Hotel.

## **NYNEX — PEIRCE-PHELPS AGREEMENT**

Nynex Computer Services and Peirce-Phelps have reached an agreement to have Nynex resell Peirce-Phelps' video conferencing room and modular video conferencing products and services. Under the one-year agreement, Nynex will integrate Peirce-Phelps products and services into its own video conferencing product, The Nynex Conference Connection, to develop customized, turnkey video conferencing systems.

## **TEF DONATED TO COLUMBIA**

Techron has donated six TEF System 12 Plus audio analyzers to Columbia University's new four-year bachelor of arts program in sound engineering. Reflecting a retail value of over \$70,000, the units are on loan to the university to provide a hands-on opportunity for advanced sound engineering students.

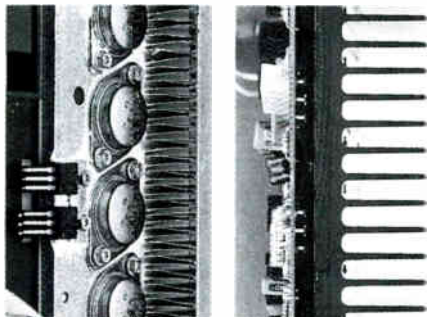


# Warning: To Avoid Risk Of Shock,

## Ignore This Amp-To-Amp Confrontation.

**L**et's be frank. We're out to change your idea of what — and who — makes a professional power amplifier. So if you just bought a Crown MacroTech, turn the page — this comparison won't be a polite one. But it will stick to the facts.

A look inside these two amps will give you a better idea of why BGW amps like the GTB Grand Touring Amplifier are built like no others in the world. And raise some questions about Crown MacroTechs.



**Left:** The MacroTech uses mostly air to dissipate heat, not metal. The closely spaced fins are vulnerable to airborne dust and dirt.

**Right:** BGW uses ten pounds of aluminum to absorb thermal transients, extending power transistor life.

### TAKING THE HEAT

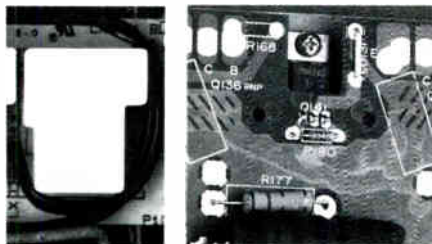
If the MacroTech heat exchanger reminds you of an air conditioner, you've grasped its design. This approach works, at least until dust and dirt clog the fins. But as soon as the air flow slows or stops, temperature rises. Soon after that, the Crown shuts off — it could even fail.

The GTB uses massive extruded aluminum heat sinks with widely spaced fins. The

mass of metal absorbs thermal transients without straining the fan. And without quick changes in transistor temperature. That's important: Transient musical loads put the worst kind of stress on power transistors. The effects of thermal cycling fatigue may not show up until after the warranty, but they can destroy lesser amps. Meanwhile, BGWs keep right on delivering clean, reliable power.

### REAL SPEAKER PROTECTION

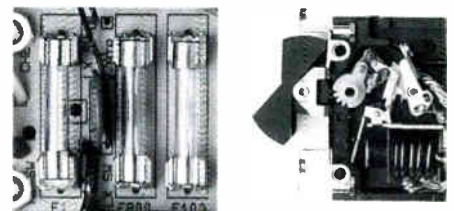
Most amps today are direct coupled, so a blown output transistor (the most common failure) connects the power supply directly to the speakers. Earlier MacroTechs had no protection against DC. Now Crown has learned their lesson — or have they? The sensing circuit and relay they now use shuts off the power transformer, but allows the filter capacitors to discharge stored DC energy directly into your drivers — risking real damage.



**Left:** Crown uses a slow-acting, less reliable relay. It can allow the filter capacitors to discharge stored energy directly into your drivers.

**Right:** BGW's modular power output section protects your speakers against DC damage with an instantaneous Thyristor Crow Bar. And the module is easily replaced in the unlikely event of failure.

BGW pioneered DC speaker protection in 1971. We stopped using relays years ago, when they no longer met our reliability standards for BGW amps. The GTB, like all BGWs over 200 Watts, uses solid-state Thyristor Crow Bars to keep DC from ever reaching your valuable speaker cones or compression drivers.



**Left:** Time is money, and with Crown's MacroTech you can lose plenty of both: You have to pull it out of the rack every time a fuse blows.

**Right:** The GTB's power switch is also a rock-actuated magnetic circuit breaker. You can reset it in a second if power lines hiccup.

### MAKE YOUR OWN COMPARISON

Before you buy or spec your next power amp, call us at 800-468-AMPS (213-973-8090 in CA). We'll send you tech info on BGW amps and the name of your nearest dealer: He can arrange a demo of any BGW model against any amp you choose. Then you'll be able to appreciate the advantages of BGW engineering with your ears, as well as your eyes.



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## Expanding Into New Markets, Part 2

**A**t the National Sound and Communications Expo in May, *Sound & Communications* magazine sponsored a seminar on "New Markets for Sound Contractors." Participants were Tim Newcomb of Newcomb Electronics; Chris Stevens from Audio Access; Bob Toerner of America Sound; Bob Rein from Acromedia; and Bill Ray of William Ray Associated. The moderator was Judith Morrison of *Sound & Communications*. This is part two of our edited transcript.

**MORRISON:** If you want to expand into a market, how do you get the job? If it's a disco, if it's DBS, if it's something brand new, how do you get yourself known? How do you get the contacts? How does it work?

**REIM:** Well, we subscribe to the philosophy that you crawl before you walk, you walk before you run. Basically, our company has built on strength. And we start from something that we know very well and we take the next logical step.

We started in the pro sound business and then went into schools and then into audio visual work and then went into professional video and then to full motion audio video teleconferencing, into security. And yet each of those entities are separate businesses within our company. Each one is separately cost accountable.

If you don't have a modern computer based cost accounting system, you're not going to know where you are. We look at our runs every week, every month and every quarter and obviously yearly.

Given a new area of business, give it enough time. If it makes money, that's what you want. If it doesn't make

money, go onto something else. Cut your losses short. As the years have gone on, we have made up a series of distinct separate divisions. Each one is autonomous, yet we use a centralized group of functions. And, we have been able to systematically expand step by step by step.

Each year we all get together. We go off-site, we spend a few days away from those telephones and all those other screaming problems that face you. And we say, "What are we going to do this year? Are we going to expand? Are we going to stay where we are?"

Each year we come up with a business plan, and probably most years we'll hit 90 percent to 95 percent of what our business plan is projected to be. And the absolute mother's milk of the whole thing is money. You cannot outstrip your cashflow. You have to go into your new markets carefully. Build up. And once they're running, you'll want something else.

**MORRISON:** Would you agree that a new market has to be somewhat connected to what you're doing now?

**REIM:** That's the way we do it. A lot of people do a tremendous variety of things. We don't. We stay within a certain envelope and again we build on strength. We have an engineering department, a purchasing department, and all these other functions. And if they're used to buying speakers and microphones, and tomorrow they're going to have to buy concrete and steel — it's a whole new ballgame.

**MORRISON:** How about labor? Can you find the people that you need to work in this new area?

**TOERNER:** Installers don't seem to be as much of a problem for us as is

finding the right salesperson. My brother and I, who run the business, go round and round about it. He has a tendency to hang onto salespeople who are probably never going to perform. And I'm more prone to cut the cord sooner and quicker. If you've been in the sales business you can kind of get a good idea whether this person is going to cut it or not. You've spent half a day with someone making calls. You get a feel for how progressive he is, whether he wants to knock off at 3 or 4 in the afternoon to go meet a friend or have a beer, what his work habits are, what time he gets to work, how well organized he is and things like that. So, for us installers are very, very easy to come by. They are all trainable. They like the business, and they're fairly easy to get into it. It's the salespeople that we really have a problem with. Getting in, training them, finding them accountable and then cutting the cord if we know they're not going to make it.

**MORRISON:** I have a question about residential work. As many of you may know, the EIA has been working on a home automation standard. And I wonder how it now affects and how it will affect residential work being done, where all the components begin to talk to each other and the furnace at one time. Will it affect commercial work at all? Chris you've been active in this whole home bus automation thing.

**STEVENS:** The whole CEbus format is actually a very noteworthy step forward for this idea of an automated home, whereby, as you say, the audio and video equipment will talk to each other regardless of brand. But it will also talk to the appliances, to the



energy management systems, to the lighting control systems, the security systems, the telephone and intercom systems. So this will all be on one network. It looks like the CEbus standard is really going to bring two things. It's not only going to bring a standard which in and of itself provides a tremendous amount of value; the standard is also a very technically competent standard. So that you can really do something with it once you have it.

For a lot of the commercial contractors, residential is a new frontier. For those who are already doing residential work, the frontier becomes home automation. Who knows what that's going to be like.

I think the notion of selling service is a key issue in all this and has been stated already.

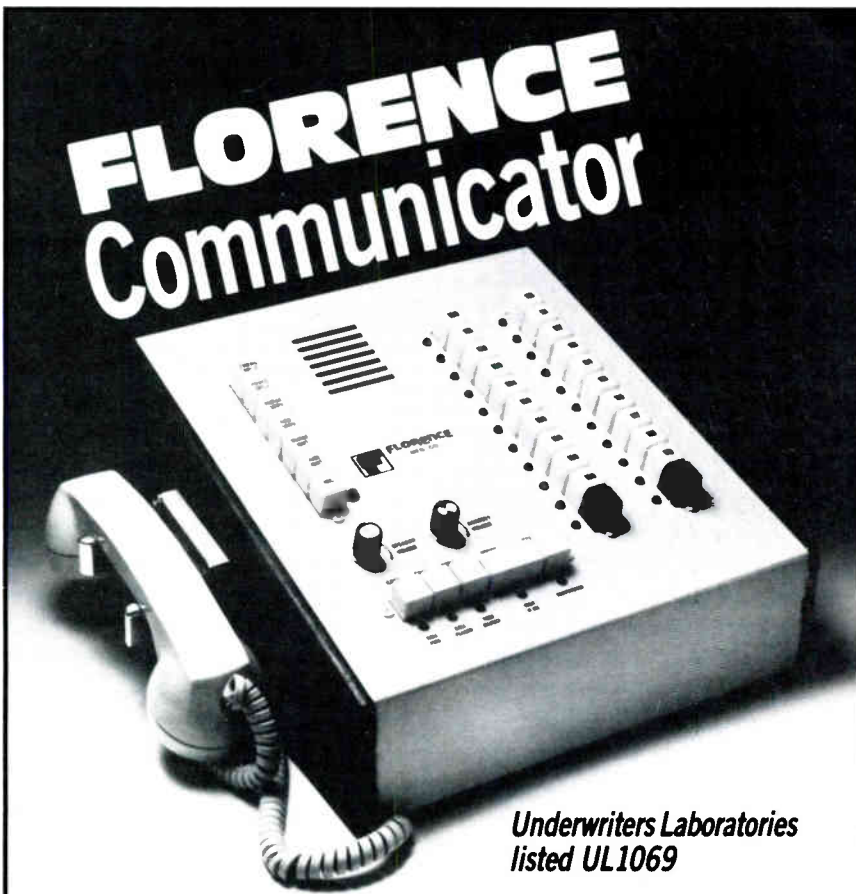
Dealing with your strengths is very, very important. With our sound contracting firm we have noticed that we have gotten a lot of jobs because we're not involved in all of the things that there are to be involved in. In the future, there'll be the general contractor, who deals with the nuts and the bolts and the nails, boards, glass, and plaster and that sort of thing. And then there'll be the other guy who deals with all of the electrical functions within the home, all the automation and communication, low voltage, and will be like a general contractor as well.

I would caution that until there really is a structure within which you can approach that whole home automation market, that it's really a bit early for it to be profitable. If you've got lots of time and money and you're prepared to throw it into that black hole, then it's great and you'll buy something in the process. I wouldn't think it would be worth-while. But you'd have to be clear that it would be an investment at this point in time. I wouldn't expect it to pay off for another several years. But that is something that will develop a significant market.

**NEWCOMB:** For those who aren't

familiar with the CE Bus, that's a method by which all consumer products and maybe some non-consumer products, will communicate with each other. It represents some really signifi-

cant opportunities for some of us because now we have to select the right devices, and we need some way to coordinate those in some intelligent fashion. It's a tremendous opportuni-



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ty, because every item that you're going to buy for your home — be it a toaster, microwave oven, telephone, or doorbell, will all be able to communicate via this pathway of information. It creates tremendous opportunity for us.

It will be pretty all-encompassing. We're talking about something that should be able to be incorporated in a unit for anywhere from less than a dollar to maybe three to five dollars — for all the communication capacity within a device. So we're talking about being broadly available in products and devices throughout the home. It also presents some opportunities for manufacturers and for everyone as a contractor, as well. When you have an open standard like that, how do you compete within an open architecture?

How do you compete when someone isn't locked into *your* format, *your* protocol? And the same thing has been mentioned before for everyone from a contractor's perspective. You can't make it based upon the exclusivity of the product lines that you have. You have to be able to make it based upon the services that you're rendering to whoever your constituency happens to be. And I would argue that this is a service business. What the job is — back and forth between you and your clients — is providing that service, whatever the service of that particular niche of the business happens to be. That's where it remains profitable.

**MORRISON:** Video was mentioned before, teleconferencing. Bill, do you have any video projection lines?

**RAY:** JBL or Harman more accurately, is involved in that. And multimedia may be a better way of going about this. It is becoming increasingly important. Video is related to computer terminals, which is related to other things. And there's getting to be little or no separation. There's another opportunity in here for contractors. Typically, video has come from a broadcast oriented video vendor or an audio visual house, and audio visual houses seem to specialize in overhead projec-

tors or 35mm film. None of these people really have all the elements to tie it together, and audio is still just as important as ever. Typically, because of the development of video, with a narrow bandwidth type of audio attached to it, prior to the advent of dbx Zenith stereo TV, audio didn't have much impact in video. Today, that's no longer true. Audio is a very important part of video. Corporate tapes that have horrendous noise are simply not acceptable, and at one time they were the norm. So as a sound contractor, when you're talking about video related installations, that could be the corporate meeting room I was talking about, and a number of other applications.

There are opportunities that could exist out there; and that could be an audio visual or a true video broadcast supplier who simply doesn't know where to turn for his audio needs. All of a sudden he has a customer who wants quality audio, and I can't tell you as a rep how often I get these calls. I can also not tell you, and I know you know this, I can not educate a guy who has little or no background in audio (although he may be an expert in video broadcast) in an hour on a telephone so that he can do a corporate meeting room. It just can't be done. It takes the life-long experience that you people can offer, and we do a lot of referring — and we try to convince them right up front — look, audio is just as complex as your video, believe or not. And you're going to need to get an expert in there if you want it done right.

I'm sure many of you have done automated mixers and so on, and understand the complexities that you get into to, especially in larger corporate meeting rooms. Quite often the people who end up with that corporate media meeting room are not sound contractors with audio experience. It will more often than not end up being a video or video broadcast oriented vendor, and he desperately needs to help with the sound. There are opportunities probably in every major city

and a lot of smaller cities for a contractor to work in conjunction with a guy who has more multi-media experience in video.

**MORRISON:** Bob, you do corporate boardrooms . . .

**REIM:** Our AV department handles a lot of those operations. I'd like to touch on a couple of other ways we have found work for us. One of them is what we call joining forces. Our advantage is that we are a relatively large company, reasonably well financed. We have a large bonding. More often than not, someone will call us and say, "look, we have a great job in our city here, but I can't bond it and I can't finance it," and so on and so forth. So, we join forces. We go into a joint venture program and we supply what we can do well and they supply what they can do well. And when each of us is working at a very competitive level and we have one plus one, it doesn't come to two; more often it comes out three. In that respect, we have been able to bounce all over the country, for that matter, all over the world. We have systems operating in 14 different countries around the world, and in 90 percent of the cases we have a joint venture arrangement. It works well. Both companies benefit. We both make a reasonable profit as a result of it. That's another way to do business.

**MORRISON:** Thank you. I'd like now to give each of the panelists a couple of minutes to sum up or bring up anything that hasn't been said. Why don't we start with Tim.

**NEWCOMB:** I don't know what more I can say that I haven't said already other than one of the primary services that we're offering the customers, be it commercial sound, be it residential, be it the computer cabling side of our business, is to take standard products and make them do something unusual. Sometimes that means just a new way to hook them up, a new wrinkle, maybe a different concept that we sell to our customer.

*(continued on page 50)*



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## Hurricane Sound: Improvising in the midst of Emergency

by Evelyn and Charles "Buck" Perry

**H**urricane Hugo struck Charleston, South Carolina, late Thursday night, September 21. The eye of the storm, causing the worst of the damage, hit at high tide at 1 AM Friday morning, bringing thousands of tornadoes.

Until Thursday morning, the highest winds had been estimated to be 105 miles per hour. The last forecasts before the TV stations went off the air indicated winds of about 140 miles per hour. That made Hugo a category 4 storm — a real killer.

Like most other Charleston businesses, Carolina Sound Communications had closed up, boarded up the windows, and sent all employees home on Wednesday afternoon. Most of us left town looking for safe refuge. We looked like Noah's ark leaving town with our two Siberian Huskies, the cat and the cockatiel in the service truck. We evacuated to Santee, South Carolina, one hour north of Charleston where only 25 tornadoes hit. We pictured 1000 Muzak antennas blowing to China with satellite dishes, like Frisbees, not far behind.

Friday morning was bright and sunny, giving no hint of the destruction created by what is now referred to as the worst storm ever to hit the continental United States. The hotel was without power, phones or water for the rest of our three-day stay. We bathed in the swimming pool and carried water back to the room to flush the commode.

On Monday morning, we returned to the office to see what was left. We had not been able to contact any of our

employees because those telephones which were still functioning had been jammed since just after the storm. We had taken one company truck filled with emergency living supplies to Santee. The others had gone home with our employees. There was no telling what condition they were in now. Thousands of cars and trucks were covered by fallen trees.

The office, like all of Charleston and most of South Carolina, was without power. We lit candles and used flashlights to find that the office and warehouse had taken only light water damage.

At 9:30 AM the phone rang. A voice on the other line asked if we installed

paging systems. We were delighted to find that there was a customer left in South Carolina. Charleston was like a ghost town, with the National Guard on most street corners. The woman on the phone had a warehouse about 5000 square feet. The design had to have a switching system allowing them to turn five zones on or off as needed.

"Sure," we said. She asked if we could install it immediately. She wanted it in service by the end of the day.

We explained that we had no available personnel, and were not even sure that we could find them. In addition, all local businesses were closed, even gasoline stations since the pumps needed electricity to function.



*Overview of the EOC portion of the warehouse, with the old speaker system and wall baffles showing.*



Anything that could be done would have to be done with what equipment we had on the shelf and by Buck alone with available truck fuel.

"O.K., can we have it by tonight?"

Asked why the urgency, she explained that the call was from the

---

**"A paging system  
was critically  
important to the  
Emergency Center."**

---

Charleston County Emergency Operations Center (EOC) serving as the heart and brain of the recovery from damage

done by Hugo. They could not operate without the ability to communicate, and a paging system was critically important to them.

We said that we could do it. Buck went to survey the building, while Evelyn set out to find our employees, trucks and equipment.

Trying to find the woman who requested the system was no small job. The warehouse was absolutely packed with equipment and personnel. Voting machines, normally stored at the facility, were moved to form corridors and open offices for the variety of personnel actually working the emergency. The entire west side of the building was devoted to radio and television organizations. ABC, NBC and CNN and several regional and local news bureaus were set up and operating in



*The new horns show above the post in the warehouse.*

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full force. A full television studio was in operation in one open corner. The rear of the main warehouse was stacked with food and food service workers. The Salvation Army was running a full feeding operation for those working the emergency.

The rear of the building was partitioned off into sleeping areas for the county jail inmates who were assisting in loading and unloading trucks. Four offices in the front of the building were taken over as a message center, quarters for amateur radio operators running emergency communications services, and a meeting room for emergency coordination. All of the offices were in an area where heavy roof

Circle 267 on Reader Response Card

damage was sustained, resulting in severely damaged ceilings and some dripping water even three days after the storm had passed. Continuing rain did not help the situation.

Dennis Clark, the Emergency Operations Coordinator, explained what he needed. The paging system was to be fairly simple. The main area was to be constantly in service, as was the parking lot. The other areas each had to be on a switch, so that if paging was not needed or desired, Clark could cut any area off. Two microphones were to be provided, one in the message center, and one at Clark's desk.

Installation was not to be so simple. All personnel had to wear emergency badges for identification. No ongoing emergency work could be interrupted. Work had to stop for televised press conferences and for announcements by Charleston, State and Federal officials.

Add to that the limitations of working only with what you have on hand, and the need to have it quickly installed, and to not be able to move any furnishings or people, and the challenge becomes obvious. Under the stress of the emergency efforts, tempers were also becoming short, and careful diplomacy had to be used before each task was undertaken.

Horns were the obvious choice for outdoor paging and for the warehouse. They were also chosen for the offices since the condition of the roof was not known, and we wanted them to work even if water came into the building during rains expected following Hugo.

Ironically, the amplifier chosen was a Hacoustic 1075 recently received for test and evaluation. A Bud chassis ordered long ago for some project never brought to fruition became the switch box, and we found six DPDT toggle switches in our offices. We had recently purchased a number of Aiphone horns for stock. We were better prepared than we had thought.

Evelyn, in the meantime, had located Billy Smith, one of our newer installers. His mobile home had no power and was damaged, and he was attempting to put plastic sheets on his roof before the predicted rains came. His service vehicle had not been damaged, so he could be in within an hour of getting the protection on his roof. Our son David joined Buck and Billy that afternoon.

With Clark, Buck decided that the most important area was the large warehouse, and tackled that first. Extension ladders were required to reach overhead areas where we could run the wiring. Each time they were moved and set up, people had to be informed that they would have to move and that the extension of the ladder would

*(continued on page 51)*

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# WIRELESS BASICS: FIRST PRINCIPLES

*The more you know, the more you need to know. At least, that's the way it's been throughout the years of wireless technology. Beginning as a sometime thing, the notion of wireless with its convenience overcame the technical obstacles to become, today, an integral part of the consideration of any sound system. But there's way more to learn, and always things to be reminded of in doing any job. There's obviously an interest out there. Seminars are common, with the NSCA convention and Infocomm both promoting seminars on wireless technology. And HME is sponsoring a series of seminars around the country (they started in October). With different systems going, different technologies coexisting, and compatibility concerns in multiple systems, wireless is a subject of moment. As Bruce Jones of Lectrosonics says, the successful installers of wireless systems know how to properly choose and install a system for the particular applications; know how to handle drop-out and interference; know how to match the system with the budget and with the criteria. And Ralph Belgique of Comtek says a good installer or specifier needs to determine up front whether RF or infrared or any other method is the method of choice. "RF is cheaper, easier, and has more range. But performing arts venues may have more problems with outside interference and have more money to spend, so they many need infrared, even with its need for strategic placement. In a difficult market, we as manufacturers try to make it easy and have flexibility."*

*We present here some basics, some thoughts from some of the folks engaged in wireless installation — because the sound and communications industry doesn't exist today without wireless.*

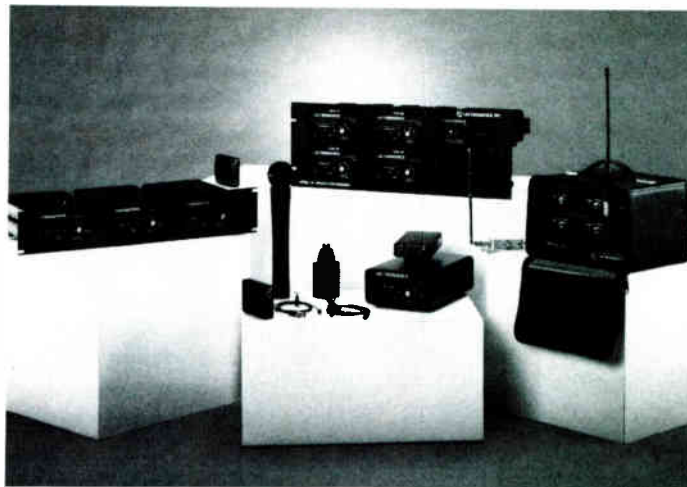
—Editor

## FIRST CHECK

**W**ireless microphones are used in theaters, churches, the entertainment industry, the lecture circuit and other public sectors. Although advancements have been made by the manufacturers of wireless microphones, proper use of the radio microphone has not changed.

One of the important decisions in their use is the choice of frequency. Ultra high frequency (UHF) is available and has been very successful in eliminating common problems associated with radio frequency (RF) pollution. With most setups, using very high frequency (VHF) wireless microphones (170-216 MHz), makes it hard to determine if the frequency will be compatible with another user.

Traveling users of wireless have learned the hard way. After spending money on a VHF system, they encounter many prob-



*Lectrosonics full line.*

lems when moving into another city. The solution for many users is the use of the UHF range.

Broadcasters also have made the move from the VHF to UHF range. They often have many frequencies operating in one area, and news crews gathering information from various places for broadcast cannot afford to have the wireless microphone system fail. More chief engineers are asking for a UHF system to insure they get the best performance. For many, the VHF range is fine. However, in an overloaded RF environment, the choice of UHF may be the recommended solution.

Receiving antennas are a great concern when using wireless microphone systems. The antennas, as the ears of the radio receiver, must be properly placed for the receiver to work according to the manufacturers specifications. With diversity reception, the user must have proper distance between the two antennas. In the UHF system, the transmit frequency is very small, so the antennas may be used close together for diversity reception. But when VHF systems are used, the antennas must be located several feet from one another. It would be a poor choice to use both antennas on the receiver; the consequences could be disastrous. It's best to remote one antenna 17 feet from the receiver antenna. When rack mounting your receiver, be sure the antenna isn't locked up inside the rack. Always make sure the receiver antenna has line-of-sight to the transmitting antenna. One must remember to keep antenna cables short whenever possible. Use RG8U cable for VHF systems when over 20 feet in length, and use RG213 for UHF systems. It is better to use a long audio cable with a balanced line than to use a long RF cable run.



When multiple wireless microphone systems are used together, their compatibility is another area of concern. A compatibility program is used to determine if intermodulation of the RF signals (two or more RF frequencies combined together to produce another frequency) will cause poor audio quality. This can be caused by other RF microphones or even local TV stations. Selection of frequencies is just as important as is the correct product. The wireless system's design plays a large part in minimizing intermodulation problems. Helical filters in the front end and the IF circuit of the receiver are very effective in reducing intermodulation problems. Metal housing for both transmitters and receivers is excellent in minimizing intermodulation problems, as well as a highly selective output stage in the transmitter. A narrow band keeps interference to a minimum. Likewise, antennas on a diversity receiver and the antennas in the distribution systems must be placed a distance from one another. They are usually separated by a 1/2 wave length (3-5 ft), but ideally 4-5 wave lengths (20 ft) is best. In the case of antennas and frequency coordination, proper attention to detail by both manufacturer and end users can go a long way to making use of RF microphones a smooth operation.

Since batteries are a must when using a wireless system, please use a good quality battery. If your transmitter does not

have a DC-DC converter in its design, RF power will drop, causing rapid short range and a distorted RF and audio signal. Transmitters with DC-DC will keep a constant output power from the time they are turned on until the batteries are almost dead. Another advantage of DC-DC voltage conversion is that frequency deviation remains stable. Also, distortion will not increase as the battery voltage diminishes. Battery life has a direct effect on RF output power and in systems using 9 volt batteries. As battery voltage decreases so will RF power. This will be important in performances that are excess of three hours.

There are always important factors to consider when determining which wireless microphone system best suits the needs. It's a major economical investment that requires knowledge.

—Al Zang  
Sennheiser

## MULTIPLE SYSTEMS

Opportunities for using wireless microphones are on the increase. Almost as frequent as the need for one wireless microphone system is the need for multiple systems. And problems with multiple wireless systems can be prevented.

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anywhere — with a prudent choice of operating frequencies. If you are free to use TV frequencies, you can confidently increase to six or eight systems. With planning and experience, 16 systems will perform well; more than 16 is more difficult and heavy dealer/manufacturer assistance is highly recommended.

The first step is to understand the application and specify equipment accordingly. You may need to specify wireless hand-helds or body-pacs or a combination of them. Clergymen or game referees may want a body-pac to allow freedom of hand movement. A performer or sports event narrator/interviewer may want a handheld for flexibility or to have the high-tech, wireless look. There are choices to be made at the receiving end also. A “clean” installation always looks better and somehow seems to work more reliably. Use of an antenna distribution unit, allowing two antennas to feed four diversity receivers, eliminates the usual clutter of six antennas and cables. A power distribution unit supplying power to many receivers also makes a cleaner installation. Rack mounting all this receive end equipment is usually in order.

Although there are, of course, many high quality, reasonably

priced wireless systems on the market today not all of them perform as well when many are used simultaneously. Get information on the equipment from the manufacturer in regard to multiple wireless system usage. Specifications pertinent to multiple system usage are antenna distribution output port isolation, transmitter spurious signal output, receiver local oscillator radia-



*Vega Ranger T-99A Wireless Hand-Held Transmitter.*

tion and receiver front end and IF bandwidth.

Use the manufacturer to specify operating frequencies, or use frequencies known to work well for that specific model. Frequency selection is the single most critical and complex task in successful multiple wireless operation.

There are many issues that affect frequency selection, some determined by the model of the equipment. Frequency selection is partly experience, partly science. A computer program to do the extensive arithmetic is mandatory, but interpretation of the computer output is also required. That interpretation requires some experience with the equipment make and model, some insight into RF equipment design and some firsthand application experience.

Equipment installation should be prioritized by performance and appearance. Place the antennas at least three feet from metal objects. Place the two antennas from a diversity receiver/antenna distribution unit at least three feet from each other. The receive antennas should be as close as they can be to the transmitter but not closer than 20 feet. You will do yourself a favor by making the wireless transmit/receiver coax path as short as is practical.

Keep the equipment and cables away from sources of electrical interference as much as possible (e.g., motors, generators, light dimmers). Keep the receive antennas line-of-sight to the transmitters.

You should thoroughly check out the equipment upon final installation. Successfully performing a complete checkout will virtually assure freedom from problems caused by multiple wireless systems operating simultaneously.

As with other sorts of interference, “multiple system” interference can be nonexistent, mild or severe. With only a few systems, it should be nonexistent. As the number of systems grows, some compromises are invariably made.

A frequently forced compromise is that of “frequency intermodulation.” Intermodulation symptoms include whistles and hearing a transmitter’s audio on a receiver other than its “companion.” Often this interference exists but it is so mild that it is never even noticed.

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the offending transmitters within inches of one another or within feet of the affected receiver's antenna. However, unless this is typical equipment placement and if the system's passed the checkout procedure, you can feel comfortable that the equipment will perform satisfactory.

If you know some of the transmitters will be used close to one another, advise the manufacturer of this. He can tell you which frequencies to use in close proximity to minimize the effects of signal intermodulation.

It's wise to perform an on-site system checkout at the time of day of the equipment usage. Occasionally, local interference may vary by time of day. This isn't common but nevertheless, it is a good insurance policy to perform this check. It is always advisable to leave transmitters turned on while the receivers are on. The transmit signal will "capture" the receiver, minimizing the effect of interference.

With large systems, other steps can solve possible problems. Separate receivers from one another, use directional receive antennas and pot down unused systems at the mixer board. These steps can make 16 systems (or more) perform satisfac-

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## THE CHALLENGE WAS NEON

I really can't think of any other word that will strike as much fear into the average knowledgeable microphone user than neon.

Some years ago I was given the task of making a number of wireless mics work with a bunch of neon. (I wonder if that should be a gaggle or perhaps a pride of neon). At any rate the neon person had managed to completely enclose the proscenium of a theater with neon tubes running in parallel about the proscenium arch.

Of course I was never invited to any pre-production meeting. As I recall I didn't find out about the neon until I arrived at the theater. I suppose that the producers didn't want to hear any negative thoughts. Especially since they had spent the big bucks on the set.

I originally set the receivers up on the stage and connected them to an antenna diversity system with the three dipoles located stage left, stage right and center stage in the foots. I did this to take advantage of the capture effect of the receivers. The typical wireless microphone receiver will receive the strongest signal and all but totally reject any other signal of a lesser strength. Everything looked pretty good, as it usually does before you dress the talent with the wireless.

Remember the old Frankenstein movies with the Jacobs ladders in the background? They have two wires set vertically. At the bottom of the ladder, the space between the two wires is rather close and at the top or other end of the two wires the space between them is bigger. When you apply a high voltage to the two wires, the arc starts at the bottom and moves to the top of the two wires where it finally cannot bridge the gap any longer and the spark is squelched, usually with a loud snapping sound. The whole process repeats itself until the power is turned off. I mention this now in order to describe the sound that was coming from the wireless channels. This sound was not in the background. When it was heard, it usually competed with the program audio. Also the interference seemed to be greater when the wireless transmitter was close to the neon. Of course the director wanted the MC to be next to the neon when he introduced the next act or when they were going to a commercial.

I went back to the office to pick up the spectrum monitor. When I hooked it up on-site, I found that the effective radiated RF signal from the neon tubes was at worst equal to the wireless transmitter's. In addition, the neon bandwidth was full spectrum. It went from 5 MHz to 1 GHz. I am sure it was wider, but the spectrum monitor only measures from 5 MHz through 1 GHz. By connecting a whip antenna to the spectrum monitor with a piece of coaxial cable I was able to see standing waves along the tubes as well as the high voltage leads feeding the tubes. The strength of the neon signal was equal throughout the entire bandwidth. This was not immediately evident in the 700 to 900 MHz range until I shorted the whip to match a quarter wave length at the higher frequencies. I found that the neon RF field was also be-

*(continued on page 70)*

torily. There are other plausible problems, but manufacturer assistance and equipment familiarity and checkout will prevent 95 percent of the problems.

The number of opportunities for multiple wireless systems is growing. Even modestly priced systems will perform well as long as the manufacturer is attentive to the necessary equipment design requirements. And don't forget the importance of frequency selection. Prudent selection, based on thorough understanding of intermodulation and equipment design parameters, can literally make the difference between success and failure.

—Kenneth R. Fasen HM Electronics

## AN OVERVIEW

Low Power Wireless Technology is defined as a means of transmitting data in some form, whether it be digital or analog, over short distances without using conventional cabling. Typical uses and applications include: entertainment and stage performers (professional singers; theater performers); ENG news crews and reporters; broadcast studio talent; IFB and cueing of live and recorded talent; electronic musical instruments (MIDI keyboards; electric guitars; acoustic mics for instruments); pro sound — PA and sound reinforcement (church sound; auditorium installations; sports facilities; aerobic exercise center facilities; corporate board rooms).

Wireless microphones have become popular over the last five years because of several factors: There is an increasing "mobility" of news reporters, stage performers, movie and video production engineers, etc. There has been a rapid change in technology relating to wireless microphones. Intensive research and development has been undergone by major corporations in the field of low power radio transmission. Equipment has been developed which is more reliable, easier to operate and less expensive than was ever available before. There is more aggressive marketing by the major manufacturers in the market. And most importantly: Sound installers have found that wireless microphones are a new "profit" source for single piece sales, rental applications, and as part of large system bids.



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**Nady 101/201 Wireless Systems:** The ultimate price/performance breakthrough in VHF Wireless Systems. 120 dB Dynamic Range. 250 foot operation. True Diversity and single-channel. Lavalier, Hand-Held, and Instrument Transmitters available. Receivers rack mount. List prices start at \$279.

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And the Nady 1200 Series Wireless sets the industry standard for full-feature, top-end wireless performance.

Wireless manufacturers make many confusing claims regarding system specifications. Take our suggestion: listen to a Nady 101/201 or a Nady 1200 side-by-side with any other wireless on the market — regardless of the claimed specs — and you'll be impressed with the extra 15 dB dynamic range you get with Nady Wireless.

The Nady IR-300 is a Large-Area Infrared system with a unique modular design for easy, efficient installation in any size facility. You don't have to run AC to power the emitters. And you can add to the system as needed in the future. Best of all, you can have a Nady IR-300 infrared package for one-third to one-half less than the competition gets for the same area coverage.

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**Nady IR-300 Large-Area Infrared Systems.** Unique modular design for easy, efficient installation in any size facility. You don't have to run AC to power the emitters. And you can add to the system as needed in the future. Choice of user-friendly receivers. Best of all, you can have a Nady IR-300 infrared package for one-third to one-half less than the competition gets for the same area coverage.

Circle 237 on Reader Response Card



## Shure L Series brings reliability to affordable wireless. Why take chances with anything else?

If you're providing wireless microphone systems to churches, schools, or other value-conscious users, you need reliable equipment you can sell at an affordable price—and make a profit doing it.

That's what the new L Series from Shure is all about. The L Series sets a new standard of value in its price range, offering features, performance and reliability other "economy" systems can't match.

### **We didn't forget the details.**

Designed and built by Shure in the U.S.A., L Series systems include many of the features that set professional-quality wireless systems apart from the "toys." L Series receivers are sturdy, metal-cased, and rack-mountable. Antennas are detachable and may be placed in remote locations, providing excellent performance in situations where many other wireless systems have trouble.

Our L1 Body-Pack Transmitter has features like a separate audio mute switch and a universal 4-pin "Tiny QG" connector that accepts a variety of microphone and musical instrument sources. And L Series

lavalier systems come with the 839W, a reliable Shure condenser microphone designed for clear, natural vocal pickup.

### **Performance meets economy.**

Even though L Series components are economically priced, they incorporate sophisticated RF technology. The L4 Diversity Receiver utilizes "intelligent" MARCAD™ circuitry to monitor signals from its two independent RF sections, blending them in the optimum proportion—not merely switching them. The result is reliable, uninterrupted audio with no clicks, no pops. And all L Series systems feature Shure "Mirror Image" companding, plus high-gain, low-noise MOSFETs, a high-fidelity quadrature detector, and a 3-pole Chebyshev audio low-pass filter. It all adds up to outstanding audio quality with exceptional freedom from noise and distortion.

### **Why risk callbacks with anything else?**

Other systems may not meet expectations. But you can recommend a Shure L Series system with confidence. So why risk callbacks—and your reputation—with anything else?

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Through the use of intelligent marketing, sound contractors can tap the vast market potential for wireless microphones. Typical approaches for promoting the product include: mail campaigns directed at specific users groups; and space advertising in local and national publications in markets such as churches, corporate A/V departments, local broadcasters, hotel facilities, health and sports facilities, auditorium and convention facilities, public and private primary and secondary schools, and colleges and universities.

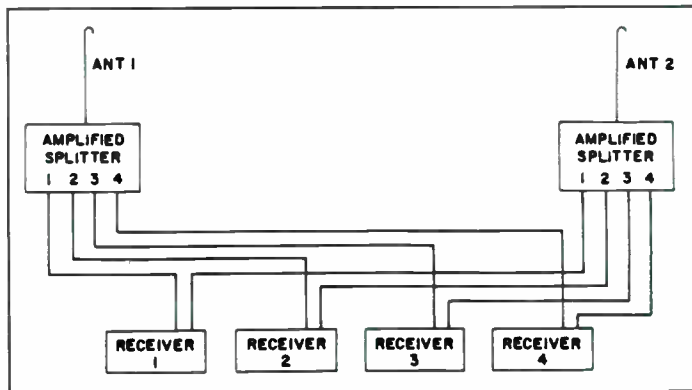
A dedicated sales person to demo and follow up on leads generated by both the in-house campaigns and the manufacturers promotion program is essential to success. Far too often, leads generated by a promotion program are not followed up in time to capture a sale. The best advice is: If you don't have the manpower to follow up on a promo, then postpone it.

For on-location filming or news gathering, a receiver which is DC powered and compact is of prime importance. Many designs will incorporate internal batteries and employ short "rubber duck" style flexible antennas.

A major disadvantage to these compact designs can be their lack of accurate metering and standard interface connections. Due to the small cabinet size, large easy-to-read LED displays or meters are impossible.

As with other larger systems, these units are often available in diversity or single antenna configurations.

The conventional AC powered rack mount systems come in both single antenna and diversity models. These systems often have a host of features and are generally available at a variety



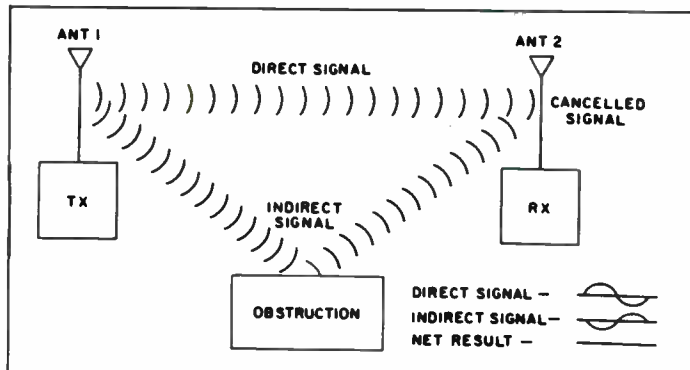
*Diversity Antenna Splitting. Courtesy Telex.*

of price points.

Stage performers, many lecturers, and others who use conventional handheld microphones will generally use integral handheld mic/transmitters. These designs incorporate the transmitter electronics into the barrel along with the microphone element.

Some designs may also have a trailing wire or flexible antenna at the base. This may be cumbersome to use but necessary if the overall length of the unit is short.

Generally, most models are available with a variety of mic heads



*Dropout Effect of Multiple Signals. Courtesy Telex.*

from other manufacturers. This allows the user to tailor the sound of the mic to the particular use.

Whenever "hands free" operation is required, a belt pack transmitter with a lapel or headworn mic is used.

Many designs employ trailing wire antennas because the pack is so small. Units without the trailing wire will generally use the

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mic cable as the antenna.

Available frequency bands for wireless microphones include: 49 MHz; 88-108 MHz; 150-216 MHz; 450 MHz and above.

The 49 MHz band is shared by a variety of services such as toy walkie talkies, cordless telephones, remote control radio equipment and several types of wireless two-way radio equipment. While it is possible to build an excellent workable system in this frequency band, the primary problem is the congestion of air waves in this region.

The 88-108 MHz band has been used for a number of years

to obtain a wireless operation inexpensively. The problem here is that the power output must be very low and the audio quality of the transmitters leaves much to be desired.

The 150-174 MHz band has become very popular and is now one of the most popular. It lies just below the upper TV band (channels 7-13). Nearly all of the transmitters in this area are low power, and the interference problems are minimal.

The 174-216 MHz band is the upper television broadcast band and is therefore reserved for broadcasters. The operation here is also reasonably clean if no interference from a nearby TV sta-

## SO WELL PUT TOGETHER,



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*Sony WRT-28 UHF Wireless Transmitter.*



*Williams Sound Corp. WIS 100 wireless intercom system.*

tion results.

The 450 MHz band (and above) is becoming more and more popular. This is commonly referred to as the UHF television band. There are a number of technical factors which now enter the picture, however. The design of the transmitters and receivers becomes extremely critical and the product may be cost-prohibitive for many users.

As far as dropouts and phase-related problems, the basic problem is this: All wireless microphone transmitters, regardless of manufacturer, frequency of operation or other factors, radiate a signal (wave) that travels to the receiving antenna (or antennas) essentially in a direct line. If this were the only signal the receiver had to deal with, no problem would exist. Unfortunately, secondary signals travel indirectly to the receiver by bouncing or reflecting off nearby objects, such as wiring, structural metals, etc. This may cause a partial cancellation of the desired signal or even a complete loss. This is a natural event with all wireless systems. The cancellation could even occur over just plain earth with no nearby objects at all. The process of cancellation due to direct or indirect signals is commonly termed phase cancella-



*Audio-Technica VHF Wireless System.*

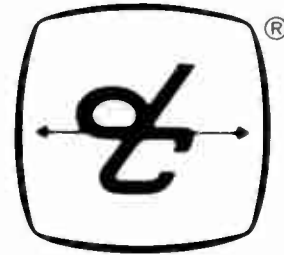
tion. Result: noisy signals or lost signals and customer dissatisfaction.

Diversity reception is a method of minimizing the effects of fading during reception of a radio signal. This is done by combining and/or selecting two or more sources of received-signal energy which carry the same intelligence, but differ in strength or signal-to-noise ratio in order to produce a usable signal. This requires more than one antenna, not necessarily receivers.

The switching diversity system makes use of the observed fact that signals induced in antennas five to ten wavelengths apart, fade independently. Wireless systems using this arrangement are quite common and effective if designed properly.

The receiver uses two separate "front ends" or radios within one chassis. Separate antennas are connected to each section and the antennas are spaced six feet or more apart. Both "front

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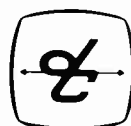
For over 30 years, David Clark Company has been the leader in the development of innovative ideas in NOISE-ATTENUATING (Reducing) HEADSETS for use in high noise areas.

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ends" are connected to an electronic switch which selects the best (or lowest noise) signal. Since the antennas are separated by a physical space, dropouts should not occur at both points simultaneously. There are certain advantages and disadvantages with this design. Advantages: Simple, proven design (first developed during WWII); very effective when manufactured properly. Disadvantages: Potential for a performance disparity between 'front ends' (squench level, frequency response, sensitivity, etc.); very costly to produce over a nondiversity equivalent; switching noise can be apparent on some designs.

Phase diversity uses two antennas on one receiver spaced some distance apart. These antennas are connected internally into logic circuits that monitor the combined signal strength be-



*Samson Concert TD wireless system.*

ing delivered to a single receiver. If the combined signals from both antennas begin to deteriorate or get noisy, the logic circuit corrects the phase between the two antennas to correct the problem. If the signal further deteriorates, the phase is changed again. If the signal gets noisy for a very short time, such as a "pop" or a "click," the diversity system has a "memory" that prevents phase correction from being needlessly applied. The advantages include: A 3 dB signal strength gain to the receiver for more distance capability over the switching variety; only one "front end" is necessary, thereby lowering cost and complexity of the receiver; one "front end" ensures consistent performance while diversity is in operation. The disadvantage is that it requires quality I.F. design to be most effective.

There are several companding systems on the market. All of them employ a gain riding technique to compress the signal at the transmitting end and then expand the signal after it is received. There are several trade names and some minor technical variations, but all of them are essentially similar in operation. There are several advantages in the use of companders. The primary ones are: increased operating range; lower noise floor; enhanced signal to noise ratio; protection from overload distortion.

For the compander system to function properly, a "clean"

audio link must be present. A good measure of this is to look at the signal-to-noise ratio of the radio without the compander in. This is the "raw" spec and will tell you the true noise floor of the system. When the gain riding action of the compander is introduced, this noise level is what is heard "pumping" in the background. The cleaner the "raw" signal is to start, the more free the companded signal is from noise pumping.

A good I.F. design will incorporate filters to reject unwanted R.F. energy outside the radio's primary reception frequency. The objective is to reduce outside interference and allow for multi-plex system use.

The more selective the radio, the "sharper" the walls on its selectivity or bandpass curve.

Typical high selectivity receiver designs may incorporate helical resonators or linear phase filters. Crystal or ceramic filters have a wider bandwidth but may be used effectively if the situation is not critical.

In application considerations, thought must be given as to whether that system is diversity or nondiversity. The issues include: Room Construction. Does it have high ceilings, brick or concrete construction, large pillar or other obstructions? User Requirements. Will the speaker or singer be very active? Are there frequent obstructions in the user's path or movement? RF Environment. Is the installation in or near a large city? Major metro areas often have high RF energy levels. Cost. For instance, should a high performance nondiversity receiver rather than a cheaper diversity model be used?

Another consideration is frequency agile systems. For traveling use, frequency agile systems offer the user more reliable



*Comtek RC-72 Receive-a-cue system.*

reception capability. Crystal controlled systems are generally preferred because of their inherently high S/N ratios and frequency stability. Usually no more than two to four frequencies are necessary to ensure reliable reception. Spacing between the highest and lowest frequency should be kept to a minimum to provide good antenna matching.

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## WIRELESS SYSTEMS

For diversity systems, optimum antenna spacing is critical. For transmission distances in excess of 50 feet, antenna spacing must be over three feet.

Proper antenna placement is also important. The antennas should be in line of sight with the transmitter, and free from most obstructions if possible.

Maintaining a minimum distance between transmitter and receiver antenna is important. The strength of the signal is related to the transmission distance. To maintain a good signal level, the receiving antenna should be vertical at all times.

Rules for multiple systems include: Use the minimum number of microphones possible in simultaneous operation; choose your frequencies carefully so that you will not receive interference from external systems; maintain a minimum separation of 15 feet between transmitter and receiving antenna(s); but, do keep this distance as small as possible; do not operate transmitters on frequencies closer than plus or minus 200 kHz; do not operate transmitters on frequencies whose differences fall within 9.2-9.4 MHz; do not operate transmitters on frequencies whose differences fall within 4.55-4.75 MHz; do not operate transmitters closer than 1.5 feet from each other.

Although a wide variety of lapel microphones can be used with wireless systems, certain precautions should be observed.

Many lapel mics have insufficient shielding into the head end of the element. This allows RF to enter into the mic capsule and cause low level buzzing.



*Nady 650 VHF wireless system.*

If the mic does not have sufficient output, the transmitter will not be able to fully modulate the receiver. This results in a lower S/N ratio and poor distance capability. An overload condition exists if the mic is too hot for the input stage of the transmitter. Distortion results and excessive feedback may occur.

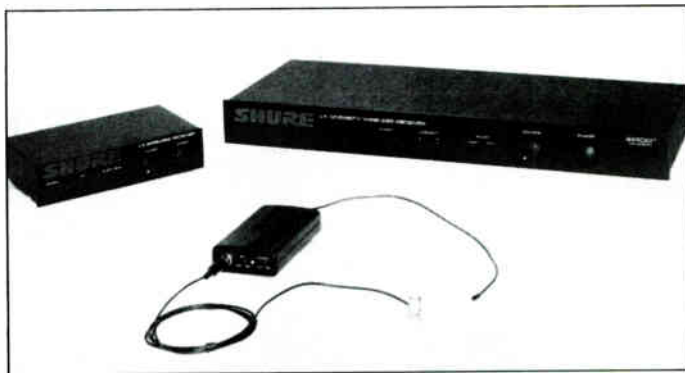
Some mics may acquire high bias voltages to operate. Most belt packs supply 5 to 9 x DC at the bias pin.

Unusual or abnormal frequency response may cause overload or over-modulation at some frequencies.

As an example of an application problem, we can briefly

describe a typical installation in an auditorium or large church sanctuary. The setup involves six wireless systems, two of which are handheld types; the rest are the belt pack variety. The budget for this system is moderate (\$1,000 to \$1,500 per system).

The task is to do the following: Design the proper operating components for the system; select receiver types (e.g., portable, frequency agile, diversity etc); design an effective antenna system and select the appropriate antenna components; determine the proper location for the antennas; outline the trade-offs involved in the system you designed; consider the potential user's budget restriction when designing the system.



*Shure L Series wireless microphone system.*

Remember there is no right or wrong answer. An effective and efficient system can be installed in a number of ways. Your primary goal is to assemble a reliable system for your customer. We are assuming a couple of important factors: The receivers are of a professional variety with detachable antenna systems; the systems can be rack mounted; a band specified antenna divider is used.

The application consists of six wireless systems installed into a 200-seat sanctuary. The structure is approximately 80 x 150 feet in size and consists primarily of wood and plaster construction with some interior brick. There are few obstructions in the interior of the room. The sound equipment rack, however, is in another room off to the side of the main hall about 20 feet away.

The use of three of the belt pack mics will be restricted to the front of the sanctuary. The remaining belt pack mics will be used only occasionally for visitors. The two handhelds will be passed around the congregation during the service.

The antenna systems must be concealed from view as best as possible. The esthetics of the building are extremely important.

Clearly, in any audio installation, the end result is what is most important. Clean reliable audio in a wireless microphone is the objective. The only way to accomplish this is through careful design and installation and not compromising performance in one area in favor of another.

—Telex Communications



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# THE POSSIBILITIES

The Flex System from Rane: A Powerful New Approach to Modular Signal Processing



F

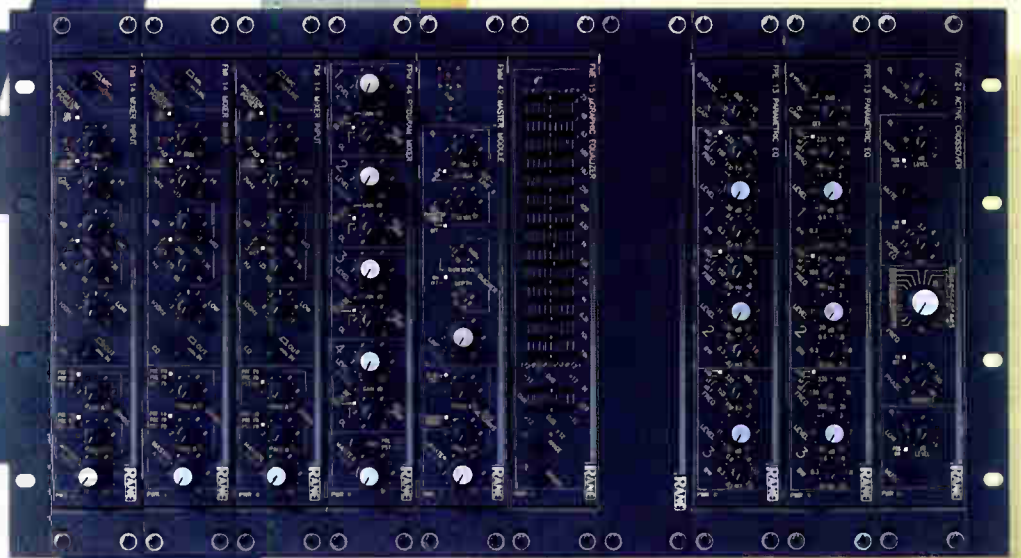
Flexibility, no matter how you spell it, means power. It's the power to meet varied needs. To meet budgets with optimum performance. To efficiently accommodate system growth. Long into the future.

Flexibility is the essence of Rane's new FLEX System. The first universally compatible, cost effective, modular approach to signal processing and routing. With no special requirements. And no dead ends.

Each Flex module is an HR (Half Rack) compatible, UL/CSA/VDE approved, self-contained processing unit. Each capable of being EIA rack-mounted either horizontally or vertically, with inexpensive, readily available hardware. Or simply set on a shelf, stand-alone fashion.

**HIGH-POWERED COMPATIBILITY.** Using standard 3-pin, 1/4" or barrier strip connectors, FLEX modules are directly compatible with professional audio gear. And since they are remote powered—via Rane's proposed power supply standard—troublesome ground loops, hum and agency approval problems are solved up front by design.

**ENDLESS POSSIBLE COMBINATIONS FOR CUSTOM DESIGNS.** The FLEX non-exclusive modular concept makes it inherently expandable





# ARE STAGGERING!

and upgradeable. It boasts a large and growing number of functions and components to choose from. Mixers. Preamps. Splitters. Crossovers. Dynamic controllers. Equalizers. Amplifiers. Line drivers. And much more under development.

And thanks to Rane's efficient bus design, system wiring is greatly simplified in even complex mixing and splitting layouts.

**COST EFFECTIVE CAPABILITIES.** Modular flexibility. Uncompromising performance. All without a premium price. That's the FLEX System manifesto. There is no expensive main-frame to buy; you only pay for the functions you want, when you want them.

Say, for example, you only need a 3 channel mixer with one channel of crossover. The FLEX System delivers. And when your needs expand, just add more modules. No need to obsolete old equipment for a loss.

Whether you use two modules or twenty modules, the FLEX System remains cost effective. And supremely flexible. Year after year.

**SUPERLATIVE PERFORMANCE, RANE RELIABILITY.** The design and performance of each and every Flex module is, in a word, superlative. Every model carries top-grade studio specifications, utilizing the best components available. The result is unsurpassed performance and reliability.

Our HR compatible modules may be compact, but they're stuffed with more top-notch features than you would have thought possible. For example, the **FMI 14 Mixer Input module** measures only 1.75" x 10.5", yet it boasts a -128dB EIN mic stage, switchable phantom power, true 20dB pad, powerful 3-way EQ section, insert loop, two source-selectable Aux sends and balanced master channel outputs. A single DIN cable, supplied with each module, routes the Master and Aux buses from unit to unit for quick and clean hook-up.

The **FMM 42 Master Module** not only provides Aux returns and mixing, but features extra mic and stereo line inputs with ducking capability for paging and other applications.

For even more mixing flexibility, the **FPM 44 Program Mixer** allows 4 separate mic or line inputs to be mixed to 4 output programs, with pre or post fade switch selection for the Aux sends. Both the direct balanced/unbalanced terminal strip and the DIN Flex bus inputs and outputs can be used simultaneously for easy expansion and integration into larger systems.

Carrying on a fine tradition of innovative equalizer technology, Rane sets yet more new standards with the Flex Series. The **FPE 13 Parametric Equalizer** provides 3 separate bands, each capable of

+15/-20dB boost/cut, 2-octave down to 1/30th-octave bandwidth range for notch capability, and a full 10Hz-20kHz frequency sweep range for unprecedented flexibility.

The **FME 15 MicroGraphic Equalizer** brings Interpolating Constant-Q filter performance to the Flex line, pioneered by our full-sized GE 30

current balanced outputs, and you've got a powerful, flexible new crossover standard.

This is but a sampling of the innovative Flex Modules to be released this year. We encourage you to obtain separate, detailed data sheets on the many FLEX System modules. Then compare these with the best standard equipment available. You'll discover that FLEX offers the best of all worlds: compact, cost effective, flexible, uncompromising performance.



model which has set new industry standards. Minimized filter interaction, smooth combined response and fully balanced three-pin and terminal strip input/output are but a few of the features. Both the FME 15 and the FPE 13 also provide an exclusive Patch I/O jack which allows direct connection to an insert loop jack with a single 1/4" TRS patch cable.

The **FAC 24 Active Crossover** is the next generation to follow in the respected footsteps of our AC 22 and AC 23 designs. In addition to the proven 24dB/octave Linkwitz-Riley performance, the FAC 24 features a true 24-position frequency selector switch to provide plug-in card accuracy and repeatability with the convenience of a knob. Add to this a built-in CD Horn EQ section, electronic phase alignment, summing LF input and three-pin high-

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# HEARING LOSS, ACOUSTICS AND SOUND SYSTEM DESIGN

BY STEVEN J. ORFIELD

**H**earing loss has, indirectly, been a strong interest of the audio and acoustics community, especially with the advent of hearing assistance wireless receiver systems now so common in church sound system applications. While there is clear precedent for consideration

of hearing loss in audio system design, the response to this problem is often from a rather limited set of options, based on common misconception with regard to hearing loss, itself. Although the best minds within the audiological field have strong disagreement over what the

phenomenon of hearing loss and language understanding really are, this discussion is intended to introduce some of the concepts which are generally considered relevant to this subject area.

## DEMOGRAPHICS

This first misconception with regard to

Frequency in Hz	Age in years	Males					Females				
		0.9	0.75	0.5	0.25	0.1	0.9	0.75	0.5	0.25	0.1
125	20	-7	-4	0	5	9	-7	-4	0	5	9
	30	-7	-4	0	5	10	-7	-3	0	5	9
	40	-7	-3	2	7	12	-6	-2	2	6	11
	50	-6	-2	3	9	14	-5	-1	3	9	13
	60	-4	0	5	12	18	-4	0	5	11	17
70	-3	2	8	15	22	-2	3	8	15	21	
250	20	-7	-4	0	5	9	-6	-3	0	4	8
	30	-7	-3	0	5	9	-6	-3	0	5	9
	40	-6	-2	2	6	11	-5	-2	2	6	10
	50	-5	-1	3	9	13	-5	-1	3	8	13
	60	-4	0	5	11	17	-3	1	5	11	16
70	-2	3	8	15	21	-2	3	8	15	21	
500	20	-6	-3	0	4	8	-6	-3	0	4	8
	30	-6	-3	1	5	9	-6	-3	1	5	9
	40	-5	-2	2	6	11	-5	-2	2	6	11
	50	-4	-1	4	9	14	-4	-1	4	9	14
	60	-3	1	6	12	18	-3	1	6	12	18
70	-1	4	10	16	23	-1	4	10	16	23	
1000	20	-6	-3	0	4	8	-6	-3	0	4	8
	30	-6	-3	1	5	9	-6	-3	1	5	9
	40	-5	-2	2	7	11	-5	-2	2	7	11
	50	-4	0	4	9	14	-4	0	4	9	14
	60	-2	2	7	13	19	-2	2	7	13	19
70	0	5	11	18	25	0	5	11	18	25	
1500	20	-7	-4	0	5	9	-7	-4	0	5	9
	30	-6	-3	1	6	10	-6	-3	1	5	10
	40	-5	-2	3	8	13	-5	-2	2	8	12
	50	-4	1	6	12	17	-4	0	5	11	17
	60	-2	4	10	17	24	-2	3	9	16	22
70	1	8	15	24	32	1	7	14	22	30	

Figure One: ISO Hearing Loss — 125 Hz-1500 Hz.

Frequency in Hz	Age in years	Males					Females				
		0.9	0.75	0.5	0.25	0.1	0.9	0.75	0.5	0.25	0.1
2000	20	-7	-4	0	5	9	-7	-4	0	5	9
	30	-7	-3	1	6	11	-6	-3	1	6	10
	40	-6	-1	3	9	15	-5	-1	3	8	13
	50	-3	2	7	14	21	-3	1	6	13	18
	60	-1	6	12	21	29	-1	4	11	18	25
70	3	11	19	30	39	2	9	16	26	34	
3000	20	-8	-4	0	5	10	-7	-4	0	5	9
	30	-7	-3	2	7	13	-7	-3	1	6	11
	40	-5	0	6	13	19	-5	-1	4	10	15
	50	-2	5	12	21	29	-3	2	8	15	21
	60	3	11	20	32	42	0	6	13	22	30
70	9	19	31	46	59	4	12	20	31	41	
4000	20	-8	-4	0	6	11	-8	-4	0	5	10
	30	-7	-3	2	9	14	-7	-3	1	7	12
	40	-4	1	8	16	23	-6	-1	4	11	17
	50	0	8	16	27	36	-3	3	9	17	24
	60	7	17	28	42	55	1	8	16	26	35
70	15	28	43	62	79	5	14	24	37	48	
6000	20	-10	-5	0	7	12	-9	-5	0	6	12
	30	-8	-3	3	10	16	-8	-3	2	8	14
	40	-5	2	9	18	26	-6	0	6	14	21
	50	0	9	18	30	41	-2	5	12	22	31
	60	8	19	32	48	62	2	11	21	34	45
70	17	32	49	70	>80	9	20	32	48	62	
8000	20	-11	-6	0	7	14	-11	-6	0	7	14
	30	-9	-3	3	11	19	-10	-4	2	10	17
	40	-5	2	11	21	30	-7	0	7	17	25
	50	1	11	23	36	49	-3	6	15	27	38
	60	10	24	39	58	75	4	14	27	42	55
70	22	40	60	>80	>80	11	25	41	60	77	

Figure Two: ISO Hearing Loss — 2000 Hz-8000 Hz.



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hearing loss relates to the view that this is a "handicap" of certain members of society. It is often not understood that the vast majority of the entire population will experience predictable levels of hearing loss with age, just as they will experience loss of visual acuity and sensitivity. Graphs of typical statistics available from ISO (International Standards Organization) demonstrate this clearly with regard to both age and sex.

A number of facts are interesting in this regard. First, attendance at events which require speech amplification or high quality basic room acoustics are often weighted

*(continued on page 43)*

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# MULTI-USE THEATRICAL CENTER: Easy to Use and Easy to Hear

BY TAYANITI DURR

Phoenix's recently opened Herberger Theater Center is spearheading a cultural rebirth worthy of the city's mythical namesake. For years, Phoenix has not had a facility



*Two of the radiator panels on the stage right lighting cover of Center Stage, the larger of the two theaters.*

designed specifically for theater productions. Still, more than a dozen theater and dance troupes endured — usually relegated to high school auditoriums or cavernous multi-purpose arenas. The need for an intimate, modern theater was unmistakable.

“First and foremost,” says Gary Moore, executive director of the Herberger Center, “we wanted an environment for the presentation of the spoken word.”

1984 determined that there was a growing need for two performing areas in a downtown facility.

The larger of the two areas, Center Stage, is an 827 seat theater with a proscenium stage. The last row of the balcony is approximately sixty feet from the front of the stage. The smaller theater, Stage West, is a flexible area that can convert from proscenium to thrust to arena with a transformation time of one hour; the distance from the back of the house to the apron is 50 feet.

The modest dimensions make an ideal setting for plays and dance productions, eliminating the need for actors to wear microphones. However, as Moore points out, the facility is not an all-purpose performing arts center: “If you decide you want to do full symphony orchestra programming, as well as theatre and dance,

then something has to go or compromises will be made. The acoustics needed for an orchestra are simply not going to work for the spoken word.”

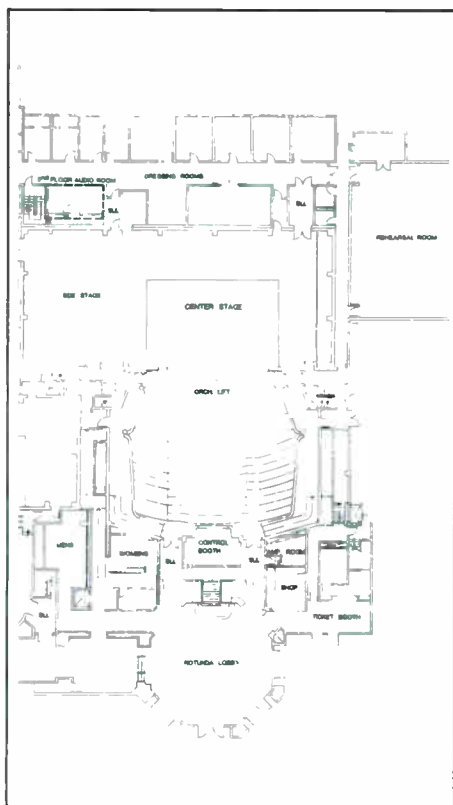
The main audio requirements established by the Herberger committee were for systems that provided a multiple configuration designed for audio playback of film soundtracks as well as sound effects for theatrical presentations; audio monitoring of any event located in either theater from lobbies, offices, rehearsal room, dressing areas and support spaces; an infrared sound system for the hearing impaired; and an efficient, flexible intercommunication system.

In late 1985, George Thomas Howard & Associates was hired to design the audio systems (as well as seating forms and seating, theatrical rigging and draperies, dimming and electrical distribution,



*Herberger Theater Center, Phoenix, Arizona: courtyard and main entrance.*





Theater Center, partial view.

theatrical lighting, and orchestra pit lifts). Since the center is a public facility owned by the city of Phoenix and operated by the non-profit Herberger Theater Center, cost considerations were the governing factors for each sound system. "We are trying to achieve artistic excellence, economic soundness and financial efficiency," says Center president Richard Mallery. The audio systems needed to be highly flexible — especially in the convertible Stage West — and cost efficient.

Another consideration was the fact that one set of technicians would be handling the audio needs for both theaters; the sound systems had to be highly compatible. As a means to this end, one audio control room was designed to manage the back-of-house and the paging system for the entire facility. Also, the intercommunication and hearing assistance systems in each theater used identical components.

At the stage manager's section a Clearcom MS-200 Dual Channel Master Station

# Wireless Solutions

## Hearing Assistance?

The T-72 Auditory Assistance system by Lectrosonics offers more features at competitive pricing. The T-72 RF transmitter has switchable dynamic processing to compress dynamic range to provide better intelligibility. Selectable low and high frequency contours adjust the sound to the listeners needs. The sensitive PRS-72 receiver is easily tuned to a test tone from the transmitter and features a wide band AFC circuit to prevent "drift". The earphone output is user adjustable up to 1 Watt. The T-72 transmitter is built in stand-alone, MAP module or tour guide configurations.



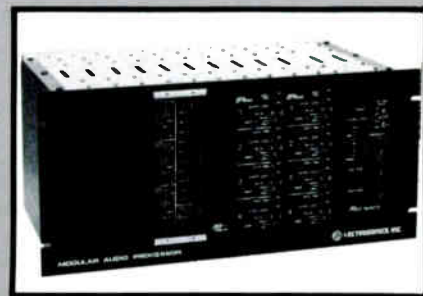
## Multi-Channel Headaches?



This is the solution. Lectrosonics wireless systems are available in configurations from simple single channel units retailing for \$399.00 to multi-channel systems for church, conference or theatrical installations. The PRO 4 rack mount system provides 4 simultaneous channels without intermodulation or crosstalk. The DM4 distribution module provides single or diversity antenna/s, helical resonator filtering and maximum isolation between receivers. Additional racks can be stacked for larger multi-channel installations.

## Automatic Mixer ...that does more?

The Modular Audio Processor (MAP) offers a complete audio system in a small space. Modules include automatic mixing, auditory assistance transmitter, standard mixing, equalization, crossovers, leveller-limiter-compressor, and several others. The MAP system approach guarantees compatibility, and easy installation. Automatic mixer functions include expansion attenuation, priority channel, last mic on hold, NOM attenuation and phantom power.



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## INSTALLATION PROFILE

connected to a CC MX820 Matrix Switching Panel provide intercommunication. The system has over fifty outlets in the Center Stage Theater, including portable remote stations and belt packs. IC is tied to the back-of-house system for main program monitoring.

The nucleus of the back-of-house system is an audio room located on the second floor behind Center Stage. The programs from both theaters and three tape recorders are fed into ADC BJF203-4MKII patch bays via Yamaha PM-180 mixers. A paging system is integrated into the back-of-house system through a dozen Shure FP-51 gate/compressor mixers. The programs and paging go through JBL 6200 series amps and are distributed to 12  
*(continued on page 52)*

## HERBERGER THEATER CENTER EQUIPMENT LIST

### BACK-OF-HOUSE AUDIO SYSTEM

Qty	Component Description
3	JBL-6230 75 Watts x 2 8 ohm Power Amplifier
3	JBL-6260 150 Watts x 2 8 ohm Power Amplifier
1	JBL-6290 300 Watts x 2 8 ohm Power Amplifier
5	JBL-6237 AFMR 150 Watts Autotransformer
7	JBL-6267 AFMR 300 Watts Autotransformer
3	Yamaha PM-180 6 x 2 x 2 Rack Mount Mixer
12	Shure FP-51 4 x 1 Automatic Gate/Compressor Mixer
3	Shure M-267 4 x 1 Patch Mic/Line Mixer
3	Altec 1689A 2 x 1 Mixer/Line Combinder
1	Otari MX5050-B-1/4 Reel-to-Reel Tape Machine
1	Tascam 122B Cassette Tape Reproducer/Recorder Machine
1	BE 3400ARPS Cartridge Tape Reproducer/Recorder Machine
8	ADC BJF203-4MKII Audio Patch Bays
3	Soundolier MVXA-195 Audio Program Monitor Panel

### BACK-OF-HOUSE SPEAKERS

158	JBL 8140 HT 8' Dia Coaxial Transducer with XFMR
153	Lowell DX 108 1 cu. ft. Loudspeaker Enclosure
130	Lowell FW8 Recessed Ceiling Baffle
16	Soundolier SVI-7K Ceiling Baffle/Attenuator
7	JBL 8110HT 4' Dia Coaxial Transducer with XFMR
7	Lowell CP4 Loudspeaker Enclosure
17	Soundolier V95-8-5/HT-167 Loudspeaker Enclosure/Transformer
17	Lowell NB-8 Recessed Ceiling Baffle
28	University MLCT Extended Range Horn Loaded Transducer
2	Atlas AP-15T Double Re-entrant Loudspeaker
2	Anchor AN1000 Powered Portable Loudspeaker
20	Soundolier AT35 Wall Mount Attenuator

### EQUIPMENT RACKS

20	Soundolier 500-77 Full Height Rack
2	Soundolier 300-61 Wall Mount Rack/Modified Door
Lot	Soundolier Rack Accessories
6	Escort 'Calzone' Portable Rack
6	Custom Portable Rack Cart
3	Bud Radio B-25A Rack Blower
22	Waber UL7619-6 Rack Power Strip
6	Midland Ross P6100V Portable Rack Outlet Strip

### INFRARED HEARING ASSISTANCE SYSTEM COMPONENTS


#### (For each theater)

1	Sennheiser ST1013 Modulator and Control Unit
4	Sennheiser SZ11019-A Infrared Emitter/Radiator Panel
10	Sennheiser HDI405 Infrared Receiver Headset
1	Sennheiser GZL406 Infrared Receiver Charging Unit
1	Soundolier MVXA-195 Program Monitor Unit
1	ADC BJF-203 MKII Audio Patch Bays

### INTERCOMMUNICATIONS SYSTEM COMPONENTS

#### (For each theater)

1	Clearcom MS-200 Dual Channel Master Station
1	Clearcom MX820 Matrix Switching Panel
5	Clearcom KB-111P Portable Remote Stations
7	Clearcom RM-120A Rack Mount Remote Station
4	Clearcom HS-6 Telephone Type Handset
10	Clearcom DT-108 Single Muff Headset
10	Clearcom RS-501 Single Channel Belt Pack




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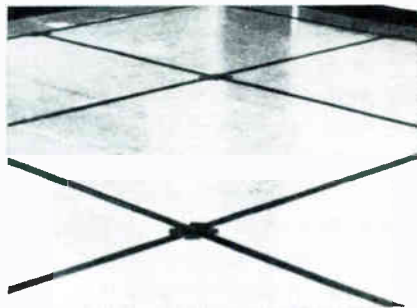


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There are over 14 million hearing impaired people, 23 million illiterate Americans and 26 million immigrants learning the English language. Add to this the movement towards governmental rulings requiring equal access for the handicapped, and there's no doubt that there's hope in many quarters for enhanced business opportunities in the hearing assistance business.



*What looks like a floor is actually the mat for the two-piece Oval Window Audio assistive listening system.*

Oval Window Audio has just completed the first year of a two-year government grant to develop its "3-D" listening system, a two piece system consisting of a mat and a "black box," which essentially allows direct assistance through the listener's hearing aid. Hearing aids with functioning telecoils can receive the signal which is transmitted through wiring elements in the mat, which is covered with carpeting. The system is being tested in a school for the deaf in Maine, and in Massachusetts.

Phonic Ear, which has been in the business of FM hearing enhancement systems for 25 years, recently moved into the market of auditoriums, churches etc. with its "Easy Listener" fm hearing system, which uses an existing PA system.

For Art Noxon, President of Acoustic Sciences, the makers of Tube Traps,



*"Easy Listener" by Phonic Ear.*

some of the assistance for the hearing impaired can come from properly designed rooms. An improved intelligibility level, improved signal-to-noise ratio, and low ambient noise can help the hearing impaired without electronic stimulation.

And in the non-audio field, other movements are making their way. Toshiba has donated several FAX machines to schools for the deaf, bringing them instant communication without sound.

—Editor

## HEARING ASSISTANCE

*(continued from page 38)*

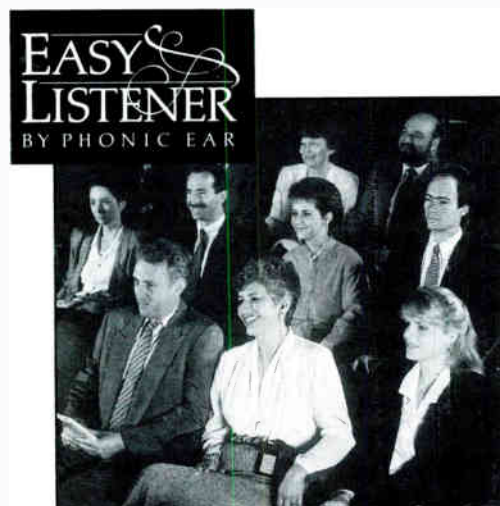
toward older audiences (e.g., theaters, churches, etc.). Secondly, events requiring communication assistance (telephone calls, drive-up banking) are often characterized more by male than female use patterns, even though older males have significantly more hearing loss than females of similar ages. Finally, one other population exhibits a problem with intelligibility akin to that of hearing loss, and that is persons with a limited ability to deal in the language or dialect being spoken (This population is significant in many portions of the United States).

### CHARACTERISTICS OF HEARING LOSS

Most familiar hearing loss patterns fall under the audiological definition of "sensorineural hearing loss". This condition is characterized by a limited loss of hearing acuity, rather than physical deformity or another more organic hearing disorder. Persons with sensorineural hearing loss are generally considered to exhibit one or more of these symptoms:

*(continued on page 52)*

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## “Perspectives In Audiology”

Review by Steven J. Orfield

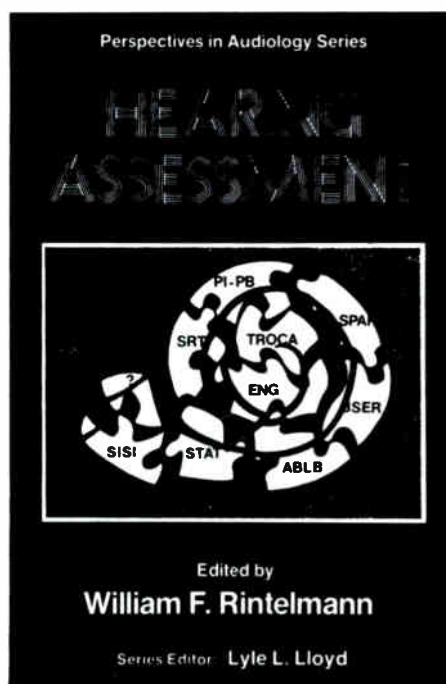
**W**hen I first began to have a serious interest in the relationship between hearing and acoustics, I contacted a number of noted audiologists regarding the subject. Upon requesting an introductory text, I was referred by several of them to a series which was originally published by University Park Press and is now published by ProEd. The series was entitled *Perspectives in Audiology*. Each volume is an edited collection of discussions on various subject areas. While so many of these introductory series are poorly written and provide little current information, this series was a surprising exception.

The series was originally made up of 14 published and planned books covering a broad range of subjects within the field. Currently some of these are under revision. The existing list covers the issues below:

1. Language development.
2. Oral interpreting.
3. Speech communication.
4. Hearing assessment.
5. Aural rehabilitation.
6. Acoustics and hearing aid performance.

The two books which are most central to the acoustics and audio community are *Acoustical Factors Affecting Hearing Aid Performance*, edited by Studebaker and Hochberg (now under revision) and *Hearing Assessment*, edited by Rintelmann. The first of these books provides a clear view of the ongoing research and testing related to hearing aids and acoustics. The second provides an in-depth explanation of hearing loss detection procedures and types.

*Acoustical Factors Affecting Hearing Aid Performance* covers a very broad field, beginning with the characterization of performance of “normal



listeners in typical rooms.” Its 18 chapters move through four general subject areas:

1. Acoustical Effects of the Environment.
2. The External Ear, the Earmold and the Earphone.
3. Modeling Techniques.
4. Frequency Response Selection Techniques.

For the reader specifically interested in acoustics, the first five chapters are the central thrust into this area. They

deal with reverberation and perception, the effects of room acoustics on speech perception, speech reception thresholds (SRT's), hearing aid input signal variations and the environmental contribution to the directional performance of hearing aids. This volume is an extremely good introduction on acoustics and hearing loss.

The second volume, *Hearing Assessment*, is a very well written set of articles on the types of hearing loss diagnoses which are available to the audiological practitioner. The text moves from a discussion of the simpler measurement methods into discussions of speech audiometry, adaptation, intensity discrimination, recruitment and auditory processing. Particular chapters of greatest interest to the acoustics and audio communities are chapters 1, 2 and 5, which introduce audiometric measurement procedures and discuss the difference between pure tone testing and evaluation via the use of speech material. While the level of writing is intended for graduate students in this field, the concepts are clearly delineated and well discussed.

These two volumes in particular, and this series in general, could be considered as a basic reference set for the acoustical consultant, the interested audio practitioner, or the designer of audio products intended to be used by hearing impaired persons. The cost of the books is nominal and the information is extremely useful in understanding this subject area.

*Perspectives in Audiology*. Proed Publishers, 8700 Shoal Creek Blvd., Austin, Texas 78758.

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## HI-TEST, FAST-FOOD AND OTHER OUTLETS

BY SUZAN PRINCE

**F**ast food and other convenience outlets aren't ordering up new drive-through intercom installations in quite the volume that their customers zip by for burgers and shakes. Yet leading suppliers and dealers focused on the segment say the business remains robust and is expected to stay strong right through 1990, bolstered in part by growing demand for the newest lightweight wireless configurations, as well as for tie-in services that greatly strengthen buyers' point-of-sale communications.

Drive-through remains a relatively small niche in the overall market for intercoms, which includes sports and entertainment applications, as well as industrial uses in

factories, warehouses and office buildings. While fast food is clearly king among drive-through installations, many other retail conveniences are set to play catch-up — from banks, liquor stores and dry cleaners, to your friendly neighborhood voice-activated gas pump.

According to equipment makers, therein lies the potential, long-term bonanza for full-service dealers. A recent Elenex national dealer survey revealed that "Drive-through components are still hot sellers," reports David Arseneau, product manager.

In fact, he says, "It looks like the rest of this year and probably a good portion of 1990 is going to be devoted to reconstruction. There are a lot of stores

with older drive-through systems that need to upgrade." Arseneau predicts about 50 percent of Elenex's sales over the next twelve months will come from updating existing properties.

In general, those stores are expected to choose from among a wide variety of new wireless systems for their upgrades. "Wireless seems to be the next big trend," notes Arseneau. Industry sources estimate wireless system sales will account for as much as 25 percent of the total drive-through equipment market next year.

"Fast food operators are becoming increasingly interested in wireless systems because they provide very high quality communications to the customer," affirms Rich Barker, 3M Co. marketing communications manager. "It gives the order taker a good level of sound when talking with the customer, and unlike using a standard mic, sound quality won't change or fade out if he bends over or moves around near the point of sale register."

Overall, Barker projects "continuing strength" for drive-through systems in the fast food arena. "Although there are some vendors that are not doing that well at the moment, overall I'd say it's still a very strong market, for both wired and wireless intercom products."

Although Gary Fisher, Sales Manager — Microphone Products for Telex Communications, acknowledges the existence of stand-alone wireless intercom sets in the quick serve restaurant segment, he envisions a "significant" portion of wireless sales going to hard wired owners "who simply wish to adapt and extend the reach of their current systems."

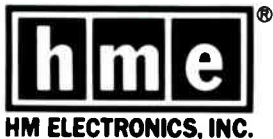
St. Louis, MO, dealer Graphic Sound Systems Inc. confirms that such retrofits are becoming more and more com-



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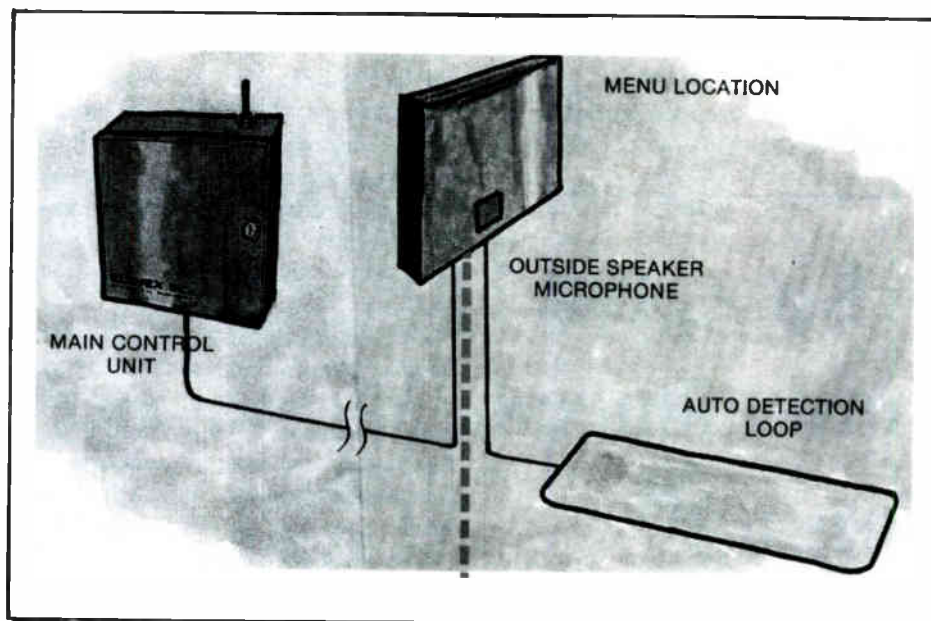
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System installation. Courtesy Elenex.

monplace in its territory, which includes all of Missouri and Illinois' lower third. "We're doing a lot of new installations and some retrofits," reports owner Steve Barnholtz.

The dealer, who typically installs and services equipment from Drive Through Intercoms Inc., says his fastest growing customer group remains "the standard fast food outlet — the Burger King market, the Taco Bells, and similar operations," for whom wireless extensions increasingly act as retail safety nets.

"If one of the two systems goes down," explains Barnholtz, "they still have the other to rely on, which is great because that's what they're after. When that system goes down, it's usually down for a half a day, or a day. And it's costing a lot of money. If he's got a hard wired system with a wireless retrofit, now he's got redundancy. They know there's always one working system. And that puts money in their pockets."

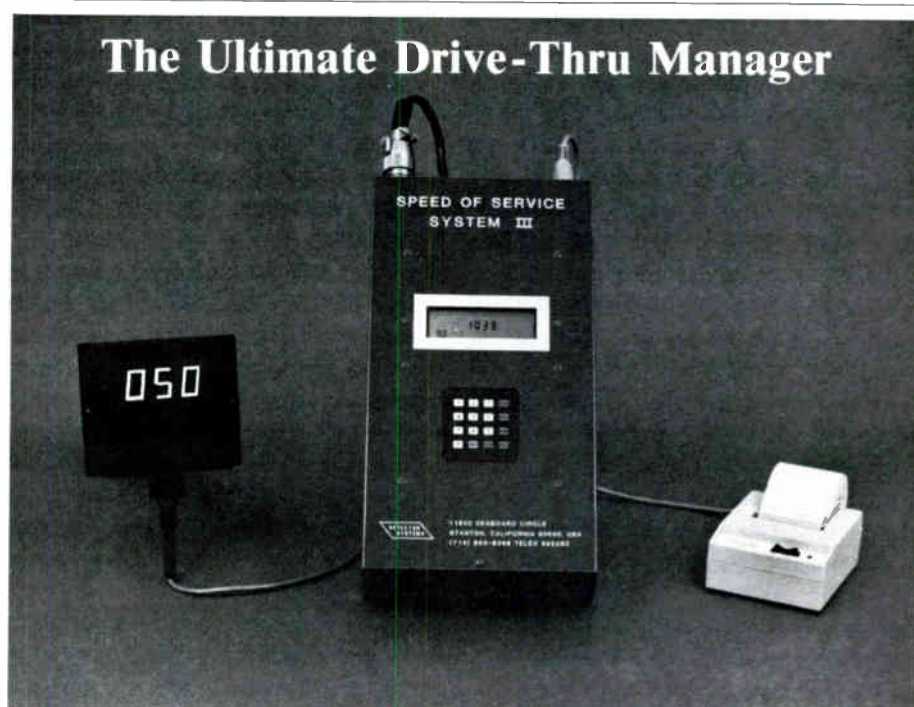
Burger King franchisee Rusty Gunther agrees the backup configuration affords him "a great feeling of security." The Graphic Sound customer just recently upgraded all five of his St. Louis area stores to drive-through wireless units in

conjunction with existing, hard wired systems.

Whatever the ultimate configuration, Barnholtz contends that high-volume, quick-food operators value the quality of a full-featured point-of-sale communications system which often includes devices such as dual microphones, speaker combinations and voice clarity enhancements.

"These owners and managers realize that hearing a customer the first time is vital to the revenue flow," Barnholtz comments. "They're clearly after the quality communications that we can put into their stores, and importantly, they're willing to pay for it."

Indeed, Graphic Sound says its job pricing can start "anywhere from around \$1,300 and go all the way up, depending on how sophisticated somebody wants to get," says Barnholtz. "I mean, we can



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give them units for each drive-through, and then have multiple channels, dining room background music systems, kitchen and dining room paging — the whole works

Apparently they feel that the hard wired is probably more cost-effective, and that there hasn't yet been enough of an increase in efficiency to warrant the extra

wearing the belt pack they can hear when a vehicle comes into the drive-through lane. They can start to take the order as they're walking back to the POS, and this employee is now beginning to be used more efficiently and more cost effectively because they can be doing multiple jobs. They're not stuck at the drive-through window."

3M's Barker adds that the quality of the wireless systems is improving "constantly, so that they've become more reliable, more dependable. Battery life is improving. Overall durability is improving. In general they are more durable and more maintenance-free than in the past."

Still, vendors concede their systems' weakest link remains the headset transceiver. "The wireless is not as durable as the wired system," Barker allows, "primarily because the transceiver is subject to constant movement. They get flexed a lot, and are more prone to breakdown."

Both HME and 3M urge installers to stress customer education on the matter. "About the single, most important thing you can do to assure longer life and less maintenance of your customer's wireless product is to encourage a strong operator training program," advises Barker.

Among other points, "Make certain that they are thoroughly trained on how the system works, how to properly use it, how to put the batteries into the system and how to keep the batteries fully recharged."

Davis agrees today's wireless units "definitely are more ruggedly built. But they do need more attention, because the belt packs can be dropped. And they're used over extended periods of time, anywhere from 12-hour days to 24 hours a day by those chains that stay open 24 hours."

Because dealers are selling this "very high-tech product" to a "largely non-technical end user," Davis stresses customer maintenance, as well as operator training. "It's not only a matter of selling them the system, it's a matter of giving them a lot of support in caring for that

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# “Fast-food is King, but other retail conveniences are catching up.”

---

— all run through the main system.”

Graphic Sound is also among those dealers who've discovered the profits in ancillary service categories such as speed of service. Via graph prints generated by a computer connected to the main system, "A store can time how fast it is serving its customers on an hourly, a daily, a weekly, or a monthly basis, and then analyze those results in relation to their ideal serving time goals," Barnholtz elaborates.

While acknowledging that a goodly number of large-scale operations are moving toward wireless systems with wired backups, Ron Cole, national dealer coordinator for Drive Through Intercoms Inc., which designs equipment strictly for the fast food industry, observes that "It's not necessarily true that anyone who's doing any kind of volume has gone in for a wireless system."

He cites as a major case in point the new Burger Kings now being built by the U.S. Army/Navy/Air Force Exchange Service on military bases in all 50 states. "These are expected to be some of the highest-volume stores in the country," says Cole.

"But the Exchange still is using strictly hard-wired systems, rather than wireless.

cost of installing the wireless system."

DTI supplied the new armed services outlets with drive-through systems consisting of a closed-circuit television system with two indoor monitors and an outdoor camera. "We also supplied the background music speakers for the dining rooms," Cole adds.

Elenex's Arseneau admits that the expense of upgrading to a wireless system can run to the high side, "especially compared to what people spent for hard-wired systems in the past." Still, he says, "Most customers understand that anything that saves them a few seconds means dollar signs."

More specifically, using a wireless drive-through headset communications system "allows that drive-through to work a lot more efficiently and cost-effectively, by doing more with less people," says Eunice Davis, marketing manager for HM Electronics, which helped pioneer development of the wireless drive-through unit for fast food outlets several years ago.

In many cases, she contends, installing a wireless system means a chain can eliminate at least one employee per shift. "Someone can be out in the dining room cleaning the tables, and because they're

system," she says. HME will soon offer its large end users a new video tape training series covering installation, use and maintenance of its wireless devices.

As far as the installation process goes, Barker notes that "Fortunately, wireless installation procedures are becoming more standardized, the contractors have developed the necessary skills, and at this point there really aren't any major, major differences between performing a wired and a wireless drive-through installation."

While Elenex sells solely into the fast food marketplace, Arseneau says he can't help but notice the rapidly diversifying customer base among his dealers/installers. "Altogether, perhaps only about 15 to 20 percent of my dealers' customers are drive-through customers. Of those, there are a growing number of banks, convenience stores and self-serve gasoline stations looking to install both hard-wired and wireless systems at their locations."

In agreement is Richard Pauley,

"Many of these stations have their people pretty much tied down to the 'in-store' part of the operation. They need to know what's going on outside. Our system lets them pay attention to their customers without having to leave that retail area. So it's a real benefit to them."

GLP installations emphasize greatly improved employee productivity. "The stations need to accomplish more with fewer human resources," Pauley observes. "Part of that involves making sure they've got a good communications link to the customer at the fuel island, or at the multiple-pump dispenser."

The dealer sells and services 3M's D-20 six-channel, voice-operated system, which can be configured to provide communication to a car wash as well as to the gas islands. Pauley says at some point he'd like to be able to offer clients wireless operation to the islands, "mainly because of some constraints of current construction. I think that, and being able to install a

## "Hearing the customer the first time is vital to the revenue flow."

petroleum sales specialist for GLP Communications Inc. an Oklahoma City-based 3M dealer, who cites rising sales in his area of expertise. "We've seen an increased interest, and quite a few more new installations in the last year or two," he says.

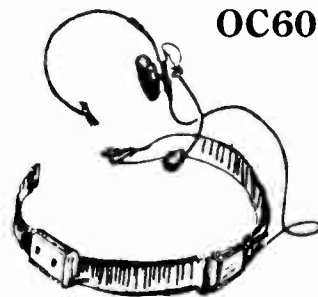
In the fuel/convenience store market, which comprises a large percentage of its business, GLP counts as major clients Phillips Petroleum, Conoco, Texaco, Circle K and others. "The systems are really becoming popular with this group because of the convenience factor," Pauley continues.

larger unit with more channels at some sites, would be very beneficial."

The ability to grant the dealer's wishes may be close at hand. "We're seeing a trend towards more individualized communications on the fuel islands," Barker maintains. "Today you're seeing almost a speaker per pump, whereas in the past it was something like one speaker for six pumps. As the size of these service stations increases, so will the requirement for multiple-location intercom systems. We envision future new-product opportunities in that regard."

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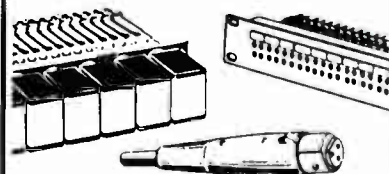
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## SALES & MARKETING

(continued from page 14)

Every once in a while that means making yourselves a little gizmo that allows those devices to reach your full potential. Again, in our businesses, the materials and the hardware are just commodity items. They're commodity items that allow us to sell intelligent design services and qualified installation services. We actually have some customers where we've said, "listen Mr. Customer, here's our product, here's our list of the items we're going to use in our the product. If you want to dial 47th Street Photo or Sam Ash Music and get those devices, that's fine. Get them to our loading dock. We'll perform our labor on them. We'll complete the design, we'll install them satisfactorily. And we'll still make the same profit."

**STEVENS:** I think that the thing that is most useful is this element of selling service. You know how to sell service. You know how to design systems. You know how to install systems. You know how to get in and out of a home. You know how to price so that you're profitable. I would

also say that one of the things that's going to be key in this kind of growth is the accounting. As you're doing your operations in multiple areas, your accounting system has to be sophisticated enough so that you can account for each division as a separate profit center. Otherwise it will be very difficult for you to know if you're making the kinds of profit margins that are necessary, and in our business they happen to be pretty high. You need about a 40 to 50 percent growth margin in order to be profitable in the long haul.

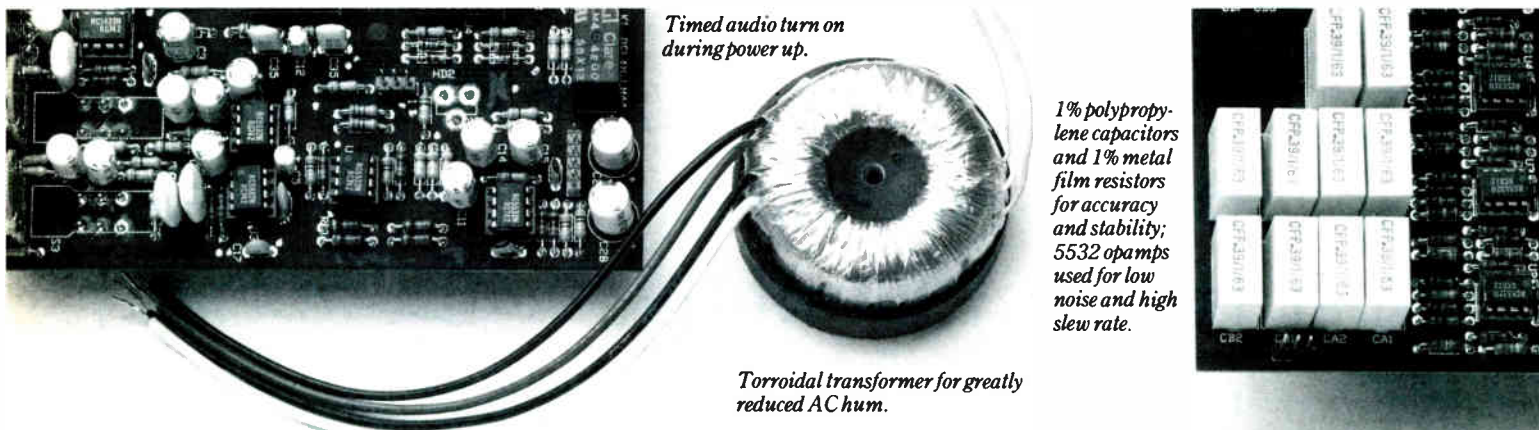
**TOERNER:** It seems that there are a lot of new areas out there, including the DBS we talked about, fire alarms, wire; we're finding out too about the custom home stereo applications. The key, as far as we've seen it, is the person you hire to sell it. That person has to have an aptitude for the product, an understanding of what they're supposed to be selling and how they're suppose to be selling it. Pay and motivation are the other key ingredients. You've got to make that person feel that he is going to be able to make a dollar and make you a dollar in the process.

I often see people getting into a new area but not being willing to pay the per-

son a decent income. And they're into it three or four months and they say, "Well I can't make any money at it." Don't kid yourself about certain things, also; don't discount a lot of markets just because you don't have any experience with them. Ask other people who have been in it and don't rush into anything; but street smarts count for a lot.

**REIM:** I guess it boils down to the fact that you're going to have to spend money to make money; and you're going to have to make a commitment, and before you make that commitment you've got to have a plan. But once you make the commitment, follow your plan; if it looks viable, you will make money in the long run. We spend a lot of money in one area and that's the area of negotiated contracts. Negotiated contracts amount to 40 percent of our total business; and yet, it is 80 percent of our profit. When we negotiate a contract, we look at it a little differently than most people do, and in the process of negotiating and selling that contract it sometimes is a very costly thing. But we get it back.

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Dynamic Range	+117 dBm	+114 dBm	+112 dBm	+112 dBm
Frequency Response	18 Hz to 30 kHz +/-0.5 dB	10 Hz to 40 kHz +0/-3 dB	20 Hz to 20 kHz +1/-2 dB	20 Hz to 20 kHz +/-0.5 dB
Number of Bands	31	30	30	30
THD plus noise	Less than .005% @ +22 dBm @ 1 kHz	Less than .01% @ +4 dBm	Less than .5% @ +22 dBm	Less than .01% @ +4 @ 1 kHz
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\*All specs taken from manufacturers' published literature.

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money.

**RAY:** It's really encouraging to hear my fellow panelist talk about the things they've done, because it does seem to carry this theme that the main thing that we can offer is service and excellence and support and our knowledge and technical abilities that we've honed over the years. I concur with every one of them. I'm sure that that's not entirely new to you. There is one thing that I would like to bring to everybody's attention and this is from my point of view as a manufacturer's rep. As we get into an ever changing technological environment that we're now in, the importance of getting information out to not only the general public but especially to you as contractors is higher and higher.

I know for a fact that my manufacturers spend many hundreds of thousands of dollars a year and go to great lengths to make sure that I am technically aware of what emerging technologies are coming into the industry, and that they're being applied to the specific products that I sell. Unfortunately, I don't always get the opportunity to convey that to all of you out there. And what I would like to do is encourage every contractor in here to work

with manufacturers more hand in hand.

I think you'd be surprised to find that they really are interested in helping you train your salespeople, for instance, and we're not offended. In fact, we're enthusiastic when we get a call from the new salesman and he says, "I just started with Joe's Engineering firm over here and I don't understand how this works. Will you please help me out." And if I can't explain, I'll get an engineer from the company to get in touch with you.

You have a valuable resource in the manufacturer's products that you sell and that resource is not as much the product any more because let's face the facts — you're going to make money on your service. We know that, and the manufacturers have gone to great lengths to help you to understand and educate your customers, you, your salespeople. So, I'd like to encourage everyone of you to work with your reps, manufacturers, your technical support people and get what you can out of them. That's what they're there for.

**MORRISON:** I think to sum it up — it's a service industry that everyone hopes to make money in. You have to watch technology, you have to watch those

balance books, and you have to make sure you get paid in whatever industry your in. Thank you. ■

## FIRST PERSON

*(continued from page 21)*

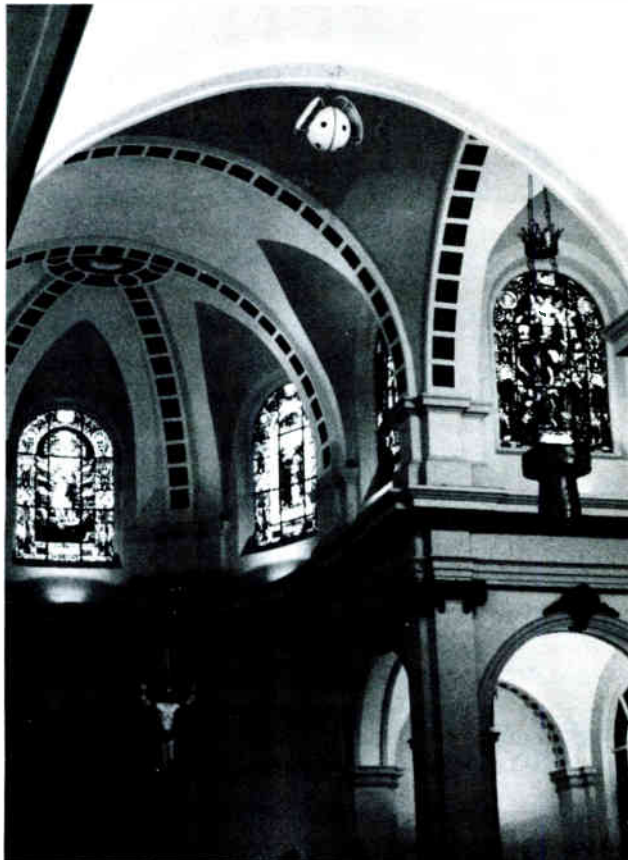
generate some unwanted noise. Creation of additional noise seemed to cause tempers to flair. By letting people know that there would be some rattling and inconvenience, we were able to do our work with minimal problems. A few failures to explain what we were doing and why, quickly taught us the value of effective communication.

Planning wire pulls and speaker interconnection to minimize ladder movement and noise, we got most of the system in and working by about midnight. With only the outdoor horns left to wire, we called it a night.

By Tuesday, we had located Mike Stiteler, our second technician, who was clearing a tree from his roof, and we were able to put a crew of three to work.

The outdoor horns required wiring to be

## "I WOULD RECOMMEND THE SOUNDSPHERE SYSTEM TO ANYONE.."



Built just after the turn of the century, St. Mary's Church in Monroe, Michigan recently completed an extensive repair and rebuilding program. Fr. Brian Chabala, pastor of St. Mary's, was faced with a completely obsolete sound system since the new facility incorporated a vaulted ceiling. People complained constantly, and various sound adjustments did not make any difference. Echo was a large problem, especially with the people who were seated in the rear portion of the church building.

The sound problem was eliminated totally after the installation of one Soundsphere #2212-2 upon completion of the renovation project. Fr. Chabala stated, "I would recommend the Soundsphere system to anyone having sound problems. I can't speak highly enough about it...in fact since its installation there has not been a single complaint about hearing, even when some of the softest readers serve as Lector at Liturgy."

Last July, former Miss America Kay Lani Rafko was married at St. Mary's before an overflow crowd in the refurbished church. The sound operated perfectly and the Soundsphere helped contribute to the beauty of the occasion.

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run on the inside west wall of the warehouse, right through the heart of the broadcast operations covering the Hugo recovery. This presented two difficulties. First the tape and camera equipment was constantly in service, and there was literally no access to the area. Secondly, emergency broadcast operations require miles of coaxial and audio wiring, which is usually just laid around the operating area as required, to make things work very quickly. A misstep in those cable nests could cause a lost news story or a lost news afternoon.

The solution turned out to be wall walking. Mike literally walked the needed cable down the wall, walking on building support steel, above the news operations on the floor below.

By the afternoon of the second day, the installation was complete. A very simple, even mundane, paging system design under normal conditions turned into one of the most challenging installations we have ever performed. ■

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*Evelyn and Buck Perry are proprietors of Carolina Sound Communications in Charleston, South Carolina.*

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## INSTALLATION PROFILE

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*(continued from page 42)*

designated areas where most of the 170 speakers are JBL 8140 HT 8' coaxial transducers, which are encased in Lowell DX 108 enclosures and Lowell FW8 baffles to increase vocal clarity.

### HEARING ASSISTANCE SYSTEM

Hearing-impaired assistance systems are now required as part of Arizona's free-access law for handicapped and disabled persons. It also makes fiscal sense to provide this service, especially in a city such as Phoenix, where a significant percentage of theater patrons are elderly. The committee wanted a system that would be expandable — not limited by the number of available jacks or signal strength.

Both theaters have a Sennheiser infrared system with certain modifications. The main program feed is sent from the audio control booth to a wall-mounted rack backstage; after running through a dbx 160X compressor/limiter and a Klark Teknik DN 300B 1/3 octave equalizer, the line is inter-

faced with a life safety relay from the building's fire control panel. A Soundolier MVXA-195 monitors the signal before it reaches the infrared transmitter. The program signal goes into a Sennheiser SH1013 FM modulator control unit, which is connected to four SZ1019-A high power radiator panels located in each corner of the house.

Theoretically, each panel will cover approximately 4,000 square feet, which means that two panels should provide sufficient coverage. However, the assurance of quality transmission due to the extra panels was deemed worth the added expense. Patrons using the system wear lightweight HDI405 headsets, which have a rechargeable accumulator that operates for six hours.

The center will be the home for The Arizona Theater Company, The Phoenix Little Theater, The Phoenix Boys Choir, Childsplay, The Black Theater Troupe, Jazz in Arizona, Ballet West and others. In fact, events are already scheduled in one of the two central performance areas every day for the next 18 months. The city of Phoenix has made a considerable investment in their cultural future, and the Herberger Center is beginning to pay big dividends. ■

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*Tayaniti Durr is a project designer with George Thomas Howard & Associates, Hollywood, California, a full service theater consulting firm.*

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## HEARING ASSISTANCE

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*(continued from page 43)*

1. Loss of basic hearing acuity  
Lower sensitivity to acoustic signals
2. Poorer spectral resolution  
Problems with frequency discrimination
3. Poorer temporal resolution  
Problems with time-based aural changes
4. Poorer acoustic localization  
Problems with identifying source position or monaural hearing
5. Higher levels of masking effect  
Problems with interference from background noise

Thus, the common view, that amplifying the sound level which is heard by hearing-impaired individuals will resolve the problem, is often misleading. It may be far more useful to reduce room

reverberation (reduce temporal distortion), reduce background noise (reduce masking effect), slow speech patterns (reduce temporal distortion), increase localization cues and increase bandwidth of the signal (broader set of frequency-based information).

Another basic problem of the hearing-impaired is that of having a reduced amplitude hearing envelope. This simply means that even though hearing acuity is less and amplification may be necessary, this amplification can only be used to a limited extent because high levels of sound can damage the ear, much the same as in a person of normal hearing. Thus, the desired 25 dB of signal-to-noise ratio, which is often the goal of intelligibility, may be only 5 or 10 dB in a hearing-impaired person, due to concern for causing further damage via amplification, itself.

### INTELLIGIBILITY

The most obvious method of evaluating the effectiveness of a sound system is in evaluating its intelligibility. This is a function of many things including the characteristics of the message, the transmission path and the listener. Audiological researchers have attempted to establish a required Speech Transmission Index (STI) for various listener groups. An example of this (Plomp and Duquesnoy) is noted in the figure.

Thus, there is clearly, within the audiological field, a growing belief that the general acoustics of the communication channel (including source, path and receiver) can be mathematically characterized by metrics already used in acoustical research. [See "Speech Intelligibility" Parts I and II, *Sound & Communications*, November, December 1986.]

### THE ROOM AND THE SOUND SYSTEM

Developing a view on the response of the sound system designer to the problem of hearing impairment can be difficult, partially due to the fact that a good portion of the problem is within the domain of the listener. The listener may have a properly tested and fitted aid, may use a binaural or monaural aid, may have it properly or improperly set and may be differentially sensitive to any of the symptoms of sensorineural hearing loss or specific environmental noise conditions.

Luckily, there appears to be some cor-  
*(continued on page 55)*



## HEARING ASSISTANCE

(continued from page 52)

relation in intelligibility between those listeners of moderate loss and persons of normal hearing. Additionally, it is safe to assume, in general terms, that conditions which degrade speech for normal listeners degrade it as much or more for hearing-impaired listeners. Thus, the consideration of hearing impairment in a listening environment should begin with these two facts:

1. Acoustically well controlled environments provide significantly higher intelligibility for hearing impaired listeners.
2. Sound systems of higher intelligibility provide significantly better intelligibility results for hearing impaired listeners. More specifically, the following conditions are known to affect many hearing impaired persons negatively:

### ROOM ACOUSTICS

- Longer Reverberation Times
- Time delays
- Masking sound (HVAC or other)
- Long distances to listener

### SOUND SYSTEMS

- Lower Q Systems
- Limited Bandwidth Systems
- Multiple Loudspeaker Source Systems

Some standards which may be considered as a guideline for moderate hearing loss audience benefit are:

- Reverberation times of .5 second or less
- No multiple path delays
- No significant masking sound
- Listeners close to talkers
- Listener covered mainly by direct sound
- Listener presented with full frequency response
- Availability of wireless hearing assistance systems

The field of hearing loss and hearing aid design is in the middle of a technical renaissance, in that the development of highly adjustable aids is just now emerging and audiological research into hearing loss is intense. In the acoustical and audio field, there are a number of developments which may assist in this process of research, testing and psychophysical evaluation of the problem. The first of these is the emergence of new and improved hearing and speech testing artificial head and torso simulators, such as the Bruel and Kjaer 4128 and the Achen Head, a German torso system. The former has

both an active "voice", or mouth transducer, and two active ears. It is available either with or without ear canal response (with artificial ears or standard studio microphones) so that both ear response testing and psychoacoustic testing can be accomplished. The latter is available with special frequency corrections for use in recording and playback to simulate the same problem. These torso's are becoming increasingly interesting to both the acoustical and audiological field, which has so far been dominated by use of the KEMAR torso. [See January 1988, *Sound & Communications*.]

Another development is the use of pro-

grammable equalizers and simulated reverberation processors, both of which can be used for specific benefits when hearing-impaired audiences are assumed to be present. (Reverberation processors can be used to increase the perceived reverberation of music in otherwise low-reverberation spaces. Programmable EQ's can be used to provide a separate EQ for hearing-impaired audiences.)

Over the next few years, major additional developments are underway and expected, including better understanding and reproduction of the hearing process, itself, and of associated electronics to provide this phenomenon to non-hearing persons.

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# “NCAD”: Non-Computer-Aided-Design

BY MIKE KLASCO

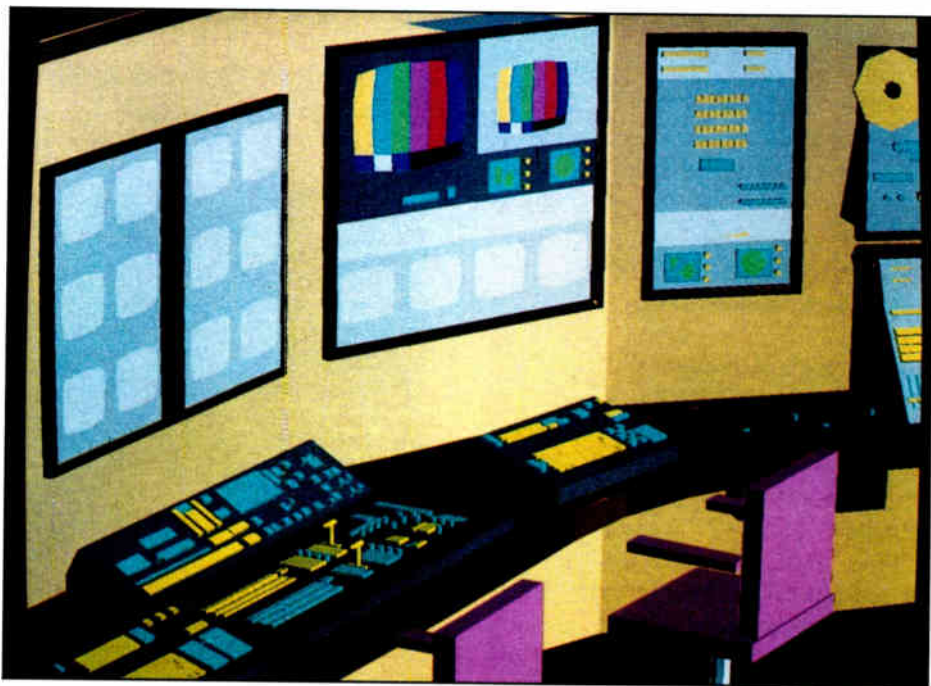
**S**ome people just hate computers. This distaste may be caused by lack of familiarity, an aversion to learning how to type, philosophical reasons, or perhaps because you just cannot teach an old dog new tricks. There simply will always be a group of sound contractors and consultants who are not going to deal with computers, no matter what.

This month's review is dedicated to this group. Two "programs" will be examined that do not use computers, nor even calculators. Aside from their utility for engineers with computer phobia, these programs have some application for quick estimates for preliminary design studies, such as for sales proposals, and paging/distributed system applications. While it is not necessary to use a design aid to figure out what the on-axis level of a given horn and driver at a specified distance will be, the off-axis level is not as easily determined. Essentially, these programs help the designer predict both on-axis and off-axis direct sound levels; that is, uniformity of coverage.

One program is from University Sound and is called "Easy-Vamp"; the other program is "Horn Dispersion Contour Overlays" from the acoustical consulting firm of G.R. Thurmond and Associates. Both programs use isobar overlays and are easy to learn and use.

For creating system flow charts and rack diagrams without using either a computer or mechanical drafting equipment, users of Easy-Vamp and Horn Dispersion Overlays may want to consider VDP's AudPAD (Audio Paper Aided Design). Paper Aided Design consists of scale drawings of audio equipment plus detailed specifications.

*Mike Klasco is the proprietor of Menlo Scientific.*



*Photo of VidCad rendered with AutoShade. Classic Video; VDP.*

PADs can be copied, cut and pasted to mock-ups or drawings and save hand drawing and literature file cabinet search time.

## EASY-VAMP FROM UNIVERSITY SOUND

Over the last decade, a number of architectural room mapping techniques have been developed to help achieve uniform direct field coverage. Tom McCarthy first conceived of isobars in the late 1970s and created a sound system design program called Umbulus. Ted Uzzle developed Array Perspective, a variation of McCarthy's work which Altec provided to sound contractors from 1982. Array Perspective contained some mapping distortions that are endemic to flat mapping of spherical phenomena (such as the sound radiation of horns). Electro-Voice (a Mark IV com-

pany) engineers developed a scheme to minimize these architectural mapping distortions. These techniques were the basis of VAMP (Very Accurate Mapping Program), which was introduced in 1985. Unfortunately, this was also a Very Cumbersome Mapping Program, with literally hundreds of transparencies (about 25 transparencies for each horn!). An HP 41 scientific calculator or an IBM compatible was also used for direct SPL calculations and some other performance predictions. Although some consultants and sound contractors who had used Altec's Array Perspective and wanted to avoid its mapping distortions welcomed VAMP, the program never gained wide acceptance.

University Sound (another Mark IV company) prepared an adaptation of VAMP called EASY-VAMP™ which provides a similar design aid without the complexity



If you're working to bust out into the big time, Yamaha has the right console to take along for the ride.

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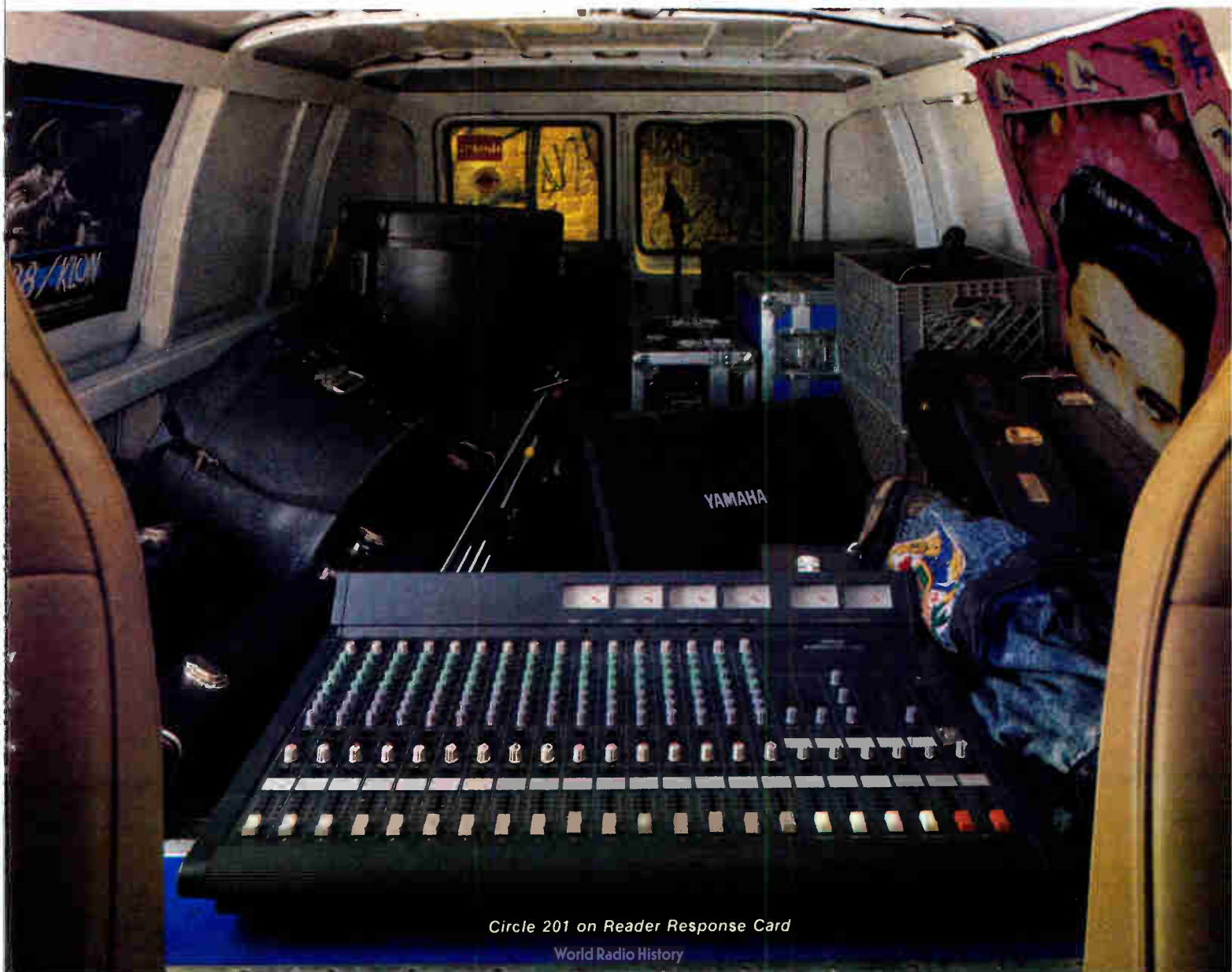
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and cost of the VAMP program. EASY-VAMP requires only four floor plan isobar transparencies per horn, and the cost of the program is free. For a copy, contact University Sound's Advertising Department.

**DOCUMENTATION**

Operation of this design aid is briefly, but clearly covered in two pages of the University Sound Commercial and Public Address Installation Guide. This guide contains a lot of common sense advice as well as a specific design example using EASY-VAMP. Using the design aid with arrays of horns is not covered in the guide, and the intended purpose of EASY-VAMP seems more for distributed systems. Still, there is no inherent reason that simple cluster designs could not be generated with EASY-VAMP, starting with one horn at a time and adding adjacent horns.

**FLOOR PLAN ISOBARS**

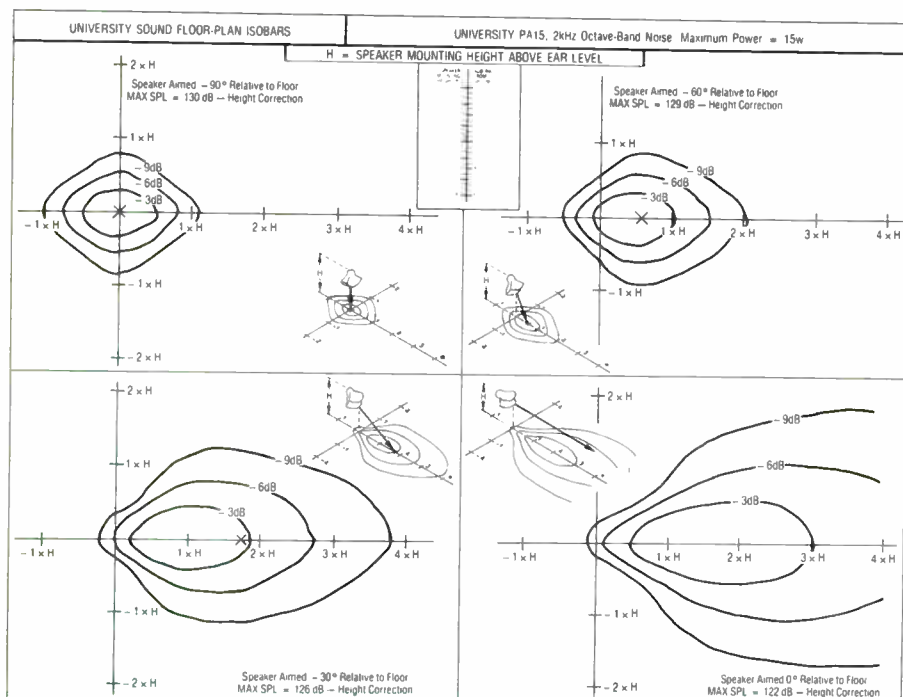
The sound pattern radiated by a loudspeaker can be described by a set of isobar curves. Floor plan isobars show the 2 kHz octave-band footprint for the speaker aimed at 0, 30, 60, and 90 degrees below

horizontal. Two kHz was selected because this band is critical to voice intelligibility. The angle represents a typical range of speaker orientations for practical situations. Intermediate angles may be used if the designer interpolated the information contained in the isobar patterns. The "X" within the three sound pressure contours of the floor plan isobar marks the spot where the speaker is aimed (on-axis) and the contour lines represent locations off-axis where the sound pressure level is constant. The inner contour defines where the sound pressure level is 3 dB less than measured near the center of the contour. The middle contour indicates the coverage area where the sound pressure level is 6 dB below maximum and the outer contour indicates the 9 dB down level boundary. The 6 dB contour can be loosely thought of as the defined speaker pattern traced onto the floor. In Altec's new AcoustacADD program, floor plan isobars are used and a new term for this display has been coined: "Iso-Beams."

University provides a library of floor plan isobars for University Sound products, including a dozen reentrant paging horns, a couple of co-axes, a column speaker and

the Musicaster outdoor speaker. Actually, floor plan isobars of other horns for EASY-VAMP can be generated by the PHD Program's Q-Plus module, or Altec's Acousta-CADD using the "Iso-Beam". The isobars can then be printed out and copied onto transparencies on any copy machine. All you would need is a friend with one of these programs.

Each floor-plan isobar is plotted in graphical form with two perpendicular axes corresponding to the horizontal and vertical angles of coverage. Each axis has a series of marks labeled 1xh, 2xh, 3xh, 4xh, etc. The H represents the mounting height of the speaker above ear level and defines the scale of the floor plan. If the speaker mounting height is 10 feet, the resulting scale distances of the marks are 10 feet, 20 feet, 30 feet, 40 feet, etc. If the mounting height is 15 feet, the marks then become 15, 30, 60 feet, etc. Using this method, the size of the pattern on the floor may be determined for a particular speaker height. If the room is drawn to the same scale (or the prints copied on a reducing copy machine), the sound coverage of the room may be predicted by overlaying the floor-plan isobar onto the scaled floor plan of the room.



*Floor Plan Isobar set for paging horn. University Sound.*

**EASY-VAMP PROGRAM FLOW**

A potential location is selected for the speaker. The height of the speaker above the average ear level is determined. A scaled floor plan is drawn on tracing paper. University suggests a simple way to accomplish this is to create a scaled ruler. Calculate and label the marked distances on the floor plan isobar for the chosen mounting height above ear level. A blank note card is laid along the longest axis of the floor plan isobar and transferred to the edge of the card, the location of each marked on the isobar. Label these marks on the card with the appropriate distances. The card can now be used as the scaled ruler for drawing the room onto the tracing paper.

An alternative approach is possible if you have access to a variable reduction copy machine and a light-table. The prints can

then be copied to a sheet of normal weight paper (rather than tracing paper) to the correct scale. Incidentally, a light-table can be easily constructed with white acrylic plastic table top, a wood frame, and fluorescent lights for under \$50.

Experiment with mounting positions and angles for the chosen height by laying the room sketch over various isobars. Ideally, the pattern should cover the entire listening area of the room uniformly, while directing very little sound at the walls and ceiling. The trade-off here is between uniformity of coverage at the periphery of the seating areas versus minimizing slap-back and reverberation, both of which will degrade intelligibility. If the room is "dead," then you have the luxury of more uniform coverage; if the room has reverberation problems, you have to tighten the coverage pattern and sacrifice the direct sound levels near reflecting surfaces.

A nomograph is provided on the floor plan isobar for determining the direct sound level. The nomograph uses the inverse square law; that is, 6 dB drop in level for every doubling distance. No attempt is made to include air absorption or outdoor effects in this calculation.

If the coverage and maximum sound levels are acceptable, then you go on to document the design. If the isobar pattern does not cover the listening area as desired, then the mounting height can be altered, a different pattern horn can be used, or the spacing of the speaker (in a distributed system) can be changed.

Ideally the -3 dB contours of adjacent

speakers should touch but not overlap. Essentially this is the most intuitive way to lay out speakers, yet some of the most sophisticated sound system engineering programs are unable to depict this in an unambiguous way. The PHD Program and Acousta-CAD do provide this capability, but instead of moving overlays through eye-hand coordination, you must continually re-enter the speaker location coordinates into these programs.

### DOCUMENTATION OF THE DESIGN

Trace or copy the isobar(s) and room onto a single sheet for comparison to other designs. Also, compute the max (direct) SPL and note it on the tracings.

## G.R. THURMOND'S HORN DISPERSION CONTOUR OVERLAYS

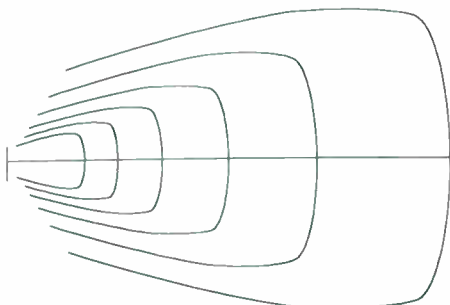
Horn Dispersion Contour Overlays, like Easy-VAMP, does not require any computer or other apparatus (except for the transparent overlays), and there is no mapping or data entry. The user manipulates horn dispersion contours which show the sound dispersion characteristics of standard horn types. These overlays provide a quick means for locating and aiming horns to provide even audience coverage. They are placed directly on scale drawings of the facility (such as can be generated by a copy shop or an in-house copy machine with variable reduction — and some Scotch tape).

Coverage can be immediately seen. Unlike the computer based programs that graphically depict coverage using isobars, moving the pattern does not require re-entering Cartesian coordinates, but one must simply move the transparencies by hand!

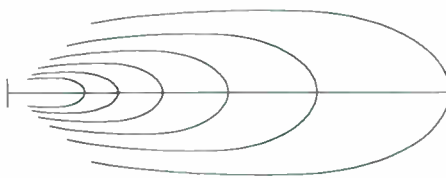
This simplistic approach has some shortcomings, and Thurmond himself pointed these out to me. The most serious assumption is that every horn has a dispersion pattern in a plane perpendicular to the horn axis (footprint) which is a perfect ellipse. Some are closer to a funky rectangle, while one older design that was popular a while ago was actually diamond shaped. Thurmond finds that horns rarely deviate from the assumed perfect ellipse by more than 2 dB, which would probably be okay for estimating purposes. If a tighter performance estimate is desired, then the horn's actual footprint pattern can be obtained (from the manufacturer or from the horn directivity data library of the PHD Program, for example), and compared to the assumed ellipse, and the difference applied as a correction to the indicated coverage. Of course dispersion overlays that are not generic (i.e., 60 x 40, 40 x 20, etc.), but are actual patterns of the horns that are going to be installed, can be used, but then you are losing the minimalist approach that this program is really about and turning it into VAMP!

The overlays also cannot efficiently deal with oblique aimings; that is, when horns are steeply angled downward, such as in a central cluster in an arena. Unfortunately, this is just when intuitive "eyeball" design techniques will fail you, and engineering tools are called for. In fact, the problem of oblique aimings is what motivated McCarthy to develop isobars and his room mapping approaches in the first place. It is possible to use some rotations with this design aid for oblique aimings, and this is covered somewhat toward the end of the manual and in Thurmond's AES paper.

The overlays themselves consist of a number of isobar contours, both horizon-



*Horizontal Isobar Overlay, 60 x 40. Thurmond and Associates.*



*Vertical Isobar Overlay, 60 by 40. Thurmond and Associates.*

tal for plane view and vertical for elevations, which indicate the points of equal sound level around a horn. The contours are drawn at 3 dB intervals, which allows interpolation to 1 dB. As we move toward the origin, each contour line represents a 3 dB increase in level, while as we move away from the origin, a 3 dB decrease in level is denoted by each line. The overlays may be used with drawings of any scale; the only imitation is the actual size of the overlay and the drawing. Overlays of direct radiators, column speakers, and other devices may be custom ordered from G.R. Thurmond and Associates.

## DOCUMENTATION

A fairly complete ten page manual is provided, which includes good advice, graphics and some design examples. Additional information can also be gleaned from G.R. Thurmond's recent AES paper on this design technique. Although it is not specifically linked to the overlays, Thurmond also has devised an intriguing way to calculate the approximate reverberation time of a small to medium size facility by calculation of the (acoustical equivalent) of people in the space. If you are ordering the overlays, be sure to ask Bob Thurmond about his Absorption Equivalent to a Person (AEP) technique.

## DESIGN FLOW WITH HORN DISPERSION CONTOUR OVERLAYS

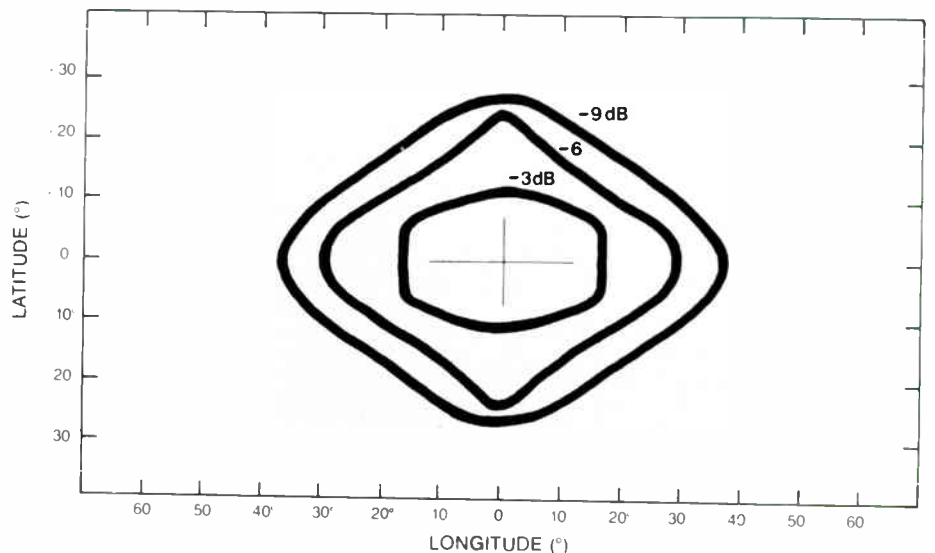
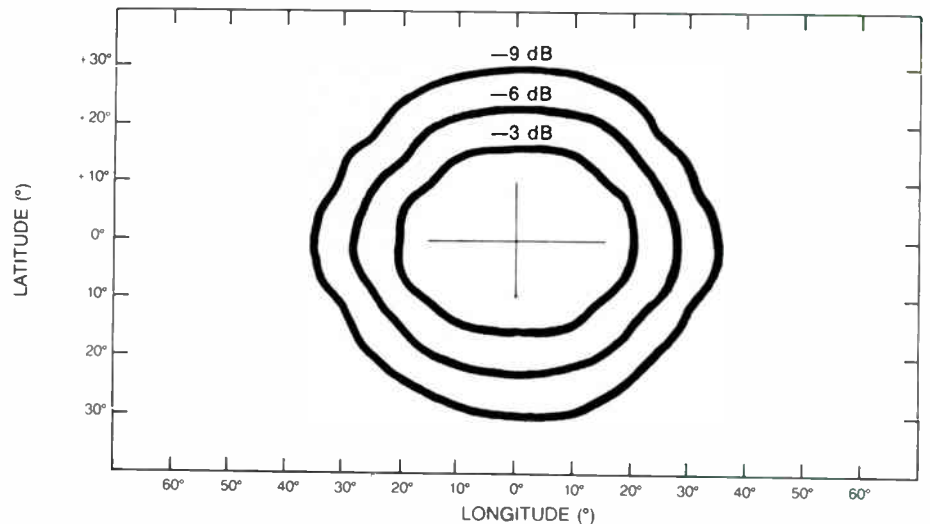
One horn at a time is selected and optimized. Thurmond suggests you start with the most difficult areas, the front to rear coverage in the most distant seats. A front to rear section drawing through the seating area is required. The ear level height is marked off by a line 4½ feet above the floor. The goal is to have even direct sound level along this line. An overlay is placed which shows the vertical dispersion of a horn on the drawing, with its origin at the horn location and its aim in the same direction as the actual horn. We then see how well the ear level line aligns with a contour line on the overlay. The closer they match, the closer you have come to your goal.

## VDP's AUDPAD AND VIDPAD

Video Design Pro (VDP) is best known for full scale libraries of audio and video equipment drawing and data files for the AutoCAD computer-aided-drafting program. Their library disks are expensive (various packages are available, but most of their programs cost a few grand over the cost of AutoCAD) and generally more comprehensive than what most sound contractors and consultants need. VDP is most successful with heavy hitters such as the television networks and video pro-

duction facilities contractors.

For non-CAD users, VDP has AudPAD and VidPAD. These scale drawings of video and audio equipment also include detailed specifications. Each piece of equipment is represented in scaled front and top views of the model, with its accessories and system block views of each showing input/outputs and connectors. Some applications for these design aids are: comparing specifications and equipment selection, making drawings for system flow diagrams, building scale models, on-site consulting, drafting, and preparation of operation manuals for



*Real horns do not have elliptical "foot prints," as assumed by the overlay program. Altec Lansing.*



installations.

PAD (Paper Aided Design) is intended for those who want to speed up their design and do not have access (or do not want access) to a computer, or as a reference for a CAD user.

Functioning of PAD is straightforward. Pricing is reasonable at \$190 for the audio set and \$190 for the Video set.

### CONCLUSIONS: EASY-VAMP, HORN OVERLAYS, AND AUDPAD

Easy-Vamp is a useful aid for distributed systems and is able to show the coverage of obliquely aimed speakers. Aside from showing maximum direct sound levels and uniformity of coverage, the user is also provided with an instant and intuitive feel for the effects of changes in horn selection, location, and aiming. Specific horns, direct radiators, and column speakers are included in the floor plan isobar library. This design aid is easy to learn and use.

The Thurmond Horn Dispersion Overlay program provides documentation showing how to use the overlays for clusters, but the design aid cannot easily be used for obliquely aimed speakers (speakers aimed downward at steep angles). The program only provides generic horn patterns (90 x 40, 60 x 40, 40 x 20) which somewhat limits the accuracy, as specific horn idiosyncrasies are not accounted for. This approach is the opposite end of the spectrum to programs that attempt to account for apex angle, acoustic centers, phase response versus coverage angle, etc., etc.!! The Horn Dispersion Contour Overlays are handy for quick estimates of the coverage requirements of sound systems. As with Easy-VAMP, the nature of the technique encourages experimenting with and tweaking a design until adequate results are obtained.

Both programs are genuinely useful as quick estimators of horn patterns, locations, power levels required and uniformity of coverage, and also as a reality check regardless of whether you do your design work manually or by computer. ■

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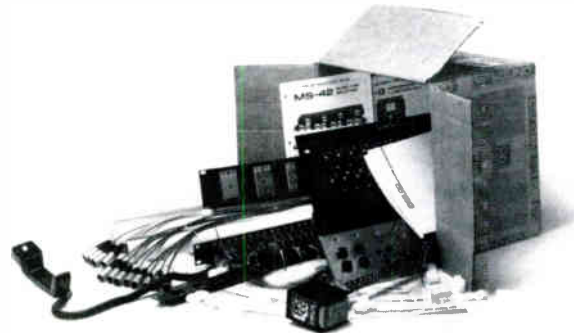
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# U P D A T E



## News from around the Industry

### New Designs; New Shipments; New Purchases

#### Teaching Facility

The Joiner-Rose Group is providing acoustical and technical systems design for a mass communications teaching facility at Middle Tennessee State University. The 85,000 square foot facility will feature two music industry control rooms and studios, MIDI labs, television stage with audio and on-air control rooms, two video post rooms, ten video edit suites, music labs, classrooms and seminar rooms, along with a pop music archive with a media restoration control room and lab.

#### Boardroom Facility

TSI in Mineola, New York is providing the audiovisual design services for law firm Hunton & Williams' headquarters in Richmond, Virginia. The facilities will include a boardroom and dining room with rear screen projection of video, slides and computers, and teleconferencing system; along with a paging system, staff lounge, computer support training facility and a mock courtroom with fixed video cameras and VCR playback.

#### Klipsch Purchased

Klipsch & Associates, Inc. has been purchased by Fred S. Klipsch from Paul W. Klipsch, the 85-year-old company founder. Fred Klipsch, a businessman from Indianapolis, is a cousin of Paul Klipsch, and becomes chairman of the board of the company. Paul Klipsch remains with the company in a technical and market advisory position. Other management is unchanged, including Woody Jackson, president and chief executive officer,



*Fred S. Klipsch (left) and Paul W. Klipsch (right).*

and Jack Fountain, executive vice president.

#### Digital on Hold

Audiocom is now providing its Promotions on Hold service with an equipment option of digital voice recorders for playback of the "messages on hold" programming. Audiocom president Ron Deblinger says, "While cassette decks are more affordable, digital recorders require no maintenance and provide reliable transmission of the on-hold programming."

#### Sing-Along for Nightclubs

Pioneer Laser Entertainment, Inc. has released two new software discs for its Laser Karaoke system. Volumes

11 and 12 each contain 28 popular songs for consumers to sign along with. Songs include Bon Jovi's "Livin' on a Prayer," and "Say, Say, Say" by Paul McCartney and Michael Jackson.

#### Blue Ribbon

Telex Communications, Inc. has been awarded a Blue Ribbon Contractor status by the U.S. Army Communication — Electronics Command. The company has supplied antennas to the armed forces for over 20 years.

#### Executive Benefits

Representative Dan Rostenkowski, Chairman of the House Ways and Means Committee, has announced his support for repeal of the "Section 89 employee benefit plan nondiscrimination rules." Section 89 was enacted in 1986, and established rules that reduced tax deductibility for "executive only" health benefit plans. The rule was widely seen as bringing hardship to small businesses.

#### Typed by Voice

Dictaphone's Digital Express EM integrated voice processing system links a Kurzweil voice recognition system and a Speech Plus speech synthesizer to Dictaphone's Digital Express dictation products. The company designed the system for hospital emergency rooms where physicians can produce typed reports in "less than a minute" with no writing or transcription.

#### "Advanced Television" Advances

Nine U.S. companies have agreed to provide funding to Faroudja Research Enterprises for continued development of the company's SuperNTSC advanced television transmission system. The investing companies are Capital

# THE IEQ WITH Smartcurve™

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The IEQ with Smartcurve™ is a programmable, high performance graphic equalizer that includes a video output. For those who wish to enjoy the video output of the IEQ, ART makes the IEQ Video Monitor.\* Smartcurve™, proprietary software developed by ART gives you instant actual frequency response as easy as the push of a button. The IEQ Family consists of both the 2/3 octave and the 1/3 octave graphic equalizers. Both types come in two varieties, Controllers and Satellites. A Controller is a self-contained programmable intelligent graphic equalizer capable of controlling 15 satellites at once. IEQ Satellites are exactly the same unit except the front panel controls are eliminated.

#### IEQ Model Specifications: Controller & Satellite

- 128 battery backed presets
- MIDI
- Frequency Response  
20Hz-20kHz  $\pm$  0.5dB
- THD  $\leq$  .009% @ 1kHz, 0dBm typical
- Dynamic Range  $\geq$  100dB typical
- Balanced inputs and outputs

#### \*IEQ Video Monitor Features

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

It Has To Be A Work Of . . .

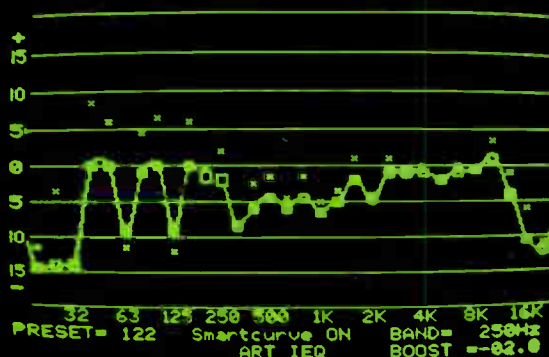
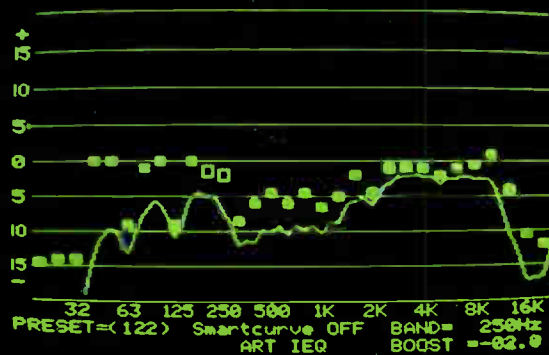
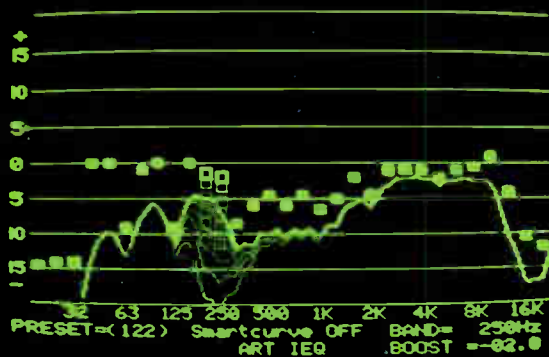
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## 1 See the Sound

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

## 2 Hear the Sound

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

## 3 Perfect Sound

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



World Radio History



Cities/ABC, Comcast Cable, Continental Cablevision, General Instrument, Newhouse Broadcasting, Scientific Atlanta, Tele-Communications, Viacom, and Westinghouse Broadcasting.

**PLASA Success**

The Light & Sound Show 89, held in London in September by the Professional Lighting & Sound Association (PLASA), grew in attendance in this, its twelfth year, with 5,510 people attending. Next year's show will again be in London, September 9 through 12, 1990.



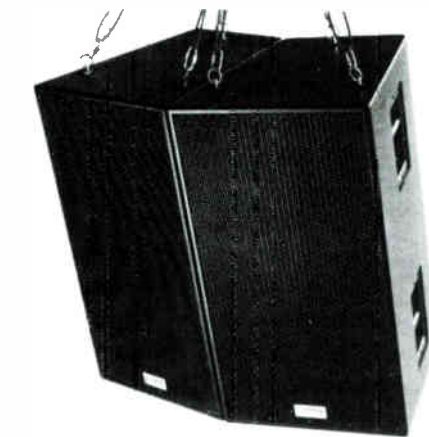
*Light & Sound Show '89.*

**THAT and the New dbx**

New, "reduced-cost" dbx 321-Series noise-reduction circuit cards for satellite, microwave and cable transmission are being shipped by That Corporation, the company formed by former dbx employees, which purchased dbx OEM products in June of 1989.

**Virtual Array Shipping**

Eastern Acoustic Works has announced that its KF600 Virtual Array Systems "is available for immediate shipment now that the factory's pre-



*EAW KF600.*

production commitments have been fulfilled." According to EAW president Ken Berger, prototypes of the system were well received, and large orders were made before the company went into production.

**Voice Messaging Franchises**

Voice-Tel, which offers voice messaging service bureaus on a franchised basis, is networking together all its franchised locations. The program is scheduled to be available to Voice-Tel subscribers in the first quarter of 1990. According to Charles M. Feuer, president of Voice-Tel, the service will allow "a local telephone message that can be transmitted anywhere in the country for less than fifty cents, and can be automatically sent to 250 people and networked to 1,500 locations."

**Tape Duplication in China**

Electro Sound has sold music duplicating systems to three companies in the People's Republic of China — Simex, Kong Sen Tape Factory, and Shaanxi Audio.

**Products**

**New Loudspeaker Systems; DAT Portable Recorder**

**Coax-Based Speaker**

Radian has introduced two series of coax-based loudspeaker systems: the CE Extended Range Series, and the CS Standard Series. The CE Series provides "extended low frequency response in modest sized enclosures" for applications where full frequency response is important and "lower efficiency can be accommodated." The CS Series provides "normal low frequency response in modest sized enclosures with standard efficiency ratings." According to the company, the point-source systems permit wide angle dispersion of high frequency program material (averaging over 100 degrees). Systems are available with 8-

or 10-inch coaxials, in a variety of configurations for passive or active crossover, and 70-volt distribution. The rear connector panel is recessed into the enclosure and has gold plated five-way binding posts.

*Circle 10 on Reader Response Card*

**Digital Signal Processor**

Digitech has introduced the DSP 256 Digital Multi-Effect Signal Processor offering up to four digital effects simultaneously at a full bandwidth of 20 Hz to 20 kHz with 256 memory slots (128 factory presets and 128 user programmable presets) and MIDI mapping. Signal to noise ratio is 94 dB.

*Circle 11 on Reader Response Card*

**Integrated and Power Amps**

The Series 5000 is a new line of packaged amplifiers by Paso Sound Products. Features include low impedance mic inputs, dedicated 600 ohm tel page input with level control, line inputs, adjustable mute circuit, booster output and 30-20 kHz transformer output. There are five models in the line, four integrated amplifiers and one power amplifier. The entire line can be rackmounted with an optional kit.

*Circle 12 on Reader Response Card*

**Isobar for Frazier**

Isobar tabular data is now available on Frazier CAT loudspeaker systems for use with the PHD/CAD program or the Bose Modeler Design Program. CAT (Coincident Aligned Transducer) features, according to Frazier, "acoustic alignment with phase and time parameters strictly controlled."

*Circle 13 on Reader Response Card*

**Portable DAT**

The Panasonic SV-255 portable DAT recorder has a newly designed microphone preamp with a 128 dB signal to noise (EIN) ratio, along with a true gain control, rather than a fader-style attenuator, and a new dual-channel mono recording mode, which allows a signal at the right channel input to be recorded at full level on the right channel and 15 dB lower on the left channel for a backup in field recording. As with previous Panasonic DAT models, MASH analog-to-digital converters are used.

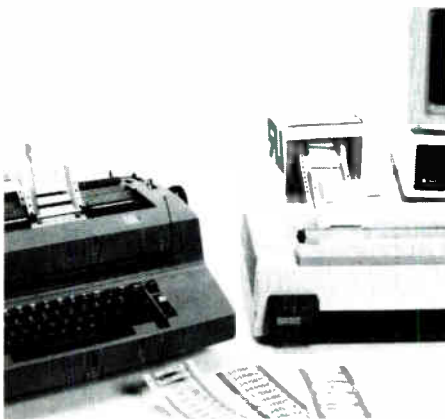
*Circle 14 on Reader Response Card*



**Cable Fasteners**

Cord-Lox fasteners are available from Toleeto Fasteners International. Enhanced with Velcro, the fasteners come in 19 models from 5/8" x 3" to 1 1/2" x 24" and in neon-like colors. The company will customize the fasteners with special size or color or logo.

*Circle 15 on Reader Response Card*



**Cable Markers**

Readyprint markers are available from Raychem Corporation. The product, supplied in a ladder configuration, consists of sleeves made from flattened heat-shrink tubing secured between two hole-punched polyester strips. Readyprint sleeves feed directly

from the shipment box into standard typewriters and printers, including dot-matrix printers. The sleeves can be printed on the front and back.

*Circle 16 on Reader Response Card*

**Crystal-Controlled SCA Tuner**

SMC International has announced its NT-1A SCA tuner, a fixed frequency, crystal controlled, superheterodyne tuner with a single subchannel output. The front end is crystal controlled and uses a diode protected dual gate D-MOS field effect transistor RF amplifier with a noise figure of 1.5 at 100 MHz. The subchannel systems are incorporated in a monolithic chip, which provides 60 dB of limiting and demodulators which permit "exceptionally good" AM rejection and signal-to-noise ratio.

*Circle 17 on Reader Response Card*

**Voice Storage System**

Racom is offering two new modifications to its 1700X Multi-Channel Voice Storage System, a digital recorder/announcer. The SP46 modification functions as a multi-channel digital announcer with the ability to take a poll. It incorporates a liquid crystal display which gives the total number of times each of the three characters was selected. The SP47 modification allows interactivity with the caller and can store 64 different messages.

*Circle 18 on Reader Response Card*

**A-to-D and D-to-A Converters**

Electrovert Inc. has introduced a "new family" of analog-to-digital and digital-to-analog converters featuring 8 bit and 12 bit resolution. The modules feature high linearity plus-or-minus 1/2 least significant bit; conversion speed of 3µ secs (8 bit) and 20µ secs (12 bit), analog connections with floating 0 point; digital connections directly capable of SPS; auxiliary voltage 24 V plus-or-minus 20 percent.

*Circle 19 on Reader Response Card*



**New Control System**

TSI's audio-visual control system, the Syscon 200, includes control cards that can apply to video projection or volume control. Each system is equipped with an operator's panel with hinged front for easy access to cards and can include up to three remote panels. The systems can accommodate up to 75 functions per unit, and up to 48 switches per panel. Syscon 200 units can be grouped together and customized.

*Circle 20 on Reader Response Card*



**Trapezoid Enclosures**

SoundTech has introduced the STS Series of trapezoid design enclosures. The STS122 is available with either Ozite carpet covering or a black matte painted finish. The reinforced cabinet is plywood and is delivered with flying hardware. The bi-amped STS122 is a two-way tuned port system with a heavy duty cast frame 12 inch speaker along with an Electro-Voice 7" x 9"

constant directivity horn coupled to an E-V titanium driver.

*Circle 21 on Reader Response Card*

**Sound Reinforcement Console**

The Soundtracs SPA sound reinforcement console is in production. The console is available in frame sizes to accommodate 24, 32, 40 and 48 inputs. The input modules feature a five-band parametric equalizer, nine auxiliary sends, and a wide range low noise electronically balanced input. Main metering is provided by eleven Vu meters; all busses are balanced. Ribbon cable was chosen for bussing, because "a solid bus was considered inappropriate and inadequate for a console which will be subjected to severe mechanical stress in the course of normal use."

*Circle 22 on Reader Response Card*

**Collet Knobs**

Elma Electronic has a line of standard color knobs employing a collet mechanism to attach to shafts, eliminating set screws or springs. "The result," says Elma, "is absolute positioning accuracy with no slippage and

total electrical isolation of shafts." They are available in six colors and in a wide range of sizes with either matte or gloss finish and a range of accessories such as figure dials.

*Circle 23 on Reader Response Card*



**Gold Probes**

The 4900K and 5100K Series gold probes from Probe Master include 18 accessories to "access most types of circuitry." The models offer bandwidths of 35 to 350 MHz, a Readout Actuator option and various cable lengths. The Probe Master Convert-A-Tip feature provides a threaded heavy duty tip that can be replaced with a micro-tip.

*Circle 24 on Reader Response Card*

**Literature**

**Book on Microphones; Cable Catalog**

**New Translation**

Gotham Audio Corporation has announced that *Microphones* is again available. The book, first published in 1978, was written by Dr. Gerhart Bore and published by Georg Neumann GmbH. The version now available is the second edition, a new translation,

expanded and updated. Gotham Audio Corporation distributes the book.

**Wire and Cable**

Anixter has introduced its Wire and Cable Catalog as a source for all wire, cable and optical fiber stocked by the



company. The 674-page catalog is organized into 12 sections. Roland Watkins, the company's Vice President of Product Management and Engineering, says the catalog is the most comprehensive generic wire and cable catalog ever produced.

Circle 26 on Reader Response Card

**Sound Level Meter Info**

Rion released a four-page color brochure describing its NA-29 Sound Level Meter/Octave Band Analyzer, a "Type 2," weighing less than 2.5 pounds.

Circle 27 on Reader Response Card

**Micro-Coax Catalog**

A 68-page illustrated catalog from Micro-Coax Components, Inc. offers information on the company's line of MIL-Spec, standard and custom coaxial cable. The catalog features over 100 tables, graphs and illustrations.

Circle 29 on Reader Response Card

**Fiber Optic Link**

Ortel Corporation is offering a new 48-page booklet called *RF/Microwave Fiber Optic Link Design Guide*. Written for microwave engineers and designers, the guide discusses link performance characteristics, applications and advantages.

Circle 30 on Reader Response Card

**RF/Microwave Fiber Optic Link Design Guide**



**People**

**New CEO at Carver; Draney at Wheelock**

**Carver Appointments**

Robert R. Dougherty has been named President and Chief Executive Officer of Carver Corporation. Bob Carver, founder of the company, remains as Chairman of the Board; and as Vice President of Advanced Research, continues his research and development work.

**Wheelock Division Sales Manager**

Ed Draney has been named Division Sales Manager for the Eastern Division for Wheelock, Inc. Draney was previously Regional Manager of Sales for Bogen and Marketing Manager at Valcom. He reports to William L. Goldstein, Vice President, Sales and Marketing.



Barry Schumaker

**Schumaker Promoted**

TIE Communications has appointed Barry Schumaker Vice President Corporate Administration. He joined the company in 1981. Prior to joining TIE, Schumaker was with Condec Corporation and Scovill Manufacturing.

**Perry Appointed at Javelin**

Mary E. B. Perry has been named Marketing Services Manager of Javelin Electronics. She oversees advertising, publicity and trade show coordination. Perry was previously with the American Society for Industrial Security; she has also served as Director, Corporate Communications for the Silent Watchman Corporation.

**Nakamichi VP**

Ted Nakamichi has returned to the United States to assume the position of Vice President, Marketing of Nakamichi America Corporation. Nakamichi has been at Nakamichi headquarters in Japan for the last nine years. Before that he was Director of Marketing and Public Relations in the United States.

**Stewart Named Vice President**

Colin Stewart has been named Vice President, Western Division of New England Digital Corporation. Stewart joined New England Digital in 1987 as Division Manager, Western Region. Before that he was Vice President of Marketing at EMI America Records. According to New England Digital, the Western Division, under Stewart's leadership, has become the company's number one sales territory, generating between a quarter and one third of the company's annual sales revenue.

# AD INDEX

Company	Page	RS #
AKG Acoustics (203) 348-2121	6	—
Applied Research & Technology-ART (716) 436-2720	63	206
Audio Digital (800) 423-1082	18	267
Audio Logic (801) 268-8400	50	244
BGW Systems (213) 973-8090	11	204
Cal-Switch (800) CAL-SWCH	49	289
Comtek (801) 466-3463	33	214
David Clark (508) 756-6216	31	248
Detector Systems (800) 828-7775	47	268
Elenex (800) 356-8433	49	290
Fisher Berkeley (415) 655-9696	21	249
Florence (312) 384-3310	13	243
Gemco (615) 452-5960	3	209
HM Electronics (619) 535-6092	46	286
JBL Professional (818) 893-8411	CIV	203
Lectrosomics (800) 821-1121	41	246
Nady Systems (415) 652-2411	27	237
Numark Electronics (201) 225-3222	55	245
Oval Window Audio (207) 846-6250	42	292
Phonic Ear (800) 227-0735	43	266
Pioneer Laser Entertainment (213) 518-4531	15-16	211
Pro Co (800) 253-7360	61	264
Quam-Nichols (312) 488-5800	8	205
Rane Corporation (206) 774-7309	36-37	207
Samson Technologies (516) 932-3810	23	250
Sennheiser Electronics (203) 434-9190	39	215
Schell Electronics (316) 431-2350	38	291
Shure Brothers (312) 866-2553	28	218
Sonic Systems (203) 356-1136	51	247
Sony Pro Audio (800) 635-SONY	30	251
Stentofon (816) 231-7200	61	265
Technical Projects (800) 562-5872	24,26, 29	285
Telecall (206) 881-2742	5	212
Telex Communications (800) 328-3771	25	208
TOA Electronics (800) 843-4753	45	216
Vega (616) 695-6831	CII	202
West Penn Wire (800) 245-4964	CIII	217
Williams Sound (612) 931-0291	35	213
Yamaha Pro Audio (714) 522-9011	57	201

## UPDATE

### 30 Years Ago

It was November 1959 and the big story of the month in *Sound & Communications* was Bowling. That's right: Bowling. This great American pastime had, in the late 50's, become big business for all involved, including the sound contractor. Close talking Bogen-Presto interphones were used to avoid the problem of extremely high noise levels in the typical bowling alleys of the day. Interphones were used to report trouble in the alleys, call the kitchen for service, and so that a nursery attendant could call the counter for help.

Interphone systems incorporating voice paging features had become very popular in industrial and commercial applications because of its advantages over conventional voice paging systems. *Sound & Communications* provided its readers with a much-needed, comprehensive primer on the installations and servicing of these systems in the November issue.

The controversy of the month within the industry involved multiplexed stereo broadcasting and the lack of a standard system. Manufacturers were misleading the public into believing a standard had been accepted before the FCC had made a decision. Twenty-two stereophonic systems were being examined for AM, FM, and TV. Many questions, including that of compatibility, stereo performance, and bandwidth required to provide good stereophony, had to be decided.

The New Products section of the November 1959 issue featured the Audio Baton made by Blonder-Tongue Laboratories. This sound filter device which controlled "audio response, octave by octave," was able to eliminate feedback in P.A. systems and improve the soft speaker system technique. In addition, the Federal Aviation Agency adapted the Audio Baton for its own special use: safety. This device, in early experiments, helped to ease tension in the tower and the cockpit by cutting down noise and raising intelligibility.

Other new products included Tape-Athon's "Marketeer," which was a P.A. system that provided background music, continuously, and intermittent commercials through the use of a tape player at 3¾ ips.

Advertising in the November issue included "an exciting new pushbutton telephone" with "dramatic new features," called the Rapidofon. Made for the desk or the wall, the Rapidofon by Tele-Norm Corporation was expandable — from two to seven stations!

In addition, Magne-tronics Inc. introduced its "Motivational Music"; "the QUALITY background music Program Service," for playback on continuous tape players.

...And that's the way it was, thirty years ago.

—Steve Jacobs

## CALENDAR

### Upcoming Events

#### NOVEMBER

**Georgia Tech Education Extension Course: Quality Control Using Physical Measurement Parameters:** Orlando, FL. Contact: 404-894-2547. November 6-7. Also, **Acoustical Noise Control**, November 3-10.

**International Hotel/Motel & Restaurant Show:** New York, NY. Contact: 212-686-6070. November 11-14.

**Georgia Tech Education Extension Course: Architectural Noise Control:** New Orleans, LA. Contact: 404-894-2547. November 13-14.

**Georgia Tech Education Extension Course: Modern Techniques for Machine Vibration Analysis:** San Francisco, CA. Contact: 404-894-2547. November 15-17.

**Lighting Dimensions International 89:** Nashville, TN. Contact: 212-677-5997. November 17-19.

# MARKETPLACE



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(continued from page 26)

ing coupled to the entire building 110 VAC line through the primary side of the high voltage neon transformers. I noticed that the high voltage wires were just twisted together at the splice points. They were not shielded either. Nor were the transformers grounded. In effect, what I had was a very broadband (DC to Light) high level signal source that was using the entire proscenium arch plus the high voltage feed lines as an antenna. Couple this with the fact that the broadband signal

With as much interference as the neon was causing, both in bandwidth and strength, I decided to move the receivers and the antenna diversity off the stage and into the balcony. I also hoped that I would be on a different AC circuit.

Most all professional wireless receivers have good RFI filters built into the AC circuit inside the receivers. The filters, however, only remove the RFI from the AC line after it gains entrance to the receiver. If the RFI is strong enough, it can radiate from the AC line just outside

had metal cases with additional metal shields built into the cases. They were stock from the manufacturer. Most of the interference was apparent when the MC stood right next to the vertical neon tubes located either stage right or left. I found that by having the transmitter antenna horizontal on the MC's body we could once again gain marked improvement. I felt that the RFI was getting into the transmitter through the transmitter antenna, and by rotating the transmit antenna 90 degrees from the neon it helped reduce the RFI. I also rotated the receiver antennas to the horizontal, but found that they worked best at a 45 degree angle from the vertical.

One additional point of RFI intrusion would be the microphone cable and head that plugs into the transmitter. Since I was using ECM-30 mic's and the transmitters had all of the latest RFI modifications on the microphone jack there was not much I could do. However, I would like to have tried a dynamic mic. I have a feeling that the electret has some real problems rejecting that strong an RFI field.

Did it work? Most of the time it did. On a scale of one to ten I would say that before we did anything, I would rate the operation of the wireless to be a dismal 3. After doing the best we could I would say that it was a tolerable 7.

In addition to the above I am convinced that it could be made to work as well as a system would work without the neon. The added precautions would be:

Enclose all of the neon tubes in 1/4-inch hardware cloth. (Nobody said it would be easy or cheap). Ground the hardware cloth to an earth ground (Not the "U" ground of the AC system).

Use shielded high voltage cables to feed the tubes. Since the highest voltage used for most neon is 15 KV, this would also be difficult. The shield should also be connected to the earth ground.

One last point. A couple of years ago, a mixer asked if I could scan the motion picture set he was working on that was using neon. I was happy to oblige. We found in a number of areas that the neon field was quite strong. Some were splices that were not soldered and some were located under the false floor where a few of the transformers were placed.

—Bill Mayhew

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“On a scale of one to ten, it was a tolerable seven.”

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was also travelling down the AC lines and I think you can see why I started to think about moving to Hawaii and opening a reef shoe rental business.

First I met with the neon person. (A side note is that I really do believe that he was subhuman. I say this because he seemed to become quite excited and happy when I showed him the radiated field that his neon was generating. He started to jump up and down and mutter utterances similar to "Far out, man.")

I suggested that he ground the cases of his eight transformers. This actually started to have a very positive effect because he started the grounding process by screwing a rather long sheetmetal screw into the transformer case and then connecting it to the AC ground. After a very short time the transformers would short out, the neon would stop working and the wireless would start working. It took a couple of hours for him to replace the transformers. When he grounded the new ones, he attached the ground using a nut and a bolt through the transformers' mounting ears. I also suggested that he solder all splices. He did not want to do this. He claimed that the voltage was getting to his neon tubes. I told him that it was also getting to my wireless.

the receiver and cause big problems. So I decided to run the receivers on DC. This seemed to help. At least there was a marked improvement between the receivers on DC. I have since learned that a high quality computer AC line power strip, the type you would use to protect your PC from power surges, would help clean up the AC line radiation. Come to think of it, if you added these surge protectors to feed the primary side of the neon transformers you could reduce the AC line radiation even further. If the surge protectors are not available, you can use some bypass capacitors hooked up. The value of the caps should be .01 uf and at least 500 volts. This is not as good as the off-the-shelf protectors, as they also have inline inductors to shunt the RF.

I also ended up removing the antenna diversity system and running the receivers off their own whip antennas. With all of the RFI from the neon in the air I was sure that it was mixing with the transmitter carriers and producing products which would be impossible to calculate. Sure enough, it did improve the wireless operation.

Up to this point, if you think about it, I was just working on removing the RFI that was getting into the receivers. What about the transmitters? The transmitters

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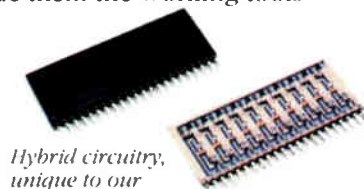
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