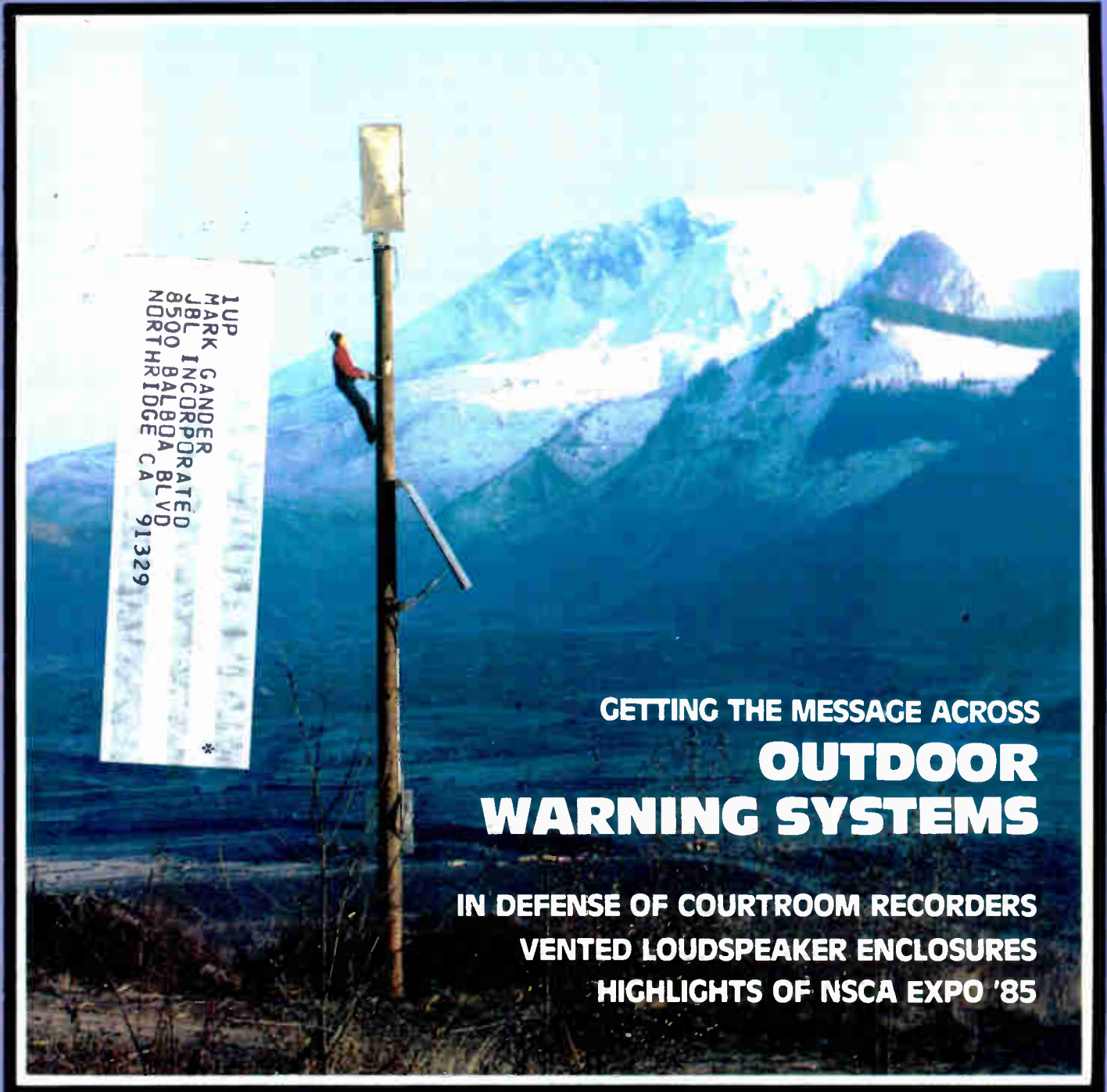


SOUND & COMMUNICATIONS

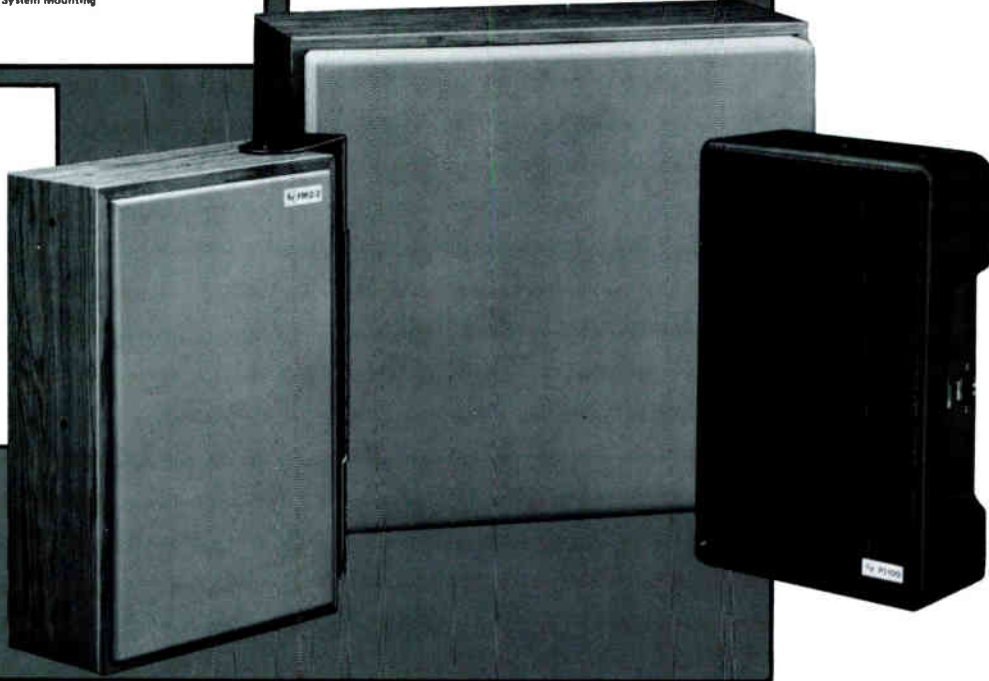
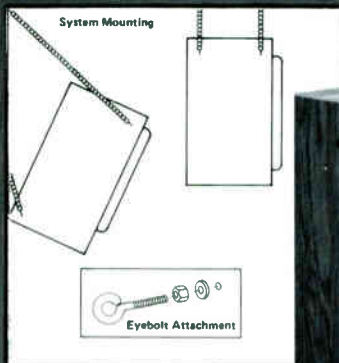
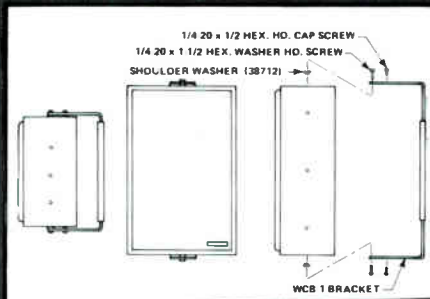
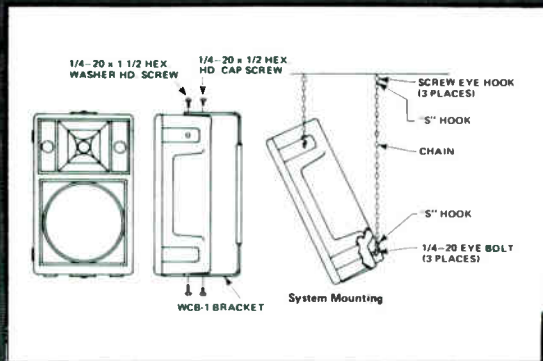
COVERING TELECOMMUNICATIONS
AND ELECTRO-ACOUSTICS

APRIL 1985



GETTING THE MESSAGE ACROSS
**OUTDOOR
WARNING SYSTEMS**

IN DEFENSE OF COURTROOM RECORDERS
VENTED LOUDSPEAKER ENCLOSURES
HIGHLIGHTS OF NSCA EXPO '85



Great Sound In Small Packages

Contractor-Friendly Speaker Systems from EV

We went into the field to find what you wanted most: a wide-angle speaker system that works like a component array, but installs with ease and looks great anywhere. Then we designed our new FR15-2, FR12-2 and PI100 speaker systems to make your job easier.

All systems are factory-fitted with threaded inserts to facilitate suspension. And, with an optional telescoping bracket, the FR12-2 and PI100 can also be wall or ceiling mounted in six versatile positions. For constant-voltage operation, an optional TK60 line

transformer kit replaces the normal direct input panel.

The FR15-2 and FR12-2 have oak-grained, vinyl-covered enclosures, for use indoors.

The PI100's one-piece molded polyethylene enclosure is tough enough to go outdoors.

All three new units are two-way, full-range systems featuring EV's own constant-directivity design which radiates sound over well-defined coverage zones: 90° x 40° for the FR15-2; 100° x 100° for the FR12-2 and PI100. They're all substantially more sensitive (96/97 dB, 1W/1m) and more rugged (100/200 watts long-term average power capacity) than most competing systems.

The FR15-2, FR12-2 and PI100 speaker systems from Electro-Voice. Outstanding performers that install with ease and look as great as they listen. Let us tell you more. Contact Jim Long, Director of Marketing/Professional Sound Reinforcement, Electro-Voice, Inc., 600 Cecil St., Buchanan, Michigan 49107.



TK60 TRANSFORMER KIT





Introducing TASCAM's new rack mount auxiliary signal processing series.

MU 40 Meter Bridge—Four VU meters with peak LEDs switchable in pairs to read either of two sets of inputs, and switchable reference level.

MX-80 Mic/Line Mixer—Eight balanced low Z inputs and a stereo output. Handles -70 dB mic to +28 dBm line levels. Features phase switches, phantom power provisions, patch in/outs, and switchable -10 dBV or 0 dBu outputs.

PE-40 Parametric Equalizer—4-channel, 4-band (overlapping), fully parametric EQ with variable Q, gain and frequency controls, plus low and high pass filters. Ultra low distortion and noise.

RS-20 Dual Reverb—Two channel unit utilizing all new, proprietary three-spring per channel design. Superb fidelity, exceptionally natural sound. Goes more than an octave above conventional units, without pass-through. LED metering.

MH-40 Multi-Headphone Amplifier—Distributes any line level (-20 dBV to +4 dBu) mono or stereo signal to four stereo jack outputs with individual balance and level controls.

For additional information on these and other professional audio products, write TASCAM Production Products, 7733 Telegraph Road, Montebello, CA 90640, or call (213) 726-0303.

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**SPECIFY
QUALITY AND
DEPENDABILITY.
SPECIFY
TASCAM.**

TASCAM
TEAC Production Products

Reader Service #201

SOUND & COMMUNICATIONS

APRIL 1985

Volume 31 #4

FEATURES

- VENTED LOUDSPEAKER ENCLOSURE DESIGN MADE EASY** 14
Written by Drew Daniels, of JBL, the article answers several commonly asked questions about vented enclosure and design and construction. Drew also includes a step by step enclosure design flow chart and a nomography for port design.
- AN EVOLUTION IN OUTDOOR WARNING SYSTEMS** 22
The article by David Hale of Whelen Engineering describes a little known application for sound and communications products; high powered voice and siren warning systems for outdoor use. Whelen has recently acquired Community Light and Sound who make the horns for these systems.
- COURTROOM AUDIO: AN UNDISCOVERED POTENTIAL** 31
Part one of a three part series by Irwin Zucker discusses the use of electronic recorders in the courtroom as a potential source of business for the sound contractor.
- THE NATIONAL SOUND AND COMMUNICATIONS EXPO '85** 34
Scenes and a brief overview of the National Sound and Communications Show Expo '85 which was held in Orlando, FL, last March. Expo '85, held for the first time away from the Electronics Distribution Show, was well attended.

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Sound & Communications (U.S. P.S. 943-140) is published monthly by

Sound & Communications Publications, Inc.

220 Westbury Ave., Carle Place, N.Y. 11514 516-334-7880

President, Vincent P. Testa, Vice President, Paul G. Gallo

Subscription rates: U.S.—3 years \$37.50, 1 year \$15.00 Canada and Mexico—3 years

\$48.00, 1 year \$18.00 Foreign and South America—1 year \$25.00

Second Class postage paid at New York, NY and at additional mailing office

Postmaster: If undeliverable notify on Form 3579 address correction

ON THE DRAWING BOARD

COURTROOM RECORDING

In May we will have Part Two of our three-part series on the use of courtroom communications.

FIELD TESTS

In future issues of *Sound & Communications* we will be publishing field tests of such products as the Peavey DECA 700 digital power amplifier and the Bose 402 Tandem-tuned bass system.

AIRPORT COMMUNICATIONS

We are working on a story which covers the massive recent audio refurbishment of the LA International Airport, including paging, emergency systems, and computer control systems.

COVER PHOTO

Our April Cover photo was taken of the solar powered WS-3000 outdoor warning system at Mt. St. Helens, Washington by George Whelen IV. Solar power was utilized since the nearest electrical service to the siren was miles away. The siren system was installed at Mt. St. Helens due to concern that the Toutle River, silted in by the ash fallout from the St. Helens eruption, would flood by the spring thaw.

The photos which appear in the feature are of the installation of the high power voice and siren system in St. Louis County, Missouri which is cited in the story. The exception being the black and white photo on page 29.

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Circulation audited by
Verified Audit Circulation Corp.

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that won't
cut you
off.



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Why buy two mics when one will do the job? Check out the new Shure 838.

SHURE

THE SOUND OF THE PROFESSIONALS... WORLDWIDE

Reader Service #202

RAULAND-BORG V. LATHEM TIME RECORDER ANNOUNCES SETTLEMENT

Lathem Time Recorder Co., Atlanta, GA, has announced that a settlement has been reached in conjunction with the infringement suit filed by Rauland-Borg. The lawsuit, which sought an injunction on further sales of several of Lathem's master controls has been dismissed. Also included in the settlement is the model manufactured by Lathem for Bogen. The settlement provides a cross-licensing arrangement between a Lathem and a Rauland-Borg patent.

TANDY/RADIO SHACK ENTERS THE BUSINESS PHONE AND CELLULAR PHONE MARKETS

Tandy/Radio Shack has entered the business phone and cellular phone market. Radio Shack System 802, a key system, and Systems 1201 and 2101 electronic telephone systems are being sold through 80 Radio Shack Telephone Centers in the U.S. While Radio Shack will not install the systems, they are making telephone marketing representatives available to evaluate customer needs and recommend a system configuration. There are other business phone systems sold at retail with no installation, and reports are that most businesses don't want to save money by installing their own -- they'd rather let an established interconnect supplier do the installation, and follow-up service.

In the business phone market, Tandy has completed marketing agreements with units of Ameritech, GTE, Bell Cellular, and Radiofone for cellular telephone service. Via agreements, Tandy will offer one-stop shopping for cellular telephones at Radio Shack Telephone and Computer Centers.

COMMUNICATIONS CORPORATION OF AMERICA WINS \$565,000 CONTRACT

A news brief in the February 1985 issue of *Sound & Communications* misidentified the recipient of the \$565,000 contract for the purchase installation and maintenance of 72 Thompson-CSF Communications Opus 20, 40, and 80 hybrid key systems for the El Paso School District. The contract was awarded to Communications Corporation of America (CCA) of Dallas, TX.

NEW REP FIRMS FOR DUKANE AND AIPHONE CORPORATIONS

Jim Shane, national sales manager of Dukane's Commercial Sound Products, announced the appointment of Dick Schnepf Associates as Dukane Rep in Southern California, Southern Nevada, and Arizona. The George Pettitt Company will represent Dukane in Northern Illinois and Wisconsin. For more information, call Betsy Fiden: (312)584-2300.

Hiko Shinoda, president of Aiphone Corporation, announced the appointment of Alby Currant Sales of Victor, NY as their representative for upstate New York and Bob Gunn and Associates of Dallas, TX for Texas, Oklahoma, Arkansas, and Louisiana. For more information, call Stan Kohagan: (206)455-0510.

TIE RELOCATES MURA DIVISION, REPORTS RECORD SALES FOR 1984

TIE Communications has announced that its Mura division, a supplier of home telephones and audio products, is relocating from Hicksville, NY to TIE headquarters in Shelton, CT.

TIE also reported that its 1984 sales rose to a record \$501,066,000 from \$324,078,000 in 1983, an increase of 55 percent. Net operating income, however, fell a full 55 percent due primarily to inventory write-downs and the financial deterioration of TIE's Technicom International subsidiary.

AT&T FILES SWITCHED 56KBS TARIFFS FOR NEW PHONE SERVICE

AT&T has filed tariffs for a 56kbs service that would allow high-speed data transmission over a public switched network in much the same manner public (analog) phone services are used. Switched 56 service is scheduled for availability in 34 cities by the end of 1985.

1985 TELECOMMUNICATIONS EXPENDITURES TO EXCEED \$600 PER TELEPHONE

Datapro Research Corporation (a division of McGraw-Hill) of New York City reported that Americans are expected to spend, on the average, more than \$600 per telephone this year. A major portion of the total \$130 billion "phone bill" for equipment and services will be borne by business customers as their communications costs continue to escalate. Datapro reports that the telecommunications budget can range from four to ten percent of a company's total revenues, especially for large corporations. Several new reports from Datapro offer help in reducing communications costs. For information, call: (212) 512-3851.

WALKER TO INTRODUCE FIRST POCKET-SIZED CELLULAR TELEPHONE

Half the size of any portable cellular phone currently on the market, the Walker "pocket cellular" should be available in September or October of this year.

TOA ELECTRONICS/USA ANNOUNCES MAJOR RESTRUCTURING

Sam Sakata, President of TOA Electronics/USA announced a major restructuring within the company. TOA is now divided into three corporate divisions: administrative, marketing, and operations. The "corporate stream-lining" coincides with their 50th anniversary in Japan and 10th in the USA.

MACMILLAN TO BUY ITT PUBLISHING

ITT Corporation has agreed to sell its publishing business to Macmillan Inc. ITT Publishing includes Howard W. Sams & Company, Bobbs-Merrill Co., Michie Co., and Intertec Publishing Corp., publisher of Sound & Video Contractor magazine. Terms were not disclosed nor were plans for the future of these publishing groups.

COMMUNITY LIGHT AND SOUND ACQUIRED BY WHELEN ENGINEERING CO., INC.

Community Light and Sound, manufacturer of fiberglass horns and enclosures, the M4 Midrange driver and other loudspeaker products, has been acquired by Whelen Engineering Co., Inc. Whelen is an internationally known manufacturer of visual and audible signaling devices ranging from revolving lights for emergency vehicles to siren products. Whelen is also noted for the development of effective high power all-electronic voice and siren systems used in outdoor, indoor, and mobile applications.

LONG ISLAND SOUND SYSTEMS BECOMES "TELSPEC VOICE AND DATA SYSTEMS"

Long Island Sound Systems, Inc., one of the nation's largest distributors of business telephone systems, has changed its name to Telespec Voice and Data Systems, Inc., since its acquisition in 1984 by Telecommunications Specialists, Inc. Long Island Sound was recognized as the 10th largest in installed base of key telephone systems and the 17th largest interconnect company overall (USA) by Teleconnect Magazine

GROWING UP

by Chris Foreman

A Promising Child

We had a great beginning. At one time, the U.S. electronics industry focused almost all its efforts on sound and communications. First there was the telephone. Then came radio. The sound industry's glory years arrived with the talking motion picture and the first "public address" systems. The communications industry came into its own with the idea of universal telephone service and with nationwide radio broadcast networks. The phonograph brought low-cost entertainment into the home. Frequency modulation, high fidelity and then stereo sound became realities.

The Sore Thumb

If you trace the development of these "sub-industries," you find that most have continued to develop in the areas of technology, market size, and public image. One exception stands out like a sore thumb: the "public address" industry and, to some extent, its cousin, the wired intercom industry.

Here are the symptoms:

Technology

With few exceptions, the P.A. and wired intercom industries are still based on technology available in the 1930s. Check it out if you don't believe me. Read the preface of Don and Carolyn Davis' *Sound System Engineering* or a book called *From Tin Foil to Stereo* by Oliver Reed and Walter Welch or Harry Olson's classic *Acoustical Engineering*. Now, I don't mean to imply that there haven't been changes. Designs have been updated, we've borrowed

semi-conductor and digital technology from other industries and the materials used in microphones and loudspeakers have been improved. Yet, very few truly new ideas have appeared since the 1950s and basic research of the quality and quantity that went on in the 1930s seems to have ended a long time ago.

Market Size

Both the P.A. business and the wired intercom business have continued to grow. Yet the growth of these industries appears to be tied to the growth of our American and worldwide economies. In the 1930s, entirely new markets were being created by the development of new technology. There was no depression in the motion picture sound business, it didn't need to depend on national economies for growth.

Public Image

Office intercoms must be sold against a telephone system with inter-office communications capabilities. Guess who usually wins? P.A. systems are often the last thing in the mind (and budget) of anyone building a new facility and, as I discussed last month, *visible* loudspeakers in a building must be avoided at all costs. Even the movies put us down. They let you know the actor is talking over a P.A. system by adding feedback and echo!

What Happened?

It's pretty simple, actually. Radar and other defense communications took over the electronics industry. Atomic physics absorbed the brightest technical minds. The computer

industry rose from its early experimental stage to a full-fledged business. All of these pulled the big businesses, and their capital, away from the production of sound equipment. We were left to fend for ourselves. Our industry had to compete in the big world of the open marketplace with little or no help from our parents.

The Bright Spots

As cast-offs, we actually haven't done all that bad. There are some bright spots. In technology, equalization, at least in its present form, is relatively new and the math that made filter design easier was perfected during and after World War II. Test equipment has made major advances; so have system design techniques. And, I shouldn't downplay the results of borrowed technology and materials improvements. Those two groups of "advances" have brought us a host of improved products from high-power solid state power amplifiers to today's electret condenser microphones.

In market growth, a few bright spots have appeared. Background music, its new offspring, foreground music, and noise masking are examples of innovative ways to take existing technology and create entirely new markets.

In the area of public image, we are receiving great benefit from the now grown-up baby boomers and their love affair with good quality stereo sound. Put one or two avid concert-goers on the church board and you have buyers who won't settle for poor quality sound. As another notable example,

after years of hard work with little return, Dolby Stereo has put film sound back in the public's mind.

But What Else Can We Do?

Anybody who has raised children (or remembers their own childhood), knows the child/adult conflict that goes on inside adolescents. They want to be treated like adults but continue to act like children. They want adult authority but hesitate to take on adult responsibilities. They want to explore the world but long for the safety of the nest.

Our industry is a little like that. After being cast off by our parents, we want recognition as a legitimate industry (why don't we have our own S.I.C. code?) yet, in important ways, we are not ready for the responsibility that it implies. We want authority in the form of our own Division 17 (see S&C's March, 1985 issue) but the question remains "Can we handle it?" We want new products and new markets but we hesitate to make the long-term commitments needed to develop new markets and we *commonly* scoff at truly new ideas when they do appear.

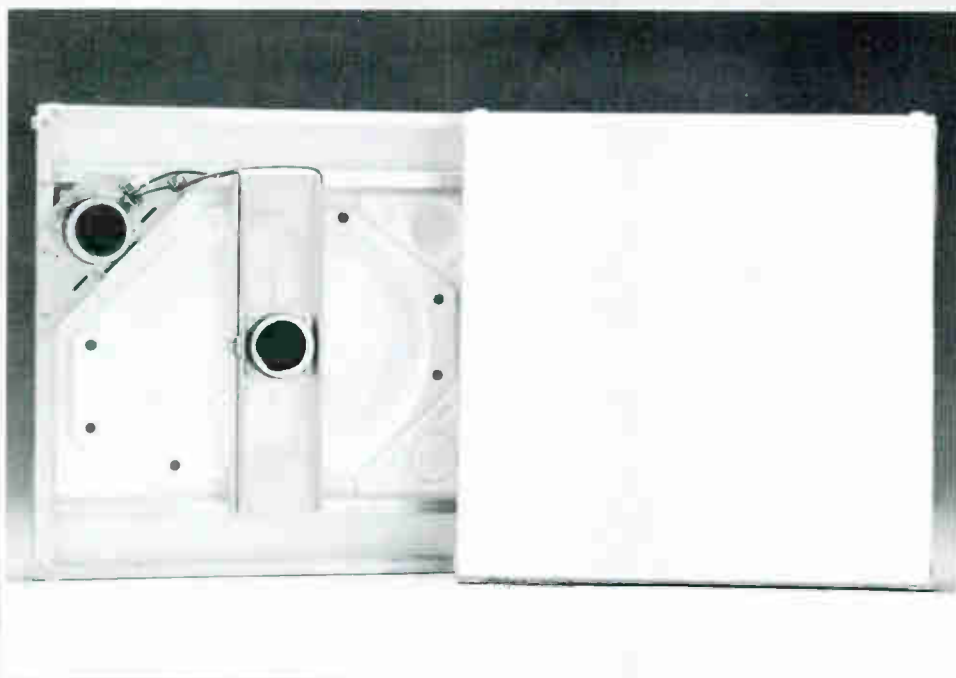
My Suggestions

If we want recognition as a legitimate industry we need to start acting like one. I can think of lots of examples but two important ones come to mind.

First, we need to start supporting *and using* our trade organizations. When I hear the outcry over AES and its show policies, I shake my head. AES is headed by a group of *elected* governors!

(continued on page 36)

Some Things are Better Than Others...



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Reader Service #203

NEGATIVE SELLING

by Chris Foreman

Negative Selling is a group of techniques that can be used to handle objections and to set the stage for that best of all worlds situation, where the customer sells you on the purchase.

Handling objections is one of the basic skills every salesman must learn. Phrases like the following crop up in almost every sales presentation. "The price is too high." "The features don't fit my needs." "The performance isn't up to my standards." "It's too big."

One way to handle objections is to answer them with carefully composed positive replies. For example, a well tested way to handle objections and set the price is too high" is to set the stage during your presentation by getting the customer to agree that quality is very important to them.

In my experience, the trouble with this approach is very simple—it hardly ever works! You've won a point in an argument but the customer, frustrated by having lost that point, will usually come back stronger with another objection. It becomes a game: How many

What can you do instead? The following technique won't work for every product, service, or customer, but I recommend it very highly.

points can you, the smooth-talking salesman, make against your customer.

If you've done your homework, you can probably make the most points and win the game—but you may well lose the sale. Why? In my opinion,

by using this approach to handling objections, you are being dishonest with your customer.

Let's examine the situation again. First, you set a trap for the customer by making the quality point early, in the expectation that the customer would raise the price objection. However, your customers are going to be sophisticated enough to realize they've been trapped and they will not respect you for that kind of selling technique. Second, you held back the price of your product or service as long as possible because you expected a negative reaction from your customer. By so doing, you've confirmed their suspicion that you are withholding information and are not to be trusted.

What can you do instead? The following technique won't work for every product, service, or customer, but I recommend it very highly. Before I explain the technique, a reminder is useful. As you begin your presentation, remind yourself that your product or service is something that will truly benefit your customer. You believe this or you wouldn't (shouldn't!) be selling whatever it is that you're selling! In addition, remind yourself that, at your request, your customer invited you make this presentation. Your customer is truly interested in your product or service and *wants* to be sold on its benefits. Start with these things in mind and you'll find that your relationship with your customer is less a battle between foes and more an agreement between friends.

But let's go on to my negative selling technique. First, I will assume that you have researched your customer very carefully. You know, because you have asked, what things are important to your customer. You know why they are dissatisfied with their present product or service, or, if a new requirement is their reason for asking you to make the presentation,

you have researched the details of this new requirement.

Unless your product or service is perfect, I recommend that you start your sales presentation by *briefly* mentioning the most significant negative points of your product or service.

Don't dwell on the negative points but don't attempt to justify them either. The idea is not to *answer* potential objections but to bring them up yourself. The purpose is to win your customer's trust with your honesty, to surprise your customer by bringing up the objections yourself and to set the stage for the best part, letting the customer sell you.

Imagine that you have a product with a high price compared to its competition. You have researched your customer and know that he is very concerned with product quality. (If this sounds like the old objection/answer technique, don't worry, there's a new twist coming up.) Early in your presentation, you bring up the price of your product and say something like: "The price of this product means it isn't for everyone. Only someone who is truly interested in a quality product will be interested in this." Again, don't dwell on this issue. Move on to other features. Then, later on, come back with something like this: "You can certainly get a lower priced product, but I think you can see that you won't get another product with these features and with this kind of quality. In the end, you have to decide how important the quality and features of this product are to you."

Pauses are useful at times like this. Give your customer a chance to reply. You've turned the tables and made price into something the *customer* must justify, not you and a pause at this point is an invitation to the customer to make that justification *and to sell you on the purchase*. It doesn't always work, but I can testify that it often

does. In more than one situation, this technique has made the sale for me by getting my customer to persuade me that they really are interested enough in the quality and features of my product to pay a higher price. At this point, of course, you ask for the order. You shouldn't need any fancy closing technique because the customer has just sold *you!*

The same technique can be applied to almost any potential objection. If you sell an ugly product that has great performance and a low price, you call it the "ugly duckling" or whatever, and suggest that your customer has to truly benefit from the high performance and low price to be willing to put up with the appearance. Then pause, and let them persuade you that they are, indeed, willing to put up with the appearance in exchange for the benefits of price and performance.

If nothing works, give up gracefully. You've lost the sale but not the customer. If possible, offer to present some other product or service that fits their needs better. Or, suggest they buy from your competition! If they were surprised when you brought up the negative aspects of your product or service, they'll be *astonished* when you make this suggestion! Yet, by doing so, you have reinforced your honesty and indicated that you believe so strongly in your own product or service that you aren't concerned about your competition. This last technique has salvaged a couple of sales that I thought were lost.

I'll admit that my examples are oversimplified, and I'll warn that no sales technique works every time. In addition, a new sales technique should be practiced thoroughly before trying it out on a customer. Finally, if you're not sure enough of your product or service to point out its negative features yourself, don't even think of trying this technique!



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Commercial Sound Division

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Edmonton, Alberta T5S 1K8 (403) 489-5511

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DIVESTITURE: ONE YEAR LATER

by Jerome Brookman

The theory was that divestiture of various AT&T segments would create a good deal of competition between smaller companies, resulting in lower consumer prices. The application has proved otherwise. The ranks of small independent single-entrepreneur interconnect contractors continue to shrink. They're combining, or they are selling out to developing

“Major changes in regulatory policy are like media events. . . There is an announcement, a flurry of speeches, a floor littered with confetti, and then everyone departs without worrying about the cleanup.”

—Macavoy

“chains” of product/system sellers.

Telecom Plus International of Long Island City, NY has bought Compath—a group of five nonregulated interconnect dealers which were operating as a general partnership.

Competition from the public carrier continues to whittle down the sales by independent interconnect vendors have petitioned the FCC to order AT&T/Information Services to explain its termination charges on embedded base fixed-term contracts. The independents cannot determine the relation of such fees to cost recovery by the carrier, nor do they understand how selective waivers of the

charges for some customers are arrived at.

While sales of certain interconnect product remain flat—the give switches—more new product for the small and medium sized business keeps coming on stream. Keyset and small PBX makers see the small and medium sized businesses as something akin to El Dorado. They are overlooking the giveaways that have gripped the local independent vendor: some dealers are sweetening the “deal” by throwing in a small computer. Others are cutting the price to the bone. Profits in the sale of keysets are being reckoned in pennies. Yet, most prime suppliers generate new product for a marketplace that admits to a quickening pace of saturation.

GTE is offering the Micro-Exchange key system featuring 16-button telephone, five plug-in feature packages available in three styles; four lines/eight stations, 10 lines/20 stations; 16/32. Retail pricing runs: \$1,350, \$3,380 and \$5,400, respectively. The product is being marketed through GTE Communications Systems, GTE Supply, independent phone companies and authorized GE dealers.

ITT Telecom's Business & Consumer Communications Systems is offering a smaller version of its System 3100 digital PBX directed at small-volume and medium-volume business users. Called the Compact, it is intended for high-volume PBX/key systems of 40 lines and under. A single module system, it offers between four and 44 ports. Within the 100 programmable features are direct inward dialing, direct inward station access, toll restrictors, station message detail recording, trunk-to-trunk conferencing, hands-free operation and paging.

Let Regulators Regulate

According to Dean Paul W.

Macavoy of the University of Rochester's Graduate School of Management, deregulation, a year later, has not achieved its promised goal. In a recent article in *The New York Times*, he said:

“Major changes in regulatory policy are like media events. . . There is an announcement, a flurry of speeches, a floor littered with confetti, and then everyone departs without worrying about the cleanup.

“That image seems particularly applicable in the case of the most important policy initiative of 1984, the breakup of American Telephone & Telegraph into seven regional Bell operating companies and one remaining AT&T long-distance service organization. The answer, clearly, is that the results will not justify the effort and that the best we can do now is make the most of a bad situation. Beyond that, the Bell breakup demonstrates strongly that we must find ways to keep the courts out of the business of regulating industries.

“In the long run . . . an important change would be to amend the Sherman Act so as to prevent courts from running regulated industries down the antitrust divestiture path. Judge Greene's record in the AT&T antitrust divestiture suggests that courts are worse regulators than either the regulatory agencies or even, heaven forbid, the market itself.”

The promise of divestitures: more competition and lower pricing is nonsense, according to GTE Corporation, the nation's second largest telephone company, in a complaint to the FCC. GTE's brief is the competition among long-distance telephone companies would lessen unless there are changes in federal regulations.

A GTE senior vice president and general counsel said: “The prospects for effective composition in the long-distance market are in severe jeopardy. The

American people may have been put through the wringer of the Bell breakup for nothing.”

What the vice president is seeking is some modification of FCC regulations pertaining to the long distance market; what these should be, he would not say.

However, the non-Bell long-distance operators are up against high access fees, and a possible \$6 billion investment, according to a study by Booz, Allen & Hamilton, in expanding their networks—with dim prospects for profits.

GTE will not abandon SPRINT, according to counsel, but within the independent long-distance service market, there are signs of economic weakening, especially among resellers.

On The Lighter Side. . .

There's always some good in an ill-blowing wind and the intercom market—duplex and simplex systems—is in the midst of an unqualified sales rise of unusual proportions.

Among the suppliers of duplex systems—sold direct or to their local distributors—the market has opened up with vigor: pricing is profitable; and there's some delay in product delivery.

The stock and bond market brokers have been buying/installing private intercom systems. 1000/1500 line systems for international brokers are common. The sale and installation in these systems is through AT&T/Information Systems. Yet, there are some intercom dealers (who never participated in interconnection) who are handling these very systems and some lower unit systems for the emerging healthcare market and the education market.

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Panasonic Industrial Company



Vented Loudspeaker Enclosure Design Made Easy

by Drew Daniels, JBL

Editor's Note:

The following is a paper by Drew Daniels of JBL. We are reprinting it here (with minor edits) because of its unusual combination of simplicity and usefulness.

Part 1 answers several commonly asked questions about vented enclosure design and construction. While the questions are very basic and the answers were written for novices, this section provides an excellent review for experienced enclosure designers.

Part 2 provides a step by step enclosure design flow chart and a nomograph for port design. I like this approach much better than a canned computer program because it reveals the logic behind the process, it gives us the basic equations used in the design and it allows us to use whatever computer or calculator we happen to own. My own preference would be to put the equations on my computer in a spreadsheet program (Spreadsheets vs. Basic Programming, January, 1985 S&C) but you can do as you wish.

The examples in the article are, of course, based on JBL loudspeakers but the overall approach is directly applicable to loudspeakers made by any manufacturer who provides the basic Thiele-Small parameters called for in the flow chart. —CF

PART I: COMMONLY ASKED QUESTIONS ABOUT ENCLOSURES

Many users build their own loudspeaker enclosures. Their audio skills range widely from novice to expert. From the thousands of letters and calls we have received at JBL addressing the subject of loudspeaker enclosure construction, we have determined the most common questions and present the

following questions and answers. The particular questions listed attempt to answer as many questions as we feel are necessary to provide enough information to build an enclosure which will allow your loudspeaker to operate to its potential.

We will concentrate on vented "bass reflex" enclosures, since low frequency horns are fairly complex, and many good tested designs exist. Also, it is often more economical to buy a bass horn enclosure than to build one. Vented box enclosures are by far the most popular enclosure type. Vented boxes are finding increasing use by touring sound companies, displacing existing horn enclosure designs because of the greater low frequency power output and extended low frequency capability they offer when used in large arrays.

In addition to their simple design requirements, vented loudspeaker enclosures offer flexibility of design in shape, weight and component complement, and usually produce the best results obtainable from modern loudspeaker drivers at the lowest cost.

Q: What makes a good vented enclosure?

A: Basically, an enclosure serves to partition the front and rear of the driver's cone, preventing the opposing air pressure changes produced by cone motion from cancelling, and allowing the radiation of sound from the front of the driver only. In addition, vented enclosures allow the compressibility of the air inside the enclosure to work as a more active part of the "system" consisting of driver and enclosure. Beyond these two basic functions, a low frequency loudspeaker enclosure should

do absolutely nothing, that is, it should add no effects of its own—no vibration, no tonality, no motion—nothing to interfere or absorb energy produced by the driver.

Q: Is it possible to get low, punchy bass from a small enclosure?

A: Yes, if the driver in the enclosure is designed for low bass operation in a small enclosure. Unfortunately, it's usually a small driver that can work properly in a small enclosure, and that dictates that lower sound levels will result from the small amount of air such a small driver can move. Larger boxes (with larger bass drivers) produce more bass, smaller boxes produce less bass. It's a fact of life, like the fact that it takes a bass violin, a tuba, longer piano strings, or very large organ pipes to produce bass energy in the air. Low bass requires that more air move, and bigger boxes contain more air that can be put to work making low bass.

Q: Can I get more bass from my enclosure by installing a bigger driver?

A: A given enclosure will not automatically produce more bass when a larger driver is installed, in fact the opposite is often the result.

Q: What about putting two drivers in the enclosure to increase bass?

A: Placing two bass drivers in an enclosure designed for one will usually produce less bass and more midrange output, and will upset the operation of the driver-enclosure system because each driver will behave as though it is installed in an enclosure which has only half the internal volume of the original enclosure (with one driver).

Q: What should I do to use two drivers (for more bass)?

A: There are alternative possibilities. When using two identical drivers, you can build an enclosure with twice the internal volume of the original enclosure that contained one driver, or you can duplicate the original enclosure and stack the two. As the latter alternative suggests, when building the double enclosure, it's necessary to treat the enclosure as if it were two enclosures—you must double the porting used on the single smaller enclosure—although it is not necessary to divide the volume of the double enclosure unless two different driver models (e.g. JBL E130 and 2225) are used and their interaction would be undesirable. A useable example of this might be a 227 liter (eight cubic feet) enclosure divided so that the E130 occupies 85 liters (three cubic feet) and the 2225 occupies 142 liters (five cubic feet). In this case, the ports tuning either chamber to the same desired frequency will be different.

Q: What does port or enclosure "tuning" mean?

A: In exactly the same way the resonant note from a bottle can be raised and lowered by adding or pouring out liquid to change the bottle's air volume, enclosure tuning is affected by the ratio of air volumes in the port (the bottleneck) with its attendant flow resistance, and the enclosure interior volume. Tuning of loudspeaker enclosures is a result of manipulating the differences in effective air mass between the enclosure interior and the air in the port. The bottle-like nature of a vented enclosure is known as a "Helmholtz resonator." The ports or ducts in a vented enclosure work only over a narrow band of frequencies near the



JBL Model 4645

because they are superior to sealed enclosure designs in several important ways—as long as it is possible to tightly control the loudspeaker driver parameters as JBL does. Vented designs produce lower distortion at the lowest operating frequencies, afford the driver protection against mechanically destructive large cone excursion, and better enable the driver to absorb and utilize its full power rating from an amplifier when operating at low frequencies. It is important to keep in mind that porting and tuning an enclosure provides air loading for the bass driver down to frequencies just below the Helmholtz frequency, but does not provide any loading for the driver at frequencies below that such as subsonic turntable rumble, record warp, or microphone wind pickup. If you intend to operate the system at high power, we highly recommend an electronic high-

Q: Where should I locate the port(s) with respect to the woofer?

A: Bass reflex enclosures are usually designed to tune from about 100 Hertz and down. The length of sound waves at these low frequencies is over 11 feet, so port placement is not critical. Ports may be located anywhere on the baffle with no change in bass performance; some designs even locate ports on the back of the enclosure which works well as long as the enclosure is not close to a wall (a couple of port diameters away) and there is an unobstructed air path between the woofer and the port. Overall, it's safest to locate the port somewhere on the baffle with the woofer(s) far enough away from side walls to avoid interaction between port and wall

Q: What should the ducts be made of? Is round better than rectangular?

A: Port ducts may be made of anything rigid, such as cardboard with about a 1.5mm ($1/16$ -inch) or larger wall thickness. They can be any shape, square or rectangular (such that port area remains constant) and made of wood or other suitable material. It is not necessary to use PVC pipe for port tubing, particularly when most carpet stores throw away large amounts of heavy cardboard tubing of between three and four and one-half inches inside diameter.

Q: What is the relationship of duct length to port area?

A: When port area is increased, independently of other factors, enclosure tuning is raised. If duct length is increased, independently of other factors, enclosure tuning is lowered. To keep the same tuning (Helmholtz frequency) you will need to increase duct length as you increase port area.

A given enclosure will not automatically produce more bass when a larger driver is installed, in fact the opposite is often the result.

chosen tuned frequency, producing the same effect noted when blowing across a bottleneck—a single distinct pitch.

Q: Is it always necessary to use a port for good bass?

A: JBL uses vented enclosure designs

pass filter to eliminate subsonic input to the power amplifier(s). This will substantially increase the available useful power from the amplifier which will then only operate in the audible frequency range. Such a filter is the UREI model 501 Sub Sonic Processor.

Q: How big should the port be?

A: The bigger, the better. Any port causes some resistance to air movement, and so introduces unavoidable losses in output to the system as a whole. The ratios of port area and length and enclosure volume determine

the Helmholtz frequency tuning. Mechanical reactance elements, stiffness and air mass, control the effective air mass ratios. At very low operating levels, where air in the port does not move very fast, a small short port will behave the same as a large longer port as far as enclosure tuning is concerned. At high power levels however, the restricted air flow of the smaller port will produce output level losses, some de-tuning and at high enough levels a small port will cause the enclosure to behave like a sealed enclosure with little or no contribution from the port. To minimize resistive losses, the largest practical port should be used. Computer listings of port choices calculated to limit air velocity inside the port duct will list duct sizes which are normally impractical. A 380mm (15 inch) diameter port is not an unreasonable for a 380mm bass driver, however the necessary length would dictate that such a port might itself have a volume of many cubic feet, often equal to or larger than the original enclosure. A good rule of thumb would be to avoid ports whose circular area is smaller than at least one-third the diameter of the driver such as a 127mm (five inch) diameter port for a 380mm (15 inch) driver. This will usually provide sufficient port area so that the port will not "whistle" when the system is operated at high power levels near the Helmholtz frequency—a sure indication of lossiness. If the enclosure is intended for continuous high power operation, use multiple ports, and increase port length accordingly.

Q: Can I use several smaller ports instead of one big one?

A: Yes, however there is a phenomenon associated with air resistance resulting from air drag on the internal surfaces of port ducts and turbulence at the ends of the ports that requires a port length correction when several ports are used. For example, when using four 100mm (four inch) tubes instead of one 200mm (eight inch) tube (which has four times the area but less internal surface area), the length needed will be slightly less than that needed for the single 200mm tube, perhaps five percent to 10 percent less, depending on overall enclosure volume. These effects exhibited by port ducts are exaggerated by proximity of the duct to enclosure interior surfaces or any other type of boundary that may cause air turbulence near the

end of the duct, therefore it's important to keep duct ends away from the rear of the cabinet or other obstructions by an amount equivalent to or larger than the dimension across the port. If you are using a rectangular port that has as one of its sides, an enclosure wall, you might have to use some correction.

Q: Is there a simple mathematical way of designing proper enclosures?

A: Yes, a JBL scientist, D.B. Keele Jr., simplified the work of A. Neville Thiele and Dr. Richard Small so that anyone with a pocket calculator and a clear plastic straight edge can design the right enclosure volume and choose the right port or duct for a given loudspeaker driver. Part two of this article contains detailed step by step instructions, written specifically for non-mathematicians, showing how to use published Thiele-Small driver parameters in enclosure design. Examples are shown with their results graphically represented. An enclosure design flow chart and enclosure venting nomograph are included.

Q: Should the enclosure's baffle be removable?

A: This is a question of mechanical strength and rigidity. All enclosures, particularly those intended for rough portable use, should be constructed with all sides permanently fixed by glue and screws, and sealed air-tight by virtue of well cut and glued joints.

Q: Is there a preferred shape for loudspeaker enclosures?

A: There are a number of shapes that improve performance and some that cause distinct degradation in performance. For single, full-range drivers (e.g. JBL's LE8T) a sphere is the ideal shape for an enclosure because the curved surfaces avoid the diffraction effects of cabinet edges, which bend sound waves in a manner dependent on frequency. For multi-way loudspeaker systems, spheres are usually impractical because of the large size needed and because of the precise orientation required for optimal listening. Conventional enclosures work best mounted flush into a wall where diffraction is controlled by virtue of the wall surface, and for free-standing enclosures, tilting, angled and curving surfaces may be employed to help reduce or control edge diffraction. The overall shape

of the enclosure is relatively unimportant except where the shape makes it difficult to build a rigid enclosure. It is best to avoid enclosure dimensions that are multiples of each other, such as 1 × 2 × 4 ratios, and strive to use dimensions that are somewhat unrelated.

Q: What is the best material to use for building enclosures?

A: For home and permanent installation use, high density particle wood is the most cost-effective material for general enclosure construction. The best wood to use for portable enclosure construction is 14 to 20 ply per inch Finland birch plywood. Birch plywood is very expensive however, and a carefully braced enclosure made of high grade void-free fir plywood can do the job just as well in most cases. The thicker you can make the cabinet walls, the better the results will be because of reduced wall vibration and resonance, but the tradeoff is cost and weight. The best glue for loudspeaker enclosures is the aliphatic resin type yellow glue.

Q: Is bracing necessary? How much should be used?

A: Bracing should be added to the enclosure interior to minimize enclosure wall vibration. Enclosure walls simply cannot be stiff enough since wall vibration indicates that energy is being wasted to move enclosure panels rather than moving air. 25 × 76mm (one × three inches) pine bracing fixed on edge with glue and screws to the enclosure walls will help provide the minimum necessary stiffening without affecting the internal volume significantly. If you are building large subwoofer enclosures, bracing with two-by-fours works better, though you should take the bracing volume into account since a three m (10-foot) length takes up 12.9 liters (0.36 cubic feet) of enclosure volume.

Q: How should I mount drivers on the baffle?

A: Mount drivers on the front of the baffle whenever possible to avoid the reflections from inside the mounting hole. Heavy drivers should normally be front-mounted using Tee-nuts and machine screws or JBL's MA15 clamps. If Tee-nuts are used, apply a bit of glue to the inside of the nut flange to help avoid losing the Tee-nut inside the enclosure when installing the driver. *(continued on page 18)*

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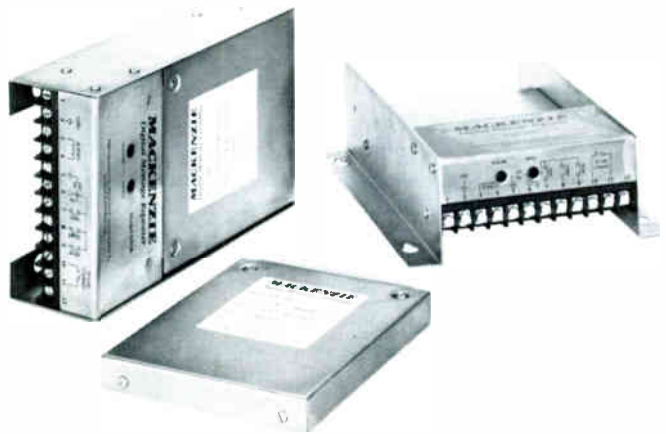
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(continued from page 16)

Q: Do I need fiberglass inside the enclosure?

A: JBL uses a 25mm (one inch) padding of one-half-pound density fiberglass stapled to the enclosure interior on all surfaces except the baffle. You can use 100mm (four inches) thick dacron or fiberglass on at least three non-parallel interior surfaces. Keep sound absorbing materials away from the port(s) as the air velocity inside the port can be sufficient to tear off bits of the material and squirt them out of the enclosure. It is not necessary to cover the inside of the baffle, but doing so will rarely degrade system performance. The enclosure exterior may be covered with your choice of any suitable finish or decoration; this will not affect bass performance and in some cases may help

stiffen the enclosure walls.

Q: Does fiberglass significantly affect enclosure tuning?

A: No, not unless the enclosure is stuffed full of fiberglass, in which case the apparent volume of the enclosure increases by 12 percent to 20 percent as seen from the point of view of the bass driver. Stuffing the enclosure full with fiberglass is not recommended because it introduces system losses, is expensive and interferes with port operation. The exception to this would be a sealed "air suspension" type system enclosure where more virtual volume is needed and actual volume is not available, and/or where box dimensions which are multiples of each other can't be avoided and the fiberglass stuffing will help absorb the internal sound reflections.

Q: What is needed to mount a midrange on the baffle with the woofer?

A: For cone-type midrange drivers, a sealed sub-chamber should be used to prevent interaction with the enclosure's bass driver. JBL drivers suitable for sealed-chamber midrange use require only 10 to 40 liters (.3 to one cubic foot) of chamber volume to operate at typical midrange frequencies, above 200 Hertz. Subchambers should be constructed solidly and liberally lined with fiberglass. As in the case of enclosure shapes, avoiding multiples of dimensions, subchambers should be built so as to avoid square and cube shapes in favor of non-related numerical ratios.

Q: Is there any special procedure for mounting a horn in an enclosure?

A: Use of a horn/compression driver does not require any subchamber since these devices form their own air-tight seal. JBL horns such as the 2344, 2370 and 2380 horn family also seal their own cutout opening in the enclosure when properly mounted on the baffle. Better compression drivers are quite heavy, so a brace should be provided to cradle the driver and avoid driver movement during shipping. In combination with the length of a horn as a lever, driver mass can cause the assembly to tear off the baffle or break the horn if the enclosure is handled roughly or dropped.

DESIGN EXAMPLE USING JBL 2235 FIFTEEN-INCH WOOFER:

2235 DATA: $Q_{TS} = .25$ $V_{AS} = 16.2 \text{ ft}^3$ $f_S = 20 \text{ hertz}$

FIND BOX VOLUME FOR FLATTEST RESPONSE - V_B :

$V_B = 15 (.25)^{2.87} (16.2) = 4.55 \text{ ft}^3$

Is the box size acceptable ?

If it is, then calculate the system's -3 dB frequency - f_3 by :

$f_3 = .26 (.25)^{-1.4} (20) = 36.2 \text{ hertz}$

If the f_3 is OK, calculate the box tuning (Helmholtz) frequency by :

$f_B = .42 (.25)^{-.9} (20) = 29.3 \text{ hertz}$

This box volume will yield the flattest response with no low-frequency passband ripple.

If you want to use a larger or smaller box, calculate the f_3 and f_B using the alternate formula: here are examples using a smaller box of 3 ft³ and a larger box of 10 ft³ with graphs showing the resulting frequency response :

10 ft³ :

$f_3 = (\sqrt{16.2/10}) (20) = 25.5 \text{ hertz}$ and $f_B = (16.2/10)^{-.32} (20) = 23.3 \text{ hertz}$

The low frequency passband ripple is then given by:

$20 \text{ Log} [2.6 (.25) (16.2/10)^{-.35}] = -2.3 \text{ dB}$

3 ft³ :

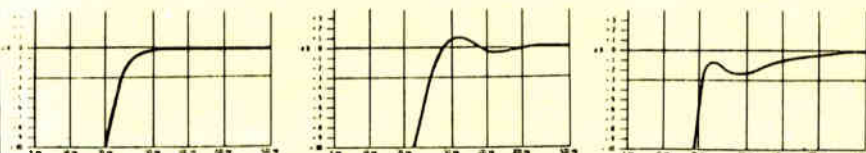
$f_3 = (\sqrt{16.2/3}) (20) = 46.5 \text{ hertz}$ and $f_B = (16.2/3)^{-.32} (20) = 34.3 \text{ hertz}$

Ripple in dB = $20 \text{ Log} [2.6 (.25) (16.2/3)^{-.35}] = 1.4 \text{ dB}$

FLATTEST DESIGN - 4.55 ft³

UNDERDAMPED - 3 ft³

OVERDAMPED - 10 ft³



Sound Wave Length = Velocity of Sound/Frequency (Hz)
 Sound Velocity = 344 m/s, 1130 ft/s or 13,560 in/s
 Area of Circle = 3.1416 × (radius squared) radius = .5 × diameter
 Volume of Tubular Duct = Circular Area × Length

PART 2: ENCLOSURE DESIGN FLOW CHART

What You Will Need:

- [1] A "scientific" pocket calculator. These can be found at electronic parts stores from about \$8. The calculator need have only minimal scientific functions; a y^x key, or the ability to raise an input number to the power of an input exponent. The calculator must also have a LOG key that takes the base-10 log of a displayed number, and of course, a square-root key.
- [2] A clear plastic straight edge about six inches long.

Instruction:

The calculations on the flow chart are simple arithmetic. If you use two sim-

ple rules, the math will quickly become simple.

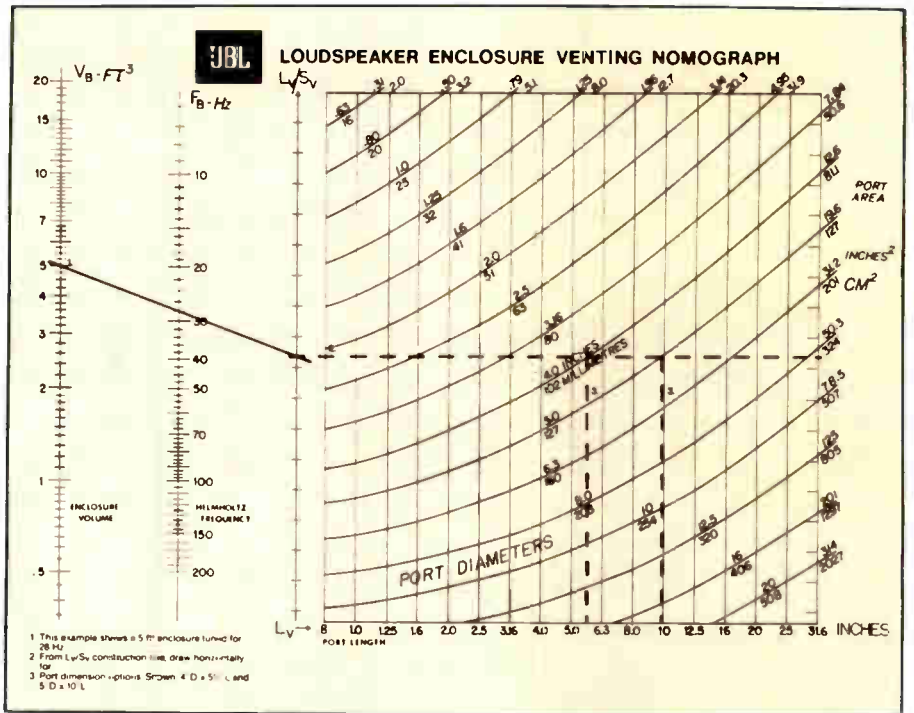
[Rule 1] Calculate equations from the inside out.

Look at the equation. Look for the innermost terms. Taking the first equation as our example: $V_B = 15$ ($Q_{TX}^{2.87}$) V_{AS} , the term $Q_{TS}^{2.87}$ appears inside a pair of parentheses, inside the two other terms in the equation, 15 and V_{AS} . Using the 2235H as our reference loudspeaker, we first raise its Q_{TX} (.25) to the power of 2.87 to obtain 0.0187, next we multiply by 15 and V_{AS} (16.2), in either order, to obtain 4.55, the box volume in ft^3 .

Where a term to be operated upon appears under a radical sign (square-root), do the operation first, then take the square-root of the result, then continue with remaining operations. For example, to find the f_3 of a larger or smaller box, the equation used is:

$$f_3 \cong \sqrt{V_{AS}/V_B} (fs)$$

First divide our V_{AS} (16.2) by the desired box volume, V_B (let's say 3 ft^3 for example), to obtain 5.4, then take the square-root of the result to get 2.324, then, finally, multiply by f_s (20 Hertz) to obtain the answer, 46.5 Hertz, which is the -3 dB frequency for



a 2235 in a 3 ft^3 box.

Where two sets of parentheses of brackets appear, the same rule applies. For example, to find the tuning frequency for the oversized or undersized box, use the bottom equation on the

page: $f_B = [(V_{AS}/V_B)^{.32}] f_s$: first divide V_{AS} (16.2) by V_B ; using a 10 ft^3 box, 16.2/10, then raise the result (1.62) to the power of .32 to obtain 1.17. Now multiply by f_s (20 Hertz) to obtain 23.3 Hertz.

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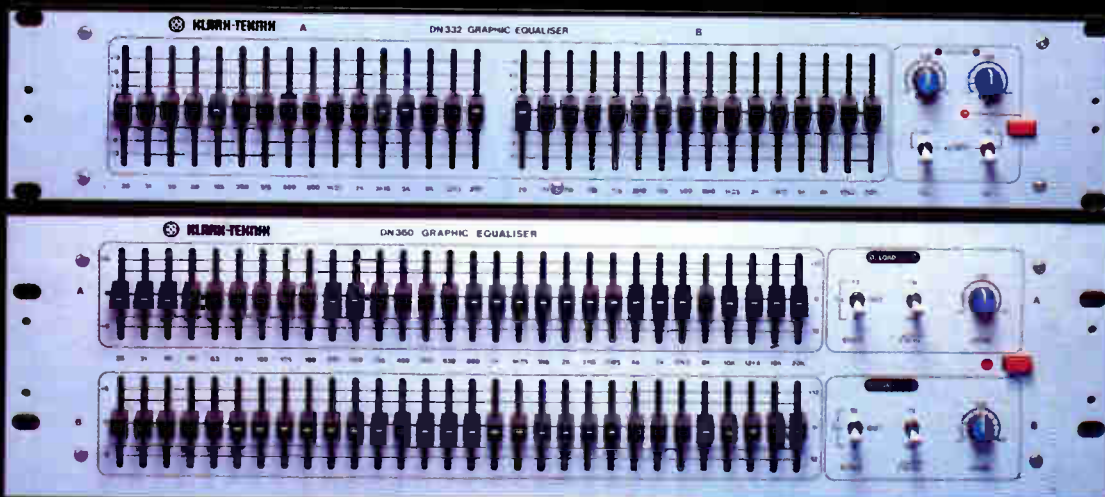
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Reader Service #208

[Rule 2] Ignore the names of the quantities you are calculating.

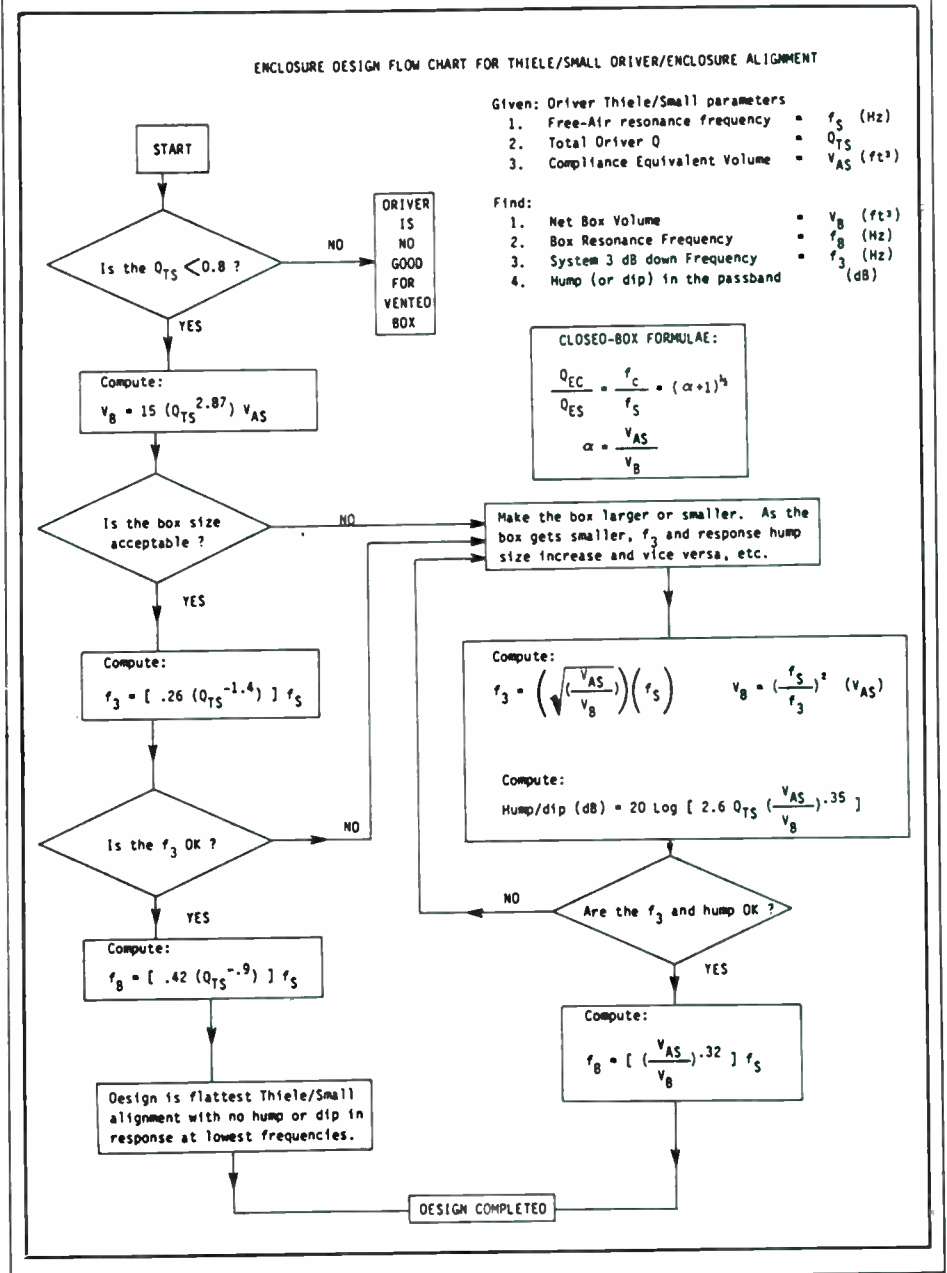
Confusion often arises trying to figure out what to do with the Hertz and the cubic feet, but just remember that the number you end up with at the end of a calculation is the quantity of the term on the other side of the equals sign. As in the case of the last example, the equation is: $f_B = [(V_{AS}/V_B)^{.32}] f_S$ so after calculating you will end up with a number that will represent f_B .

Make a chart something like this:

Box Size 3ft ³	Box Size 4ft ³	Box Size 5ft ³	Box Size 6ft ³
f_s 46.5	f_s 40.2	f_s 36.0	f_s 32.9
f_B 34.3	f_B 31.3	f_B 29.1	f_B 27.5
hump/dip dB +1.4	dB +0.5	dB -0.2	dB -0.7

Make notes of your calculated results! Don't go to all the trouble of calculating without noting your results.

After you have determined what box volume you will be using and what f_B you will tune your enclosure to, you will need to know how to port your enclosure to obtain the desired tuning (Helmholtz) frequency. Turn to the "Loudspeaker Enclosure Venting Nomograph" and place a straight edge so as to intersect the enclosure volume and Helmholtz frequency at the desired points, then make a light pencil mark at the point where the straight edge intersects the L_V/S_V construction line. This point is called the constructive point. Next, draw a light pencil line from the construction point, straight through the chart, parallel to the top and bot-



tom. A set of marks with the same spacing as those on the construction line have been added to the right border of the chart to help you to keep the line parallel.

Your choice of port diameters and lengths now appears at intersect points along the horizontal line you have last drawn. Use the largest practical port size you can, keeping the end of the port away from inside box walls by at least one full diameter's equivalent distance. When ports require ducts to tune low and maintain large port area, ducts may be round, square or rectangular, and made of any material at least as rigid as thin cardboard carpet tube. Port placement is not critical, since ports only operate at the f_B frequency, which is typically low, producing sound waves which are much longer than loudspeaker-to-port dimensions—at 40 Hertz for example, the wavelength is 28 feet.

A Note About Subjective Results: What Thiele-Small Alignment Does:

Flattest Thiele-Small alignment produces a "system" consisting of box and loudspeaker, which provides the smoothest frequency response, phase response and damping (often called "tightness") that a particular driver is capable of delivering. This system forces the driver to produce minimum distortion and phase shift, and allows the driver to handle maximum power at its lowest operating frequencies.

What Alignment Does Not Do:

Flattest alignment will not allow

loudspeakers with small V_{AS} and Q_{TS} and high f_S to produce low bass, because the calculations will place them in small boxes. Drivers with low Q_{TS} , V_{AS} and high f_S are widely used as midrange devices. Midrange drivers usually require relatively small enclosure volumes; porting for such systems does not provide significant improvement in performance over slightly larger sealed enclosures because the drivers never operate at low enough frequencies to produce significant excursion-related distortion.

Flattest alignment does not always give the lowest possible bass response, as the graphs on the example page show. In fact, you may prefer the sound of non-flat aligned speaker systems, or even non-aligned systems, to that of flat aligned systems, using particular loudspeakers. Some good-sounding examples that illustrate this apparent contradiction are open-back guitar amplifier enclosures, automobile speakers and those vastly oversized hi-fi cabinets built in the Fifties and Sixties to house JBL D130s. The most common use of non-optimum alignments is in musical instrument speaker systems. By Thiele-Small standards, a D130-type speaker is a "midrange" driver, but anyone with a 12 cubic foot D130 enclosure tuned low can tell you that D130s make plenty of bass.

The Thiele-Small flat alignment should be used as a starting point from which to judge other enclosure designs that may produce pleasing or acceptable results with particular loudspeakers.

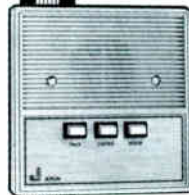
THIELE-SMALL PARAMETERS FOR JBL CONE TRANSDUCERS

	MODEL	SMALL SIGNAL							LARGE SIGNAL						
		Re ohms	Fs Hz	Qts	Qms	Qes	Vas L cu ft	ReEFF %	Sd m ² /m ²	xMAX mm/in	Vd cm ³ /m ³	PeMAX Watts	Le mH		
125 mm (5")	2105H	6.1	200	53	3.0	65	85	0.35	1.2	0062/9.6	1.5/0.6	9.2/6	25	0.25	
	2118H	5.5	85	35	2.4	40	14	5	2.1	0218/33.8	3.0/1.2	65/4	100	0.6	
	2118J	10.3	85	35	2.4	40	14	5	2.1	0218/33.8	3.0/1.2	65/4	100	0.85	
	LE8T-H	5.5	45	56	4.0	65	35	1.2	5	018/28	5.5/2.2	99/6	25	0.3	
250 mm (10")	2122H	5.8	40	23	1.9	26	65	2.3	2.4	033/51	3.0/1.2	99/6	100	0.6	
	E110.8	6.0	65	36	4.0	40	45	1.6	3.0	031/48	2.5/0.1	78/4.8	75	0.4	
300 mm (12")	2202H	5.5	50	16	3.5	17	89	3.1	6.0	053/82.5	3.5/1.4	185.5/11.4	150	1.1	
	2213H	4.4	25	49	8.5	52	235	8.3	0.68	049/78	8.0/3.1	392/23.7	75	0.6	
	128H	5.7	20	24	7.0	25	280	9.9	0.88	053/82	8.0/3.1	424/25.6	100	0.6	
	E120.8	6.3	60	17	1.8	19	80	2.8	8.6	053.82	2.5/0.1	133/8	150	0.4	
E120.16	13.0	60	17	1.8	19	80	2.8	8.6	053/82	2.5/0.1	133/8	150	1.1		
380 mm (15")	2220H	5.7	37	17	5.0	18	300	10.5	8.7	089/138	3.0/1.2	267/16.3	100	1.0	
	2220J	13.2	37	17	5.0	18	300	10.5	8.7	089/138	3.0/1.2	267/16.3	100	2.0	
	2225H	6.3	40	28	2.5	31	170	6.0	3.5	089/138	5.0/2	445/27	200	1.1	
	2225J	12.9	40	28	2.5	31	170	6.0	3.5	089/138	5.0/2	445/27	200	2.2	
	2234H	6.0	23	22	2.0	25	460	16.2	2.1	089/138	8.5/3.3	757/46	150	1.2	
	2235H	6.0	20	25	2.5	28	460	16.2	1.3	089/138	8.5/3.3	757/46	150	1.2	
	E130.8	6.3	40	19	1.8	21	300	10.5	8.8	089/138	2.5/1	233/13.6	150	0.4	
	E140.8	5.5	32	17	5.0	19	300	10.5	4.9	089/138	3.5/1.4	312/19	200	1.1	
	E145.8	5.7	35	25	6.0	26	275	9.7	4.3	089/138	7.0/2.8	623/38	150	1.6	
460 mm (18")	2240H	6.0	30	23	2.2	25	480	17	5.0	130/200	5.5/2.2	720/44	300	1.4	
	2245H	5.8	20	27	2.2	27	820	29	2.1	130/200	9.5/3.75	1230/75	300	1.4	
	E155.8	6.0	30	20	2.2	22	425	15	4.9	115/177	5.0/2	575/35	300	1.4	

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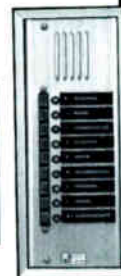
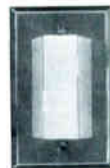
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Reader Service #209



AN EVOLUTION IN OUTDOOR WARNING SYSTEMS

by David A. Hale, Whelen Engineering

Editor's Note:

Many of us remember the Altec Giant Voice system concept. Whelen Engineering has taken that concept and developed it into a complete system with battery powered amplifiers, a unique monster-horn developed by Community Light and Sound and radio-controlled access and testing. This article describes the evolution of the current system, and also describes one application: voice and siren warning for the entire city of St. Louis. Our cover shows another Whelen warning system, installed near Mount St. Helens in Washington.

A major step in the evolution of outdoor warning systems is opening a new market to sound and communications contractors. Recently developed electronic high-power voice and siren systems are now being utilized in massive public warning systems.

More than 40 years ago, outdoor warning and the outdoor warning siren—once limited to the shrill, hand cranked device warning of enemy attack—was modernized by the addition of the electrical motor. Since then, the outdoor warning marketplace has been served by the electro-mechanical, wind-up siren, which could be installed and serviced by most electrical contracting firms capable of working on electric motors and magnetic motor starting relays.

However, today's complex emergency situations have mandated the development of a more sophisticated warning system utilizing high technology. The new high powered electronic voice and siren systems, featuring 2000 watts of solid state power amplification, have reached a level of reliability that is now being widely recognized. So much so

that the Federal Emergency Management Agency (FEMA) has accepted and now recommends the high powered electronic voice and siren system for outdoor warning.

The acceptance of the electronic high power voice and siren system has hinged largely upon performance. But, could an electronic system be developed to project voice and other warning at the same effective ranges as the electro-mechanical siren? Now, the answer is yes.

Whelen Engineering Company of Chester, CT and Community Light and Sound, Inc. of Chester, PA have been working together for several years to bring about this evolution in the outdoor warning industry. At the NSCA Contractors Expo '85 held last month in Orlando, FL, the acquisition of Community Light and Sound by Whelen Engineering was announced, capping a working relationship that started five years ago when these two companies came together with their respective strengths in acoustics and electronics to develop the current state of the outdoor warning system.

Just six years ago, the electronic outdoor warning system had no standing. FEMA, the Federal Emergency Management Association (then known as the Civil Defense Preparedness Agency) published its *Outdoor Warning Systems Guide, CPG 1-27*. The guide cited that "the output capability of loudspeaker sound sources is less than available from siren (electro-mechanical and steam) sources. . . furthermore. . . simultaneous messages from several loudspeaker sources at different distances may garble the signal so badly that some listeners will not be

able to understand voice messages."

Shortly after the guide was released, Whelen introduced the WS-2000 omni-directional High Power Voice and Siren System, the results of nearly 10 years of research and development. Producing 115 dB at 100 foot axial measurement with an 800 Hz tone, the WS-2000 with its 2000 watts of power equaled the performance of many electro-mechanical sirens and brought unmatched clarity to its public address capability, adding high powered voice communications as a viable tool in outdoor warning.

The WS-2000 gained acceptance on the merits of its radio activation system (designed by Whelen), power failure operational capability and its overall siren and public address performance.

For all the good points, however, the WS-2000 did not match the coverage of the 120-124 dB directional electro-mechanical siren. Many municipalities, where terrain permitted sound propagation over long distances, opted for the economy of a siren system that would cover 2.2 square miles instead of a 115 dB electronic system covering less than one square mile. In another marketplace, prompted by the accident at Three Mile Island, the buyers of Prompt Alert and Notification Systems for Nuclear Power Generating Facilities, opted when possible for the highest powered units available. Whelen's experience in producing the right combination of electronics, speaker drivers, and speaker arrays for the WS-2000 High Power Voice and Siren System pointed up the need for a new horn if a 120-124 dB electronic system was to be produced.

(continued on page 24)

(continued from page 23)

At that time, Whelen contacted Community Light & Sound, known for its expertise in the manufacture of horns and loudspeakers for professional and commercial use. In answer to Whelen's need, Bruce Howze of Community designed and patented the WS-3000 speaker, a highly directional horn-driver system comprised of 16 vertically arrayed siren drivers mounted upon individual exponential horn cells which enter into a single waveguide, producing 124 dB at 100 feet on an axial measurement.

The WS-3000 speaker system achieves a highly focused sound patterning which directs clear voice and tone warning to distances of 4800 feet while minimizing high level sound exposure to those nearby the siren on the ground. The use of Community's

fiberglass technology and the incorporation of the high gain exponential horn cells contributes to the low distortion quality of the horn. For alerting in all directions, the WS-3000 speaker would turn throughout 360 degrees.

Before the directional WS-3000 speaker system could be ready for the marketplace two problems required solutions. First, how can one achieve and maintain an electrical connection between the power amplifier and speaker drivers in a system where the horn rotates throughout 360 degrees? Second, how can one overcome the perceived distortion of a public address message from a rotating loudspeaker?

The rotation problem was solved by developing a drive system for the WS-3000 horn which would permit the horn to cover a 360 degree pattern by oscillating rather than rotating. This

system permits hardwired connection of the power amplifier and speaker drivers using a special high flex cable, and avoids the need for a brush ring commutator connection that would create distortion and service problems for the acoustical speaker drivers.

The second problem was solved with an operational approach; when the WS-3000 is selected for public address use, the speaker drive system remains stationary. A radio controlled electronic indexing system designed by Whelen specifically for the WS-3000 rotor permits the positioning of the speaker to the north, south, east or west and the 45 degrees points throughout 360 degrees. A message may then be broadcast to one specific area or be broadcast and repeated as the horn is indexed throughout 360 degrees.

In a large system, multiple units may be indexed simultaneously in the same direction for voice broadcasts, overcoming the distortion anticipated from two systems broadcasting at each other.

The acceptance of the WS-3000 in the marketplace was immediate. Once available in 1981, the WS-3000 was selected by several utilities as the primary tool in implementing prompt alert and notification public warning systems in areas surrounding nuclear electric generating facilities. Following the Three Mile Island reactor accident, the Nuclear Regulatory Commission mandated that all nuclear plant operators in the United States would implement a public warning system for the immediate 10 mile radius of the facility.

The concept of voice and siren warning has been accepted by many utilities and has been included in their emergency response plans. Moreover, with the multiple siren tones available on the electronic siren, these utilities have been able to designate one tone for a plant emergency and allocate other tones for local use such as volunteer fire calls and the standard civil defense warning tones.

A second feature of the electronic voice and siren system important to the utilities is the capability of the system to operate in the event of an AC power failure. The WS-2000 and WS-3000 High Power Voice and Siren systems operate on a 24 volt DC system, which requires AC power to operate a system battery charger. The WS-2000 and WS-3000 systems will operate for 30 minutes of continuous operation from the battery source. This will permit a



Loading off the WS-3000 speaker which is mounted on the shipping pallet.

(continued on page 26)

You and your customers have wrestled with bulky microphones, sagging stands, and awkward cables long enough. Introducing Audio-Technica UniPoint™ cardioid Fixed-Charge condenser microphones. Perfect for the pulpit, podium, and a host of other applications. The slimmest cardioid microphones ever! Easy to mount, adjust, and use.

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sions but wider range and plugs directly into any surface-mount XLR-type connector. No sag. No slip. No stand noise.

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on its own cable, with the electronics module high up and out of sight. Or use the included adapter on a floor or desk stand.

The AT859 is a wand mike with a difference: the *cardioid* pattern. About a foot long, it extends to 18" when you need extra reach. For interviews, talk shows, or to sneak up close in a news conference.

Because of their small diameter, all UniPoint microphones exhibit more uniform off-axis rejection than larger mikes. All can be powered from any 9-52VDC phantom power source, with a battery or an external power source as options. The AT853, AT855 and AT857QM also include a switchable low-cut filter.

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AT859
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AT8102 windscreen

AT837

AT855

AT853

AT853

AT857QM

(continued from page 24)

number of brief activations which may be necessary in an emergency condition and the hours following the emergency.

Promoting the public address capabilities of the WS-2000 and WS-3000 systems has been a long road. Many potential users equate high powered electronic public address with their experience of garbled messages from poor quality, low powered loudspeaker systems. This misconception disappears, however, when they hear the system.

Charles Phelps, vice president for civil preparedness at Whelen Engineering commented, "To this day, I enjoy the looks of surprise on the faces of emergency management officials when I demonstrate our system's siren and public address capabilities in the field. No one expects the power and clarity we achieve. Often at our demonstration, emergency management officials will compare two or three tape recordings taken near the siren station and at various ranges out to a mile. The recordings of our public address announcements taken at the far distances are understandable and nearly identical to the recordings taken nearby."

The WS-2000 and WS-3000 High Power Voice and Siren systems have also been well received by county and municipal agencies for public warning systems. The following is an overview of a large scale, county wide public warning, turn key sale and installation Whelen participated in St. Louis County, MO.

In the Spring of 1979, a tornado struck the northeast suburban community of Florissant in St. Louis County. According to James White, director of the office of emergency preparedness for St. Louis County, a tornado watch had been issued by the National Weather Services meaning conditions were present that a tornado might occur. Spotters dispatched by the county sighted a funnel cloud west of the county near Saint Charles. A warning was issued and sirens were sounded by the county.

Many residents in the northern part of the city of Florissant and residents of an unincorporated area nearby did not hear the sirens. The closest siren to the area was not operational due to the age of the device and there were no county sirens nearby the newly developed homes in that unincorporated area.

At the time, there was no coordinated system for activating outdoor warning sirens in all municipalities in St. Louis County. Several communities in the



The crew sets up the completed WS-3000 system.

county had its own siren systems and several newer communities did not. The county itself had only a small number of electro-mechanical sirens used for warning in unincorporated areas of the county. This system was put in place 20 to 30 years earlier and did not provide warning coverage to the newly populated areas of the county.

The disaster that struck Florissant pointed to the inadequacy of siren warning coverage throughout the county and also pointed to the need for a single point of responsibility and activation for all sirens, municipal and county, in St. Louis County.

Following this incident the public pressed the county for a more effective, updated warning system. Upon orders from the county executive, White initiated a study leading to a proposal for a county wide emergency warning system and single point activation for all municipal and county sirens. A 2.7 million dollar bond issue was presented in 1980 and was passed at the polls by residents of the county.

With equipment needs determined, project specification for the purchase and "turn key" installation of a county wide siren warning system were published for bidding in the Fall of 1981. The project consisted of two county activation dispatch points, 11 municipal activation points, 138 electronic high power voice and siren systems supplied and installed radio controlled, radio controls supplied and installed for 70

existing electro-mechanical sirens, and removal of 30 out-of-service, non-functioning electro-mechanical sirens.

While the magnitude of the St. Louis County project was extensive, the project for the warning system equipment totaled more than 1.4 million dollars. The process and construction procedure is essentially the same for all projects.

Whelen elected to pursue the Saint Louis project as the prime or general contractor for, maintaining a person in St. Louis County full time for project supervision and coordination.

Two sub-contractors were utilized. One was a two way radio sales installation and service firm for the installation of the radio control encoders at the county and municipal dispatch centers. The other firm was an electrical construction firm capable of assembling and wiring the siren station and electrical service onto a 60-foot class one utility pole and setting the system in place.

The construction schedule was arranged to provide the earliest possible installation of new warning systems in the springtime of 1982 for use during the severe thunderstorm and tornado season experienced in the area which typically begins in March and continues through June of each year.

Installation sites for new warning systems, located one year earlier had to be remarked and staked by the county. Spotting the precise location of each in-

stallation site was necessary in order to obtain utility locates for telephone, electric, gas, water, sewer, and cable television lines. It was said, "Call before you dig." If you don't, and you cut a telephone cable or other utility, it's your liability—not only for the repair of the damage but also for the lost revenue due to the downtime experienced in the utility break.

Fortunately, the exercise paid off. Out of 130 individual construction sites, underground utilities were damaged at only two sites, and this was due to poor marking of the locations. At a number of other sites improperly marked utilities might have been hit had it not been for the care of the contractor's line crew in excavating each site.

Several considerations were important in selecting an electrical contractor for the St. Louis County Project. First, the magnitude of the project necessitated a contractor capable of operating several crews simultaneously to achieve production on the job. Second, a contractor with equipment and experienced personnel capable of handling the sixty foot Class I utility pole chosen for the installation in difficult installation situations would be necessary. The 60-foot Class I pole by itself weighs more than 3,500 pounds.

The siren and conduit add another 750 pounds to the total weight of the installation. It is important to note that only experienced electrical contractors should attempt this phase of the installation since in many locations the siren station is to be installed near distribution power lines. At several of the installation sites in St. Louis County, the use of 10KV rated rubber gloves was necessary for handling the siren system during installation where the pole and siren might come near to high power distribution lines, as the system was in the air being positioned for installation.

One pitfall which should be allowed for in the installation of any outdoor warning system project is unforeseen problems with site excavation. The project specification for the St. Louis County warning system installation included a "Rock Clause." In several locations the use of rock drills and blasting crews was necessary. The installation of a system where rock excavation was necessitated added a cost of \$100 per linear foot of rock excavated. The provision of the rock clause permitted additional compensation for this work. To the buyer's advantage, the rock clause provision in a construction con-

"Once the show starts, I don't have time to worry about my mics."

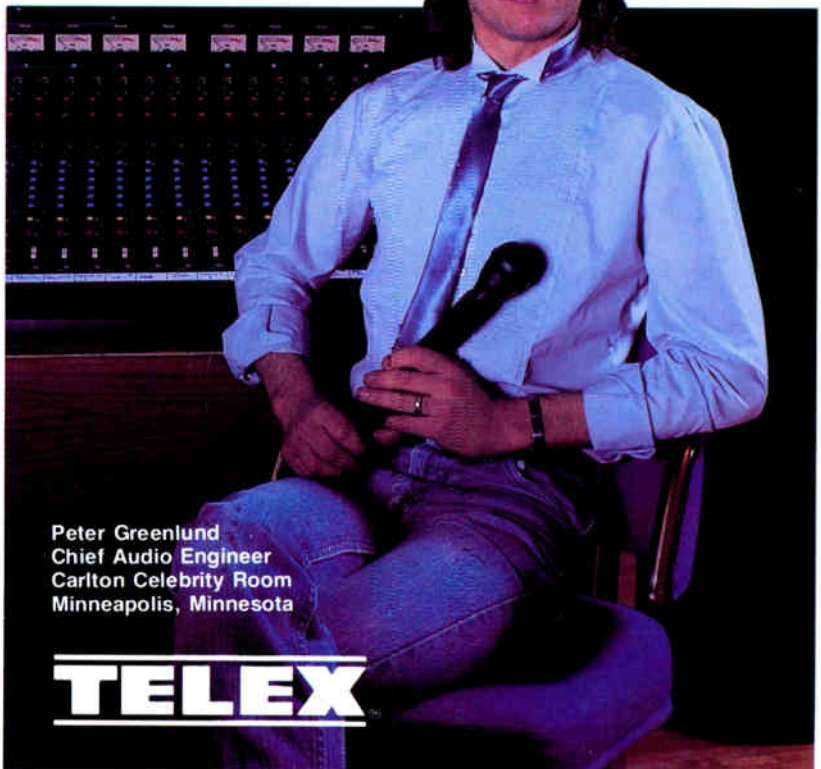
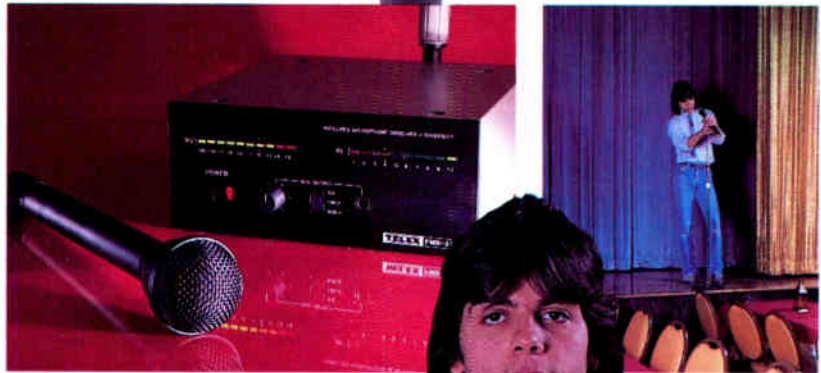
As Chief Audio Engineer for the Carlton Celebrity Room in Minneapolis, Peter Greenlund has miked the biggest names in show business. From the normal speaking voice of an emcee or comedian to the hard-hitting vocals of the rock, country or pop singer, Peter has had to balance his system for all levels of dynamic range and amplification. He knows that his entire sound system is only as good as his microphones, and once the show begins, it's too late to worry about mic failure. When a performer requires a wireless microphone, Peter chooses the dependable Telex dynamic cardioid mic with FMR receiver.

The decision to use Telex as the "house system" was made after carefully evaluating several wireless mics in the demanding acoustical environment of Carlton's Backroom Lounge as well as the larger Celebrity Room. Peter liked the full dynamic range and impressive

signal-to-noise ratio. In addition to great sound quality at a reasonable cost, Telex also provided unmatched signal dependability because of a patented dual antenna diversity option. Now, no matter how far a performer strays from center stage, the Telex dual diversity system effectively prevents "drop-outs" or "picket fencing", and does it without the switching noise commonly associated with other diversity systems.

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Peter Greenlund
Chief Audio Engineer
Carlton Celebrity Room
Minneapolis, Minnesota

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tract means one less contingent expense that a contractor has to build into his bid. The buyer pays for actual quantities removed instead of an estimated figure allocated over an entire bid price.

Unlike smaller projects, where one crew would handle the digging, framing, setting and testing of the system, the scope of the St. Louis County installation required a division of labors over several crews to achieve production. Initially, three, three-man crews were utilized. The crews were equipped with digger derricks (due to the size of the 60-foot Class I utility pole only the larger digger derrick would be used for setting the system in place). A third crew utilized a flatbed truck with a material handling crane. At the start of the day the crew with the largest digger derrick would frame and set one system, then proceed to sites where the two other crews had already framed complete systems to set these systems in place. A production goal of framing and setting five to six systems per day was often achieved. As soil conditions included rock conditions, a specialized crew was added solely for excavation.

Installing the radio controls for the mechanical sirens required lighter

equipment and the work proceeded much faster than new installations. One note of caution: all wiring and grounding to an existing siren system should be inspected prior to installation of a new device for proper and secure connections. These systems sit in an outdoor environment and are subject to vandalism and deterioration. The utility poles should be inspected for structural integrity before any persons climbs or supports a ladder against the pole. Two mechanical systems in the St. Louis County system blew down in a wind storm one day before the installing crews were scheduled to finish wiring radio controls for the system.

Following the completed installation of all hardware in the St. Louis County system an "All Call" test of the system was executed. The verification of each system's activation from the "All Call" test was necessary. For this purpose a test light which indicated that the siren station's radio receiver decoder had received and processed a command was incorporated into each new siren station and radio control for existing siren stations.

Following the All Call test, three crews expended two days patrolling the siren system recording successful ac-

tivations of the 204 systems involved. Units not responding to the activation were inspected and the system was debugged.

Ultimately, the system was handed off to St. Louis County in late 1982. Since that time, the county, through the Office of Civil Preparedness has operated and maintained the system. As time passes the county will replace the remaining mechanical sirens as the units reach a point of uneconomical repair.

With three years of experience with the Whelen High Power Voice and Siren Systems, how does the County Office of Civil Preparedness Director James White said, "The public address capability truly makes it a warning system. The County has utilized the public address feature of the system on several occasions, notably during the floods in December of 1982 to warn residents of Times Beach to evacuate in advance of rising water. During and after the floods, the public address was used to communicate the location of shelter, hot food and potable drinking water supplies."

Whelen benefitted from the experience of a turn key project and as a result produced two useful products for the Whelen High Power Voice and Siren Systems: Diagnostic Si-Test™ and Stat-Back™.

To verify the operation of a siren station, more is needed than a test light indicating the operation of a radio receiver decoder, hence the development of Diagnostic Si-Test. Diagnostic Si-Test incorporates circuitry that examines the performance of the siren station in the Alert Siren tone warning condition as well as in the Silent Test Mode, where by an inaudible tone is imposed throughout the system. Once commanded to operate, the Diagnostic Circuitry examines the system for AC power, DC power at proper operating levels, power amplifier and speaker driver operation and the operation of the rotor.

Once examined, this information is presented on an LED display on the side of the siren station indicating the yes/no operation of the following: AC, DC, Partial Speaker and Amplifier Operation, Full Amplifier and Speaker Driver Operation and Rotor Operation. Without ever opening the cabinet an observer may obtain significant operational information about the siren station. In a system on the magnitude of the St. Louis County system, collecting this data by site inspection is a labor-

TEK-ENTRY SERIES



TekTone's Tek-Entry Series Telephone Entry Systems are complete, automatic call and entry control systems, designed for easy operation and reliability.

Entering a simple 2 (or 3) digit code initiates a system call to the correct phone number. Entry is then permitted by the tenant, if desired. Front panel programming is push button simple.

Telephone Entry Systems

a 1 or 4 minute selectable talk time limit.

Tek-Entry Systems are of aluminum construction and include a metal telephone touch pad and hook switch, armored handset cable and a Lexan® display window.

Features include busy and door open displays, memory retention during a power failure, relay output for controlling elevators, doors or gates and

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and time-intensive process, hence the development of Stat-Back.

Stat-Back is part of the Whelen series of DTMF (Dual Tone Multi Frequency) radio controls which will collect the Diagnostic Si-Test information at a siren site and feed this information back to a dispatch center via encoded radio transmission. Obtaining this information by radio link is a time saving process of confirming siren station operation.

With the successful operation of the St. Louis County Emergency Warning System and the operation of many smaller systems throughout the county the Federal Emergency Management Agency recently endorsed the use of the electronic high-power voice and siren systems in its publication CPG 1-37, "State and Local Communications and Warning Systems Engineering Guidance." FEMA cited four main points supporting the evolution: electronic high power voice and siren systems now equal the performance of high power directional electronic mechanical sirens; they have the capability to operate without AC power, permitting economical power failure operation; electronic high they have public address capability; and the systems are capable of unique and multiple warning tones.

The market for the high power electronic voice and siren system continues to expand. With national attention now directed to the potential for disaster from man-made hazards, emergency plans are being developed for response to accidental chemical releases. Voice warning used to supplement siren alerting with critical life saving information will become part of these emergency response plans as the electronic high power voice and siren system gains universal acceptance. Siren alerting alone does not get the job done. This fact has been emphasized by the reporting of the chemical accident in Bhopal, India. It was reported in *The New York Times*, Dec. 9, 1984, that "when the warning sirens were sounded, residents actually ran toward the plant thinking it was on fire."

With the increasing use of electronic high power voice and siren systems, the sound and communication contractor with a knowledge of electronics, and radio control devices, is in a qualified position to offer the sales installation and service of prepackaged high power voice and siren systems for community-based and industrial applications.

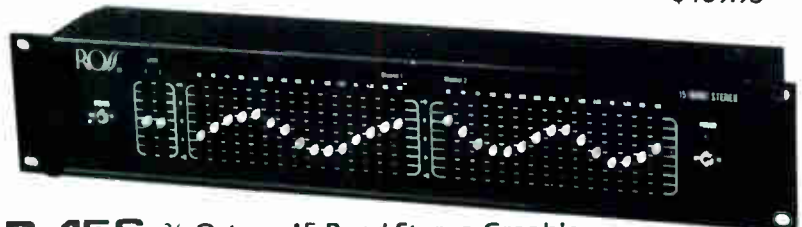


SOUND SHAPERS

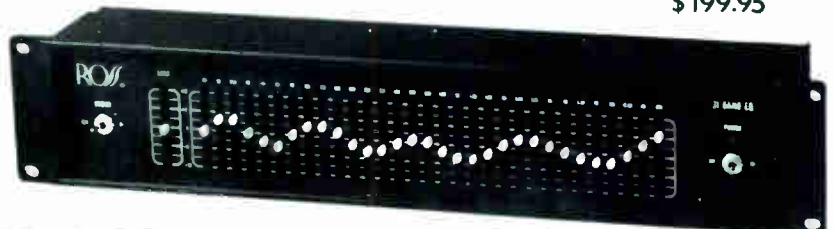
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Reader Service #214

World Radio History



COURTROOM AUDIO

An Undiscovered Potential

by Irwin Zucker

EDITOR'S FOREWARD

At one recent point in my career, I was involved with marketing microprocessor-controlled cassette recorders to courts around the world. These recorders were to be used for taking down records of proceedings electronically in lieu of the traditional stenographer.

As a long-time member of the audio technology community, it had occurred to me many times in years past (probably the first time I saw an episode of "Perry Mason") that magnetic recording would be a more accurate and efficient way of generating a court transcript than manual stenography. So, when I first decided to accept the challenge of marketing audio technology to the courts, it was with the technocrats spirit in mind: "Let's make it better, faster, and cheaper

with a machine." I had been involved with just such implementations for years, and each time the world seemed ready to accept the benefits of new technology.

This time was different. All the previous successes involved selling technology to the technologically aware (or at least, the technologically unafraid). But this time, the people involved in the purchase decisions were more likely to think that a microprocessor was a very short summons server than to think of it in high-tech terms and bask in the possibilities of its benefits. Indeed, many of these folks were actually afraid of the stuff (electronic anything), plus, many people within the court systems in the United States—primarily stenographers and their associates and advocates—viewed this new technology as a profound threat.

Despite these initially disarming factors, I saw this as a potentially lucrative market, especially for sound contractors, who as illogical as it may seem, were virtually absent from serving this market. There have been developments in the last few years which make this market more viable. And I am convinced that it will in the next few years grow into a major source of business for those who establish solid relationships with the judicial management in their local markets.

The purpose of this series of articles is to share with other professionals in the audio industry my views of where and what the potential markets are within the judiciary, and how a sound contractor might develop a solid base of growth with these markets as they develop, or as the sound contractor develops them.

How many of you count repeat business as a major contributor of your success? C'mon. Raise your hands. That's right. Not many. It's the nature of sound contracting to be constantly looking for new customers. How many times can you change the sound system in the same church? And how many times is a new airport built in your area, or new hotel, or convention center?

Sound contracting can be a tough business. Lots of prospecting, spec writing, but little contracting for a period. Then, bang! Your guys are up to their wire strippers in overtime, trying to keep up with the demand for all the last minute, "Oh, yea, we do need a P.A. system in here, don't we".

Wouldn't it be nice to build a base of business with a large customer with a continuing need for sound contracting services, and not just repair and maintenance services? But include new hardware, design, and installation, too. Well, that potential exists in almost every sound contractor's market. It's in the courthouse nearby.

We all know that courthouses are prospects for sound reinforcement, intercom, and telecommunications systems. And you may have undoubtedly put such systems into more than one courthouse, collected their fee, then said goodbye. Too bad, because they probably missed out on a lot of other business. And those sound contractors who have not done much business with the courts probably have not done so because they are not the organization known to the court as the sound equipment specialist. The local office equipment dealer is. That's right. Many courts use specialized electronic audio recorders to take down testimony for transcription. These recorders are outgrowths of compact cassette dictating machines.

The same dealers who sell word processors, copiers, and secretarial dictating recorders to the courts, often also sell them recorders for in-court transcription. The dealers do a fine job of servicing the courts as they would any corporate customer for office equipment. But the audio recorders present special problems, problems which sound contractors deal with every day. Proper microphone selection and placement, concealed cable installation, interface to sound reinforcement systems, background noise control, and environmental acoustics are just a few of the issues that affect in-court recording. Yet they are rarely dealt with in the

professional and capable way of a skilled sound contractor.

If courtroom recording installations were made by professional sound contractors, there would be more installations than there presently are, because such installations would be done better than those currently used. Doing installations could be key for sound contractors to continue doing business with the courts, such as sound reinforcement, telecom, intercom, and security.



Lanier Electronic Recorder



Sony Model BM-146



Gyrr Verbatim Recording System

Before you run down to your local courthouse with your order pad in one hand and a copy of "Early Retirement in the South Pacific" in the other, there are some things you should know about courtroom recording; what it is, where it's been, and where it is going.

Electronic recording (E.R.) is not new. First attempts at E.R. in the United States go back to the early fifties. Nor is the United States, the world's largest judicial bureaucracy, the leader in E.R. lobbying efforts from the National Shorthand Reporters Association (NSRA) have kept E.R.

systems in the U.S. archaic.

E.R. is used only in "courts of record," and such courts are found only in judiciaries founded on English law. Hence, E.R. potential is restricted to nations with their legal roots in England, such as the United States, Canada, South Africa, India, Australia, and a few others. Of these, Canada and South Africa are far ahead of the others.

A few states, Kentucky, Michigan, and Alaska, have adopted E.R. as a standard and accept it either exclusively or the same level as stenography. Kentucky has used E.R. for several years and has evolved their own engineering, maintenance, and training departments.

Michigan's program is significant because the state established a standard for E.R. operators, and tests and "licenses" individuals as certified electronic recorders (CERs). The Michigan program has shown that case loads and costs can be brought down by supplementing shorthand reporters (CSRs) with CERs. However, the use of CERs is authorized only in the lower courts in Michigan. The higher courts are reserved for CSRs, implying some second-class status for the electronic alternative. Nevertheless, Michigan is ahead of almost every other state in implementing an equitable system that embraces E.R. as an acceptable, accurate, and cost-effective system.

One notable exception is Alaska. When Alaska became a state, it had difficulty in attracting certain skills. The more scarce the skill in "the lower 48," the more difficult it was to attract to Alaska. Stenography still continues to be in short supply in all states. So it stands to reason that Alaska had a hard time attracting an adequate supply of court stenographers.

The Alaskan state court system has used E.R. almost exclusively, establishing standards and assembling its own engineering and operator staffs. The engineering team developed equipment from commercially available models, modifying where feasible and building unique circuits and interfaces where special needs existed. During most of the growth of Alaska's E.R. systems, they used a mixture of sound reinforcement amplifiers and microphones with special pre-amps and mixers built or modified. The recorders used were four-channel discrete reel-to-reel models made by Akai for the short-lived quadraphonic fad in the mid-seventies. The recorders were modified

to run at 1-7/8 ips, and getting parts became increasingly difficult as the recorders aged. Since the model was discontinued, additional recorders were virtually unavailable for the expanding Alaskan court system.

In 1983, Alaska did a study to determine the feasibility of switching from reel-to-reel to one of the commercially available four-channel cassette models which are designed for use in courtrooms. There are three models available, Sony, Lanier, and Gyyr; the latter was eventually selected and Alaska has reportedly been phasing in the Gyyr machines since mid-1984.

But you need not be doing business in Alaska, Kentucky, or Michigan to participate in this market. In fact, being in another state can have the advantage of becoming the primary contractor for a court which is converting to E.R.

Unfortunately E.R. is virtually banned in the state jurisdictions of some states, namely California, Texas, and New York. But people are at work in most every state, including these three, to authorize the use of E.R. in state courts. Even in states where E.R. is not authorized in state courts, it may be authorized on the local court level.

The most significant development in recent years has occurred in the Federal Courts. In 1983, the Government Accounting Office published a study, "*Federal Court Reporting System: Outdated and Loosely Supervised*," that blasted the waste and delays created by the human stenographer. The report estimated that more than \$10 million per year could be saved by the federal district courts if they switched to E.R. A second definitive, highly structured, and controlled study was conducted by the Federal Judicial Center. The second study used E.R. and stenographers in several federal district courts during 1983, and the transcripts generated by E.R. transcription services and stenographers were compared to the original audio recordings by a panel of legal personnel. The transcripts made through the use of E.R. were shown to be more accurate, and the cost of installing and operating with E.R. instead of stenography was shown to be substantially less: estimated at over \$13 million per year, \$3 million more than the original General Accounting Office study estimated.

By an act of Congress, federal district judges, at their individual option, may

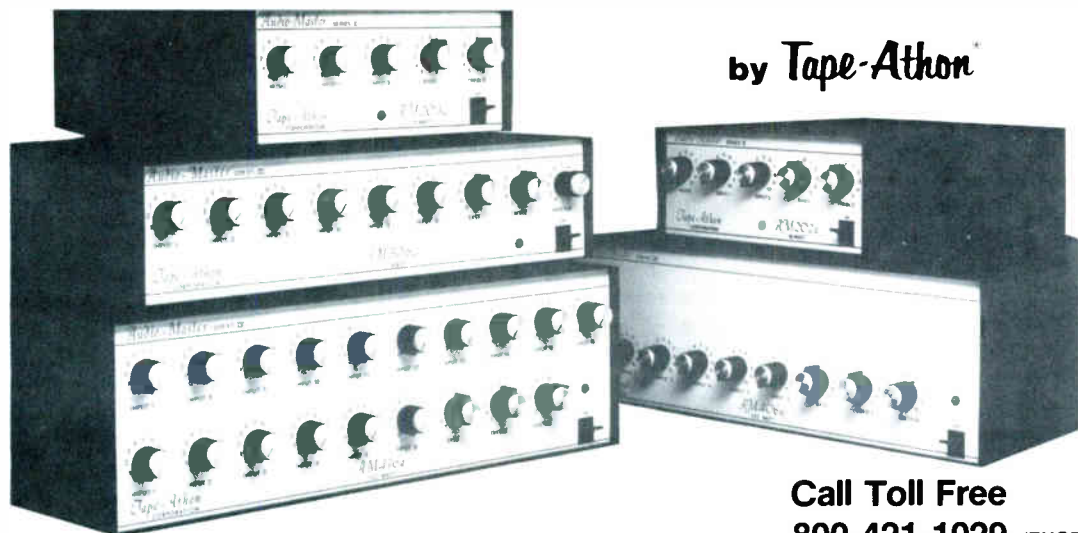
now use E.R. or stenography. E.R. is also authorized in federal bankruptcy courts.

There are federal courts in almost every major city in the country, with other federal applications available in many smaller markets. And local courts, by their sheer numbers, represent a potential that makes the federal system pale by comparison.

Every court, whether state, local or federal, is administered locally. The person to contact is the administrative officer, he may be called the clerk of the court or chief clerk. These people often have the indirect or direct power to establish policy regarding E.R. since they're directly responsible for court reporting and transcript generation. Where human reporters are used exclusively, these executives are constantly under pressure from staffing and budgetary shortfall. E.R. represents potential relief for this problem, and these administrators often welcome a well-organized approach to implementing an E.R. system in their court.

May Issue, Part II: How electronic court recording systems work: People, products, processes.

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Reader Service #215

The National Sound and Communications **EXPO '85**

by **Chris Foreman**

"Bigger and better than ever" would be a narrow statement about this year's NSCA show in Orlando, FL. There were more people in attendance, more exhibitors, more seminars, and a greater overall feeling that we are all part of the same business community.

To understand the big picture, however, you have to know something about the beginning of NSCA and how hard a small group of people have worked to build the organization to the point where it was capable of doing a show like Orlando. I understand that we will be back in Las Vegas next year, and around the same time as the EDS show (although separate from it). But, this year, NSCA proved it is an organization that can stand on its own. We finally have a contractor organization we can support with pride.

The show was bigger than ever, and that means I must limit my report to a few highlights. One of those was the

opening session where we were treated to an informative and reasonably optimistic economic forecast by Richard Thomas of *Newsweek*.

Of special interest was Barry Glick's seminar on "How to Be Successful at Interconnect." If you attended this session, you know that Barry gave away a lot of the secrets that have made his company Glicktronix a success in this very competitive field. Each attendee was given a copy of a computerized proposal that Glick says he can customize for a new prospect in about eight minutes. Glick also organized and ran the other "Management Track Seminars."

Consultant Mark Engebretson organized and ran the technical seminars which dealt with topics ranging from noise masking to "electronic architecture" and were very well received. One interesting session dealt with hi-tech audio cables. Barry Thornton handled this controversial subject

with the delicate balance of a diplomat. His practical advice is to give your customer what he wants, even if your own ears aren't finely tuned enough to hear the difference. It's hard to quarrel with logic like that.

The press was there in force. Vic Hall of Communications Company in San Diego received the "Contractor of the Year" award from *S&VC Sound & Communications* and *Pro Sound News* magazines sponsored refreshments during the first "Families Visit the Show Floor" session, and we also brought in Bradley, a Muppet-like tricycle-riding robot for the children.

If you missed the show, you can get seminar tapes from Audio Recording Services Inc., 5120 W. Charleston, Las Vegas, NV 89102; (702) 870-0947. NSCA membership can be acquired by contacting the organization at 5105 Tollview Dr., Suite 201, Rolling Meadows, IL 60008; (312) 577-8360.



An overview of the activity on the exhibit floor.



**S&C's Bradley the robot
at family hour.**



**Mark Benningson of Jaffe Acoustics, So.
Norwalk, CT.**



**Friendships renewed as diverse
interests gather.**



**Shure microphone
exhibitors talk to an
interested sound
contractor.**

IDEAS & VIEWPOINTS

(continued from page 8)

Want changes? Run for office! At least vote for candidates that support your ideas. Then don't stop at the national (international) level, join and work with your local chapters. An aggressive local AES chapter could invite architects and construction engineers to meetings designed to educate them in the practical aspects of sound system implementation. Of course that takes work, but I guarantee it would have a lot more effect than just complaining.

Our newest trade organization, the NSCA, may hold the most promise for

positive changes in the sound and communications industry. As a non-profit engineering organization, AES has certain limits. One of those is marketing. AES simply cannot be a useful vehicle for marketing our industry. NSCA, on the other hand, could market our industry if we would lend our support. I suppose this is a dream, but I point out the example of the milk industry's trade organization and the way they market milk as a generic product. All those little individual dairies couldn't hope to get the kind of national exposure they get as a group through their trade organization.

Second, we need to get our business

act together. Many sound and communications contractors were founded by technical people. That's great, but technical prowess alone doesn't make a business. The *successful* sound and communications contractor has found a good banker, hired good accountants, salespeople, technicians, and project managers and, in various and sundry other ways, turned the operation into a real business. Contractors without expertise like this may very well be incapable of bidding on the kind of project that could vault them into the "big league" *especially if we get a Division 17 and there's no electrical contractor to post the bid bonds and manage the project.* Manufacturers need to get their business act together, too. My own direct experience has convinced me that manufacturers often know less about marketing and sales than their reps and dealers!

If we want new products and new markets, we have to open our minds to new ideas, turn our thinking to the long term and be willing to take risks.

Many of the most successful new products in recent history were invented by relatively unknown people and picked up by open-minded manufacturers. Altec's automatic mixer was one. Crown's PZM microphone was another. Yet I have seen other innovative, marketable product ideas shelved by closed-minded people who were unwilling to take risks.

New markets, like new products, require an open mind and a willingness to take risks. Our cover story on wide-area voice paging represents the successful risk-taking of a small, innovative company, Whelen Engineering, who uses voice paging technology (developed by themselves and by their new partner, Community Light and Sound) to compete successfully in a business that was formally dominated by siren equipment.

Growing Up

Maybe I'm being too hard on us. Maybe other industries have the same kinds of problems. Yet, I am convinced that no one else will lead us out of our problems. We've got to grow up enough to do it ourselves and that means opening our minds, taking a long-term point of view, and being willing to take risks.



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by Deltalab

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A true digital delay product with exceptionally natural sound quality, for applications where one or even a dozen delays, via serial and parallel coupling, are needed. Unobtrusive sound reinforcement in churches, theatres, and function rooms; pre-reverb delay in studios, and special effects such as simple doubling and echo. **SUGGESTED RETAIL \$599**



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Reader Service #216

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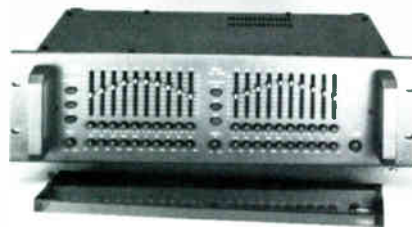
TOA ADDS FOUR SOUND REINFORCEMENT PRODUCTS

TOA Electronics, Inc. introduced four new products to its line of commercial sound reinforcement equipment: models E-111 and E-112 paragraphic equalizers, model E-131 graphic equalizer, and model V-141 electronic dividing network.



Model E-111

TOA's E-111 (single-channel) are 10-band, one-octave paragraphic equalizers featuring rotary controls for center frequency and "Q," and slide controls (with center detent) for boost/cut. The E-111/E-112 assures clean, accurate audio signals by providing 12 dB of boost or cut at each of the ten frequencies, which are centered at ISO one-octave increments (from 31.5 to 16k Hz). The center frequency of each filter is continuously variable over a range of one octave, and the "Q" of each filter is continuously variable from 1.5 to 8.



Model E-112

Model E-131 is a single-channel, $\frac{1}{3}$ octave, active graphic equalizer that provides 12 dB of boost or cut at each of its 28 frequencies, which are centered at ISO $\frac{1}{3}$ octave increments from 31.5 to 16k Hz. Active band-pass/band-reject filters provide minimum phase-shift. The filters are summed in parallel for reliability; the failure of one filter



Model E-131

does not interrupt operations of the others.

Model V-141 is a low-noise electronic dividing network that operates in any of four switch-selectable, crossover modes: two-way, three-way using lower three bands, three-way using upper three bands, and four-way, LED indicators show selected mode and output configuration. Low-, mid-, and high-frequency selection switches choose crossover points (from 63 Hz to 10 KHz). The slope of each crossover point is switchable on the front panel to 12 dB or 18 dB per octave. Other



Model V-141

features include: input level control with LED "peak" indicator; calibrated output level control for precise adjustment of signal levels for each band; automatic output muting function; phase reversal switches; 40 Hz high-pass filter; ground lift switches; transformer-balanced, ZLR-type inputs and outputs.

TOA's new sound system devices are each housed in a standard 19-inches rack-mount chassis, incorporating a cast-aluminum front panel backed with a 1/8-inch steel liner for added durability. A smoked-plastic security cover for the front panel is included with each unit to guard against accidental disturbance of control settings.

□ Contact: TOA Electronics, Inc., 480 Carlton Ct., So. San Francisco, CA 94080; (415) 588-2538.

Reader Service #1

HARRISON SYSTEMS' REINFORCEMENT CONSOLE

Harrison Systems, Inc., introduced the latest in a continuing series of sound reinforcement console systems at the Hamburg AES Convention, the HM-4 (House Main) and SM-4 (Stage Monitoring).

The HM-4 and SM-4 systems are medium scale products derived from Harrison's HM-5 and SM-5 major touring consoles. The HM-5 and SM-5 were developed for Showco, Inc. of Dallas, TX, and Clair Brothers of Lititz, PA, under a special product development agreement which involved America's two leading sound reinforcement companies and Harrison Systems, Inc.

The HM-4 and SM-4 systems feature the facilities previously available only on the HM-5 and SM-5 systems, such as four-band, parametric equalization, VCA grouping, and an eight-group mute matrix.

The HM-4 system includes eight mixable auxiliary sends, four stereo audio groups, redundant main stereo outputs, and a four by four stereo group matrix.

The SM-4 system includes eight mix sends plus eight additional fully matrixed mix outputs from four mono audio groups.

Both consoles will be available in either fixed theater or portable touring mainframes which will include XLR type microphone inputs, 30 pole DIN standard tuchel connector interfaces for patch systems, and Harrison's high reliability, high performance signal electronics.

□ For more information, contact: Harrison Systems, Inc., P.O. Box 22964, Nashville, TN 37202; (615) 834-1184, Telex 555133.

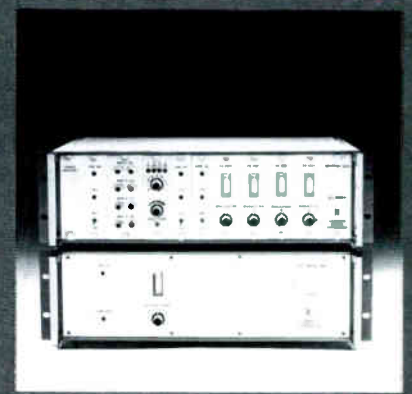
Reader Service #2



EDCOR RELEASES FIRST OF FIVE DIGITAL AMPS

Eddcor has released the first of five digital amplifiers for the sound contractor. The GLA 200D will provide a full 200 watts of rms power at less than 0.5 percent distortion. A much higher

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Reader Service #217

wattage level is available with slightly higher distortion. Voice coil outputs of four, eight and 16 ohms, 25 and 70 volt outputs are standard. The advantages of a digital amplifier are increased efficiency, lightweight, less heat, and smaller in size.

The Edcor unit is competitive with linear amplifiers. Specification information and product evaluation samples are available from the factory.

□ Contact: Edcor, 16782 Hale Ave., Irvine, CA 92714; (800) 854-0259 or (800) 523-2824(CA).

Reader Service #19



SIEDLE INTRODUCES TWO-WIRE DOOR ENTRY SYSTEM

Siedle, a manufacturer of intercom equipment, has introduced the two-wire door entry system.

Any two wires can be used (doorbell, old intercom, or two extra phone wires) to operate doorbell, door release, and two-way voice communication without pushbuttons for conversation.

As a replacement for lobby telephone systems, the intercom eliminates the monthly charges, busy signals, and number scrambling that can be caused by lightning.

The system can be expanded to accommodate up to 2,000 apartments. Outside units are completely weather-proof and available in two colors, dark brown and white.

Flush mount, surface mount and pedestal column mount makes the intercom systems usable for both new installation and retro-fitting when renovating.

□ For more information contact: Siedle Intercom/USA, One Wynnewood Road, Wynnewood, PA 19096; (800) 874-3353. In PA call (215) 649-7722.

Reader Service #20

TEKTONE TEK-ENTRY SERIES TELEPHONE ENTRY SYSTEM

TekTone Sound & Signal has introduced the Tek-Entry Series Telephone Entry Systems, available in models with a number capability from 1 to 1,000 units. Tek-Entry Systems

are complete, automatic call and entry systems, specifically designed for each operation and reliability. By entering a two or three digit code, the system calls the correct phone number to allow access by the tenant.

Each unit includes an integral power supply, panel mounted PC board, internal battery (which will operate the unit for a minimum of three hours without A.C. power), and a relay output for controlling doors, gates, and elevators. All models are capable of dialing out either rotary or touch-tone and operate on a standard telephone jack and 110 V line. Front panel key pad programming, instant remote system checking and selectable one or four minute talk time limit features are also standard in the TekTone Tek-Entry Series.

EEProm number storage provides for no loss of programmed phone numbers, even during a power failure. A crystal decoder guaranteed correct Touch-Tone decoding making ordinary phase lock loop systems obsolete.

Tek-Entry Systems are constructed of durable, anodized modular panels with metal telephone touch pad and hook switch, armored handset cable and Lexan® window to resist vandalism.

□ Contact: TekTone Sound & Signal Mfg., Inc., 1331 S. Killian Dr., Lake Park, FL 33403; (305) 844-2383.

Reader Service #21



HENRY ENGINEERING'S MATCHBOX I-FACE AMP

Henry Engineering introduced The Matchbox, an active interface amplifier, to aid in the interfacing of semi-pro or consumer HiFi equipment with professional studio gear. The Matchbox is a bi-directional, stereo device which employs four independent amplifiers to provide stereo input and output interface simultaneously. Two amplifiers convert a stereo "HiFi" HI-Z unbalanced source to

LO-Z balanced outputs at studio level.

The second pair of amplifiers convert a stereo balanced studio line source to unbalanced HiFi outputs to feed the inputs of a semi-pro device. All circuitry is active and direct-coupled for sonic transparency; and can be used with the new compact digital disc players. The Matchbox contains an internal regulated power supply, and is small enough to be mounted to most cassette decks, tuners, VTRs, portable mixers, and similar equipment.

□ For more information, contact: Hank Landsberg, Henry Engineering, 750 E. 5th St., Unit 83, Azusa, CA 91702; (818) 334-5580.

Reader Service #16

GDC INTRODUCES THE DATX INTEGRATED OFFICE SYSTEM

General DataComm Industries, Inc., announced the introduction of GDC's DATX Integrated Office System (IOS).

The system dovetails both data and voice signals and permits them to be transmitted simultaneously over ex-

isting twisted pair telephone wiring. The DATX IOS permits conversion of an existing PBX system to a combined data/voice system without rewiring the existing building, discarding the existing voice PBX, or replacing it with a data/voice PBX. The DATX IOS can be integrated into a fully controlled remote office network through the use of Megamux and Netcon.

The DATX IOS consists of a DATX 2000 and the DATX switching system. The DATX 2000 transmission capability provides access between remote terminals and CPU and currently will transmit both asynchronous and synchronous data at speeds up to 19.2 kbps with complete transparency and integrity of data/voice communication.

The DATX switching system provides communication links for up to 1320 terminations, expandable in 24 channel increments from a base capacity of 360 lines for both the DATX 2000 and DATX switching system. Present design will permit transmission at 9.6 kbps, but future upgrades will accommodate transmission of both asynchronous and synchronous data to speeds of 19.2 kbps.

□ For more information, contact: General DataComm Industries, Inc., Middlebury, CT 06762-1299; (203) 574-1118.

Reader Service #17



BGW SYSTEMS UPGRADES MODEL 85

BGW Systems, Inc. has upgraded its model 85 series single rack mounted broadcast power amplifiers. The new model 85 now delivers 35 watts per channel driving eight ohm loads. Along with the increased power output, the new amps feature black anodized brushed aluminum front panel and improved noise characteristics.

New low feedback discrete circuit design allows for a natural sound, coupled with the elimination of transient intermodulation distortion. A toroidal power transformer incorporated into the model 85 design provides minimum size, weight, and low

stray field and acoustic noise.

Three versions of the model 85 series are available. The model 85 features single ended inputs that accept 1/4-inch phone jacks for unbalanced applications. The model 85-01 features high performance active balanced input circuitry and XLR connectors, which allows BGW to guarantee a minimum of 70dB common mode rejection, which is higher than the 40dB found in other power amps. BGW's model 85-06 has built-in dual input transformers that provide 15K ohms input impedance, and utilizes XLR connectors.

Other features of the model 85 series power amps include welded steel construction for maximum mechanical integrity and RFI shielding. Modular construction provides simplified servicing. A mono bridge switch allows high power single channel operation. Transient-free circuitry prevents speakers pops or extraneous noise. All model 85 series amps include detented front panel gain controls and headphone jack.

The suggested retail price for the model 85 is \$449, model 85-01 \$499, and model 85-06 \$584.

□ Contact: J. Reynolds, BGW Systems, Inc., 13130 South Yukon Ave., Hawthorne, CA 90250; (213) 973-8090.

Reader Service #18

HARRIS ANNOUNCES NEW VERSION OF URBANET

The Harris Corporation has announced a new version of the Urbanet™ 10 digital microwave system, that increases voice capacity to 72 channels from its present 48-channel maximum capacity.

According to Harris, the new higher capacity 10-GHz radio system was made by fully utilizing the high spectral efficiency of the basic radio modem used on the original versions.

Integral to the radio system is the T1-D option of the Farinon MX2 multiplexer, which combines the bit streams of up to three 24-channel T1 channel banks to create the 4.8 Mb/s transmitted signal.

The radio may be mounted three ways: in a weatherproof cabinet outdoors, on a rack, or a wall indoors.

□ For additional information, contact:


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Reader Service #218

Harris Corporation, Farinon Division,
1691 Bayport Ave., San Carlos, CA
94070; (415) 594-3000.

Reader Service #3



STANTEL DEBUTS CORONET DIGITAL KEY SYSTEM

Stantel Information Systems, a new entrant in the telecommunications equipment market, displayed a digital key system for the first time at USTA's Southern Telecommunications Showcase earlier this month.

The new system, Coronet, is de-

signed to be easy to use and understand. It brings all the elements of many large PABXs within the reach of small businesses, but uses no complicated or long-dialed feature codes.

The Coronet system is also port-oriented, with either 20 or 40 ports initially. A wall-mounted expansion unit allows for 20 additional ports.

□ For more information, contact: Stantel Information Systems, Suite 400, One Bridge Plaza, Fort Lee, NJ 07024.

Reader Service #4



METRO TEL INTRODUCES UNIVERSAL CALL SEQUENCER

An intelligent call sequencer designed for small telephone systems and

compatible with PABX, electronic key, hybrid, and standard 1A2 phone installation has been introduced by Metro Tel Corporation.

Metro Tel's Model 816 Call Sequencer, a microprocessor-based system, is designed to answer incoming calls on up to 16 unattended lines, 24 hours a day. During business hours, the system automatically responds to calls, then places them on hold and sequences them so that they can be personally handled by telephone attendants—without interruption and in order. The system establishes priority for the call which comes in first and only that line will ring when an attendant becomes available.

The caller is provided with an appropriate tape recorded message, followed by background music.

The flexible Metro Tel Call Sequencer is easily expandable from four lines to the maximum 16 lines in four-line increments. A front panel L.E.D. display presents important management data

(continued on page 43)

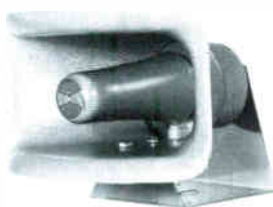
THE SOUNDS OF PROTECTION

ATLAS SOUND is the world's leading manufacturer of loudspeakers specifically designed for use with electronic siren, emergency warning and high power mobile public address systems for land, air, and marine applications.

U.L. & C.S.A. listed for installation in hazardous locations where explosive or combustible atmospheres may exist. For indoor or outdoor use in conjunction with intercom, sound signaling, and electro-acoustic communications systems.

Functional dependability and extensive area-coverage combined with the advantage of minimum size. Voice-Tone loudspeakers are recommended for application in high-rise and multi-occupancy building emergency communications where certified operational requirements and attractive appearance are prime considerations.

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80A

Reader Service #219

PRODUCTS IN REVIEW

a closer look

by gary davis



CROWN FM THREE TUNER

The Crown FM Three uses the latest tuner technology to provide outstanding performance in the AM and FM bands. It incorporates the new Schotz noise-reduction circuit (SNR), which pulls in more stereo FM stations and clarifies previously unlistenable channels.

The FM Three also features a "scan level" control, which allows you to adjust how strong a signal must be before the tuner stops scanning and locks onto a channel. Other features include six AM and six FM presets, signal-strength LEDs, and a multipath indicator.

The FM Three uses a state-of-the-art digital detector section. Unlike conventional designs, this detector cannot go out of alignment, drift with age, or add distortion by mis-tuning. The unit also uses a toroidal transformer to reduce hum and noise and has an extra RF section for increased AM sensitivity.

The FM Three is backed with the Crown three-year full warranty.

Comment: We have recently come across another manufacturer's tuner, which utilizes the Schotz SNR circuitry, and like Crown it too claims to lock in more distant FM stereo stations with greater clarity. Larry Schotz's PLL detector automatically senses signal strength and multipath interference, adjusting the filter bandwidth dynamically to optimize reception.

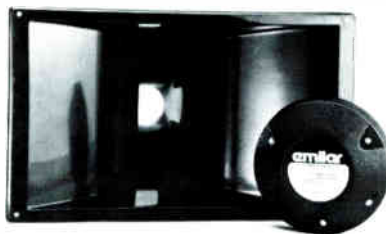
The Schotz SNR circuitry evaluates both stereo signal separation and high frequency content, and "blends" more or less off the high end to reduce the noise that would otherwise occur due to a weaker stereo signal. Add this to Crown's claimed "state of the art" no-drift digital detector, and the FM tuning would appear to promise excellent performance.

With all the high-tech FM circuitry, we are disturbed and surprised that the

release gives almost no information on the AM tuning section, and sidesteps the whole issue of AM stereo.

□ For further information, contact: Crown International, 1718 West Mishawaka Rd., Elkhart, IN 46517; (219) 294-5571.

Reader Service #5



EMILAR'S NEW EH 330 HORN

Emilar has introduced Model EH 330 Uniform Directivity Dispersion Horn. Engineered for use with the EC 600 compression driver, the new horn is crafted from lightweight, durable fiberglass and offers ease of installation.

The EH 330 has a mouth opening 27 inches wide and 16 inches high. The new horn is 16 inches deep. Holes are provided for front or rear baffle mounting. Total weight is 10 pounds.

Designed for use in two or three-way sound reinforcement or voice-only systems, the EH 330 horn offers system designers a significant new option. A useable crossover frequency point is 250 Hz. The EH 330 has an 81.3 mm (3.2 inch) throat diameter.

Comment: The horn is interesting to us in that it goes down to 250 Hz in conjunction with the recommended EC600 driver. This provides an extra degree of flexibility in cluster design, and also makes it feasible to build a simple paging system that can do a better job with background music than the average horn/driver with a 500 Hz cutoff. For a horn that measures roughly one and one half by two feet across the mouth, its 10-pound weight is light enough that installation should be greatly simplified.

□ For further information, contact: Emilar, 1365 N. McCan St., Anaheim, CA 92806; (714) 632-8500.

Reader Service #6



AUTOMATIC MIC MIXER

Edcor has released an automatic microphone mixer, the AM 401. The AM 401 is an automatic mixer with off/on microphone gates and gain change as the number of active microphones increases or decreases. AM 401 units can be linked together to provide an automatic mixer system of 20 microphones with one AM 401 acting as the master. The AM 401 has a line or microphone level balanced output. A +10 volt logic output is provided. The THD is less than .05 percent, the frequency response is +/-0.5 dB 20 Hz to 20 kHz.

Comment: Automatic microphone mixers have become an important tool for the contractor who is outfitting meeting rooms, board rooms, churches—anywhere that open mics are in use and a full-time system operator is not feasible.

The Edcor AM 401 peaked our interest more for what was unsaid than what was said in the release. Larry Weston at Edcor supplied some answers. The unit is basically an updated, refined version of their four-year-old AM 400. In order to raise and lower the gain of individual mic inputs, gating closed mics that are not in use, the unit senses the change in level and frequency of the input. Digital circuitry computes the slope, rather than merely looking at absolute levels. The benefit, ostensibly, is that soft-attack words like "love" or soft-spoken people will not lose first syllables. There is a logic output that can be used for muting the speaker which is nearest a given mic when that mic is "live," and automatically unmuting the speaker when the mic is no longer in use. The same logic can be used to trigger an alert. Suggested retail price for the AM 410 is \$800.

□ For further information, contact: Edcor, 16782 Hale Ave., Irvine, CA 92714; (714) 863-1529.

Reader Service #7

(continued from page 41)

such as "Calls Offered," "Calls Abandoned," and "Total All Busy." A more comprehensive management data package with an RS-232 port for printer interface is available as an option.

The Metro Tel Model 816 Call Sequencer System is fully configured at the factory for immediate customer use. Any variations at a later date can be easily reprogrammed by the user with front panel keys. A standard RJ-31X plug is used for the interface and the unit is then plugged in to a standard wall outlet for power.

Suggested retail for a four-line system is under \$3,000.

□ For further information, contact: Phil Johnson, Metro Tel Corp., 15 Burke Lane, Syosset, NY 11791; (516) 364-3377.

Reader Service #8



AV-200 SYSTEM FOR SENIOR CITIZEN HOUSING AND CLINICS

Jeron Electronic Systems, Inc. of Chicago, IL, has introduced the AV-200 Emergency Call System. The audio-visual call system provides visual signaling, audible alert, and two way voice communication between room and master station.

AV-200 systems are designed for use in senior citizen housing and clinics. Visual signals provide an alert and are a guide to the location of a call for assistance. Steady and flashing signals distinguish between normal and emergency calls.

□ For further information, contact: Jeron Electronic Systems, Inc., 3554 N. Clark St, Chicago, IL 60657; (800) 621-1903 or (312) 528-4020.

Reader Service #9

SC-52 DUAL COMPRESSOR/LIMITER BY ASHLY AUDIO

Ashly Audio has introduced the model SC-52 Dual Compressor/Limiter. The SC-52 provides two channels of clean, accurate gain reduction in one compact package, combining peak

detector circuitry with improved metering, according to the company.

It may be used either as two independent peak compressor/limiters, or may be strapped for stereo tracking. The amount of gain reduction, attack and release times, and output gain matching are all independent adjustments.

□ For more information, contact: Ashly Audio, 100 Fernwood Ave., Rochester, NY 14621; (800) 828-6308.

Reader Service #10

"SWISS ARMY MIXER"?



An appropriate nickname for the

SM 26 SPLITTER MIXER

... a single rack space unit which contains:

- Master L & R inputs with stereo level control
- Six mono inputs and six mono outputs with level controls
- Six dual function mix/pan pots
- Master L & R outputs with stereo level control
- Built-in variable gain for -10dBV/+4dBm interface
- Left and Right expand outputs

This 5 lb. grab-bag of ins-outs-and-pots will split, mix, pan, boost, or any combination of the above to solve an unbelievable variety of signal routing problems: keyboard mixing and monitoring, live recording splitting, additional studio or stage monitor bussing, zone level controlling, intercom splitting, line boosting, etc., etc., etc.

If you've got the signal, the SM 26 has the path ... and for only \$299 suggested list price!

RANE
CORPORATION

6510 216th SW, (206) 774-7309
Mountlake Terrace, WA 98043

Reader Service #220



Black Box 1985 Catalog Offers Many New Products

The January 1985 edition of the Black Box Catalog offers over 500 devices in its 144 pages.

Black Box Catalog users will find many new products in the latest edition.

Special application products such as Black Box's newly developed Tone activated talking Switch (TATS)[™] are explained in detail. The TATS allows remote switching between computers modems and telco lines—a voice response tells you the channel you have selected. Other new products featured in this data communications and computer hardware source book include wide area distribution products—modems, line drivers and multiplexors, and gateway products.

Published twice a year, this book contains a technical reference section that explains asynchronous data transmission, binary encoding, cable fabrication techniques, and a glossary of computer terms.

From: Black Box Corp., Box 12800, Pittsburgh, PA 15241; (412) 746-5530.

MOD-TAP Publishes New Guide and Catalog

MOD-TAP Systems, formerly Darlabs Inc, of Harvard, MA, has published a 24-page introductory guide to communications equipment and terminology reviews wiring system considerations; and a 20-page catalog illustrates a complete line of modular wiring system components.

The MOD-TAP Communications Wiring System is a twisted pair solution for attaching and interconnecting voice and data equipment.

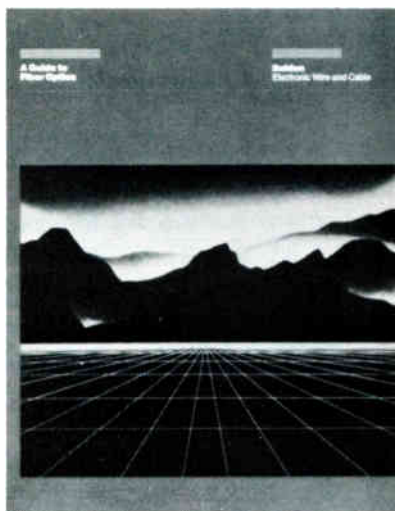
Both are available from: MOD-TAP System, Harvard, MA 01451; (617) 456-3500 or telex 951369.

ANACOM's Med-Tek Division Offers File-Folder Catalog

Ready-to-plug-in replacements for all makes and models of pillow speakers are detailed in a new file-folder catalog offered by Anacom's Med-Tek Division. The new speakers incorporate numerous advanced-design features such as molded, sealed plugs, no-wear function designations, cable strain reliefs, and color selections.

Specifically illustrated in the catalog (including wiring and plug connection schematics) are 55 makes and models. In addition, the catalog includes data on Anacom's Automatic Call Adapters and Nurse Call Cords, as well as replacement cords for all popular pillow speakers.

From: Anacom Corporation, 1116 E. Valencia Drive, Fullerton, CA 92631; (714) 992-0223.



Belden Publishes New Guide To Fiber Optics

Belden Electronic Wire and Cable has published an eight-page guide to fiber optics to assist design engineers in understanding and specifying fiber optic cable for systems design.

The new tutorial explains the advantages of selecting fiber optic systems

over typical metallic cable transmission systems. Basic elements of optical fiber, construction and types, system design considerations, and cabling design consideration are also detailed.

The new brochure contains illustrations, graphs, and diagrams to assure precise clarification of terms.

From: David Billish, Marketing Manager, Belden Electronic Wire and Cable, P.O. Box 1980, Richmond, IN 47375; (317) 983-5200.



SOLD THROUGH YOUR LOCAL PANDUIT DISTRIBUTOR

New Bulletin Describes Panduit® Panduct® Plastic Wiring Duct

A new six-page bulletin describing the full line of Panduct plastic wiring duct is now available.

Included are descriptions of three duct types—snap-in slot, solid wall, and round hole designs which make up the industry's largest selection of styles, sizes, and colors.

In addition to the standard PVC duct material, the snap-in slot, and solid wall types are available in polycarbonate and Noryl for more demanding applications. PVC duct is available with adhesive backing.

Most styles of Panduct duct are U.L. recognized and CSA certified and meet J.I.C. requirements.

Included in the bulletin are a fill capacity selection guide, dimensional data, material specifications, and information on duct notching and rivet installation tools plus the complete selection of duct mounting devices.

From: Manager, Inside Sales Dept., Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981; 1-(312) 532-1800.

BOOK REVIEW

by Ted Uzzle

The Military Market

U.S. Department of Defense, *Selling to the Military*, U.S. Government Printing Office, 1984.

The largest purchaser of goods and services in the United States—perhaps the world—is the U.S. federal government, specifically the department of defense. Among the things they buy are the types of products most contractors are familiar with, and consulting and design services for acoustics. Yet, many potential vendors have been repelled by the labyrinthian regulations and the endless paperwork required.

The labyrinthian regulations still exist, and the paperwork is still endless. But the customer has money to spend and is willing to pay top prices for quality. The new edition of *Selling to the Military*, a 141 page paperback guide through the military procurement minefield, won't teach you how to sell, but it will show you how to fill out the forms and what offices to send them to if you wish to bid on defense department projects, including reinforcement, intercommunications, and masking noise systems.

There are basically three ways into the business. One is reading the government publication *Commerce Business Daily*, which describes contracts currently being offered for bid. Another is to submit a form 29-R0069, which will place you on the bidder's mailing list for the types of work you want to do. The third is to file form 22-R0381, with which you propose a research project for the department of defense's consideration; that is, you suggest a need the military hasn't identified and make an unsolicited bid to fill it.

The bulk of the book consists of lists of military buying offices, with address and telephone number and major area

of buying activity (types of products purchased), for the Army, Navy, Air Force, and Defense Logistics Agency. A list of commodity code assignments follows for various classifications of items purchased. An analysis of federal specification systems is included; most often commercial product specifications (that which you would find on manufacturers' catalog sheets) are not used by the military. There's also a chapter on buying military and civilian surplus property, followed by a chapter on military exchanges, which buy consumer goods for resale to personnel.

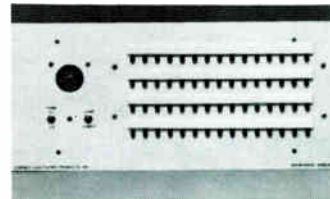
The government offers special assistance to vendors whose business is small, whose proprietors are members of certain specified disadvantaged groups, or whose business is located in areas designated as suffering from a labor surplus. And the book supplies information about the programs and assistance offices.

Finally, a dictionary of acronyms helps sort out the government alphabet soup. The necessary forms are printed throughout this book, with instructions for filling them out, and permission to duplicate them for your own use.

If you want to do business with the military, you will have to do it *their* way, and it is fairly specialized. If you are just getting started, this book should be your first stop. What you find may scare you off. Only a tiny fraction of businesses eligible to sell to the military attempt it. Even so, the book may become an entrance to a whole new market area for your products and services. The book's stock number is 008-000-00392-1 and may be purchased for six dollars postpaid from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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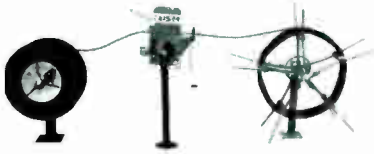
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Reader Service #222



THE ERASER COMPANY'S WIRE 1 COMBINATION

The Eraser Company, Inc. announced the availability of the Wire 1 combination of wire de-reeling, measuring, cutting, and coiling equipment for the preparation of wire, tubing, and small cables in the electrical and electronic industries.

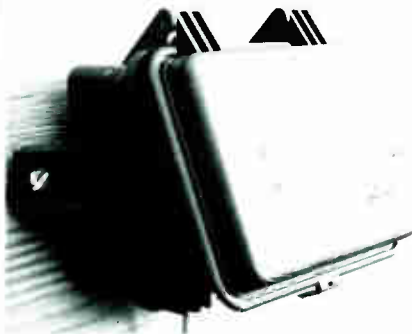
The Wire 1 Combination consists of a medium duty de-reeler, a measuring meter with cutter and stand, and a coiling device.

The Wire 1 Combination will produce accurately measured and cut coils of material from bulk reels of wire, tubing, and small cables. Coils of material containing up to 1,000 feet may be prepared and the combination will accommodate wire and cable reels up to a maximum diameter of 19 inches and weight of 50 pounds.

The three units that comprise the Wire 1 Combination are all bench mounted and adjustable for different sizes of material and specific applications.

Contact: The Eraser Company, Inc., P.O. Box 4961, Olivia Dr., Syracuse, NY 13321; (315) 454-3237.

Reader Service #11



NEW DEMARCATION BOX AND CUSTOMER REPAIRS

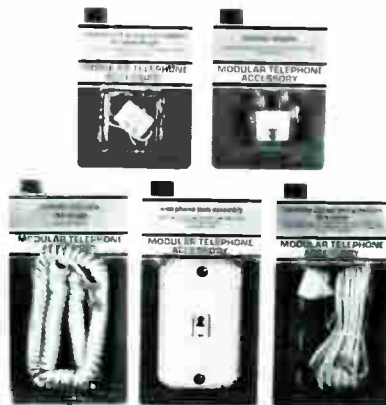
A new telephone network interface demarcation box, molded of General Electric Plastics' Noryl® resin for impact and moisture resistance, enables

phone customers to locate in-house wiring problems. By locating the trouble spot themselves, the customer may avoid paying for unnecessary service calls.

The demarcation box was designed for retrofit application, adjacent to an existing station protector on the outside of a customer's home. Network interface demarcation boxes are now required for every household that owns its own equipment.

Contact: Janice Mansfield, Plastics Group, Hector, MN; (413) 494-4738 or (413) 494-4940.

Reader Service #12



RMS ADDS MTA ACCESSORIES SERIES

RMS has added more MTA modular telephone accessories to its product line.

At present, the MTA series consists of 27 different types of telephone accessories that are blister packaged in full color, self-selling packages, with complete installation instructions on the reverse side.

Also available for the serviceman and telephone installer are the same items that are packaged in bulk, each item in a poly bag.

"Additional new telephone items will be added to the line in the very near future," Goldberg said.

The MTA series (except for the crimping tools) is licensed by AT&T or Western Electric, and carries their logos on the packaging. All telephone accessories meet with FCC Rule 68 specifications.

When the MTA series is purchased in a packaged deal, there is available a merchandising display (gondola) that is 54 inches high and 36 inches wide with

an attractive metal sign. All items are in stock for immediate delivery.

Contact: RMS Electronics, Inc., Distributor/Video Division, 50 Antin Place, Bronx, NY 10462; (212) 892-1000.

Reader Service #13

NEW TABBING SHEAR FOR TELECOMMUNICATIONS INDUSTRY

P.K. Neuses, Inc., a supplier of tools and instruments for the telecommunications industry, has announced availability of a high quality tabbing shear which can also serve as a cable jacket remover. The Neuses model N-8185 tabbing shear cuts tabs in ends of polyethylene cable sheath to permit placement of inner sheath clamps. It will also aid in the immediate removal of plastic, metal, and rubber jackets from all diameter cables.

Contact Mr. Guy A. Neuses, vice president at P.K. Neuses, Inc., 1401 Rohlwing Rd., Rolling Meadows, IL 60008; (312) 253-6555.

Reader Service #14



FSR OFFERS NEW SERVICE TO CONTRACTORS

FSR, Inc. is now offering a new service to contractors—custom panels, switchplates, and consolettes.

"Because so many contractors have asked for our help, we are now fabricating panels as a standard service," said Janice Sandri, head of sales for the firm.

FSR will work from a hand sketch, or formal drawing, and all panels and switch caps are engraved and finished to order. FSR will also supply full scale drawings.

Contact: FSR, Inc., 40 Commerce Road, Cedar Grove, NJ 07009; (201) 783-3966.

Reader Service #15

DATE BOOK

DATE	EVENT/COMMENT	LOCATION	CONTACT
April 14-17	National Association of Broadcasters Annual Convention: Forum for the latest new products and production capabilities.	Las Vegas Convention Center, Las Vegas, NV	National Association of Broadcasters Washington, D.C. (202) 293-3570
April 23-26	Telecommunications Training Workshop: Practical telecom systems grounding; and introduction to telephone technology and practice	Chicago, IL	Sandy Bourdage abc TeleTraining, Inc. P.O. Box 537 Geneva, IL 60134 (312) 879-9000
April 30-May 2	Telecommunications Training Workshops: Telecommunications transmission systems; and CATV management, engineering and operating principles	Chicago, IL	Sandy Bourdage abc TeleTraining, Inc. P.O. Box 537 Geneva, IL 60134 (312) 879-9000
April 30-May 2	EDS '85 Electronic Distribution Show and Conference	Hyatt Regency Hotel, Chicago, IL	EIS Corporation 222 South Riverside Plaza Suite 2710 Chicago, IL 60606 (312) 648-1140
May 3-6	78th AES Convention Audio Engineer's Society's Meeting and Professional Exhibits	Disneyland Hotel Anaheim, CA	AES 60 East 42nd Street New York, NY 10165 (212) 661-8528
June 2-5	34th Annual NCTA Convention and Exposition National Cable Television Association	Las Vegas, NV	NCTA 1724 Massachusetts Ave. NW Washington, DC 20036 (202) 775-3550
June 2-5	1985 Summer Consumer Electronics Show	Chicago, IL	Consumer Elec. Group/EIA 2001 Eye St. NW Washington, DC 20006 (202) 457-4919

FUTURE DATES

August 4-8	International Background Music Association Show	Vancouver, Canada	IBMA Chicago, IL (312) 685-7850
September 26-28	Electronics Industries Association: Mobile Communications Show	Washington Convention Center, Washington, DC	EIA 2001 Eye St. NW Washington, DC 20006 (202) 457-4980
December 3-6	North America Telecommunications Association Show	Infomart Dallas, TX	NATA Convention Dept. 2000 M St. NW Washington, DC 20036 (202) 296-9800

CLASSIFIEDS

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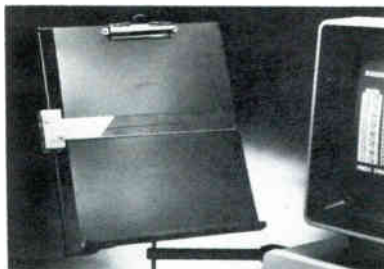
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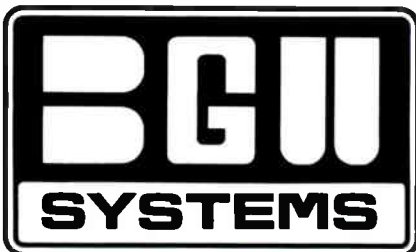
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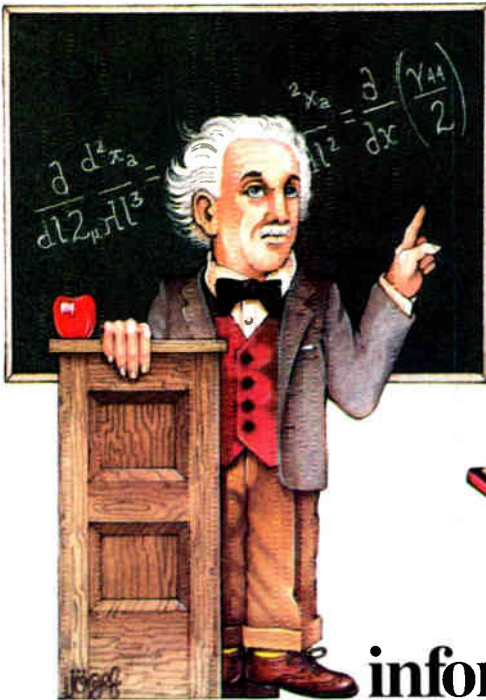
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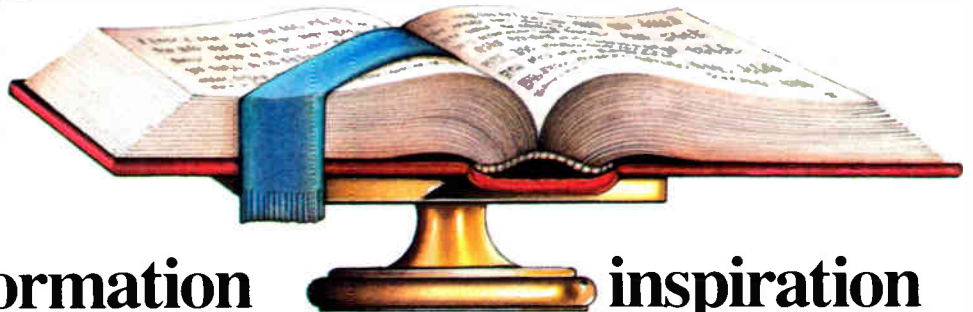
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