APRIL 1984

SOUND & COMMUNICATIONS

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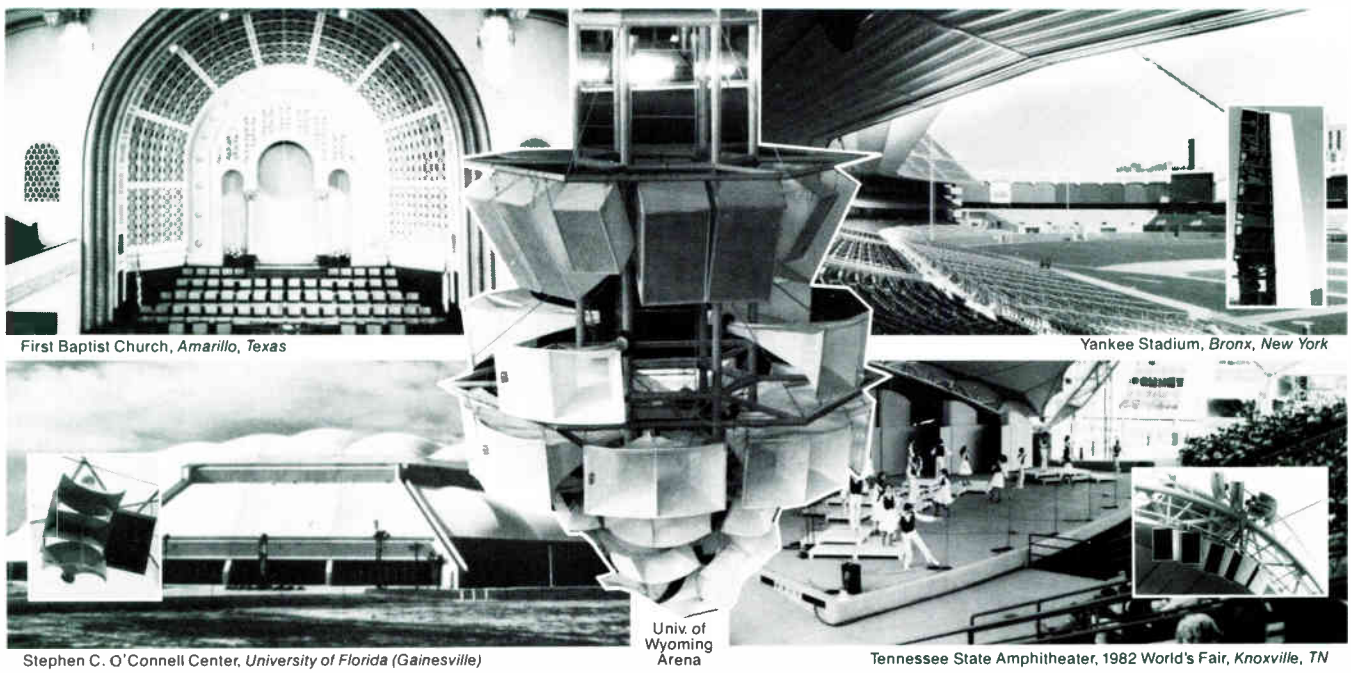

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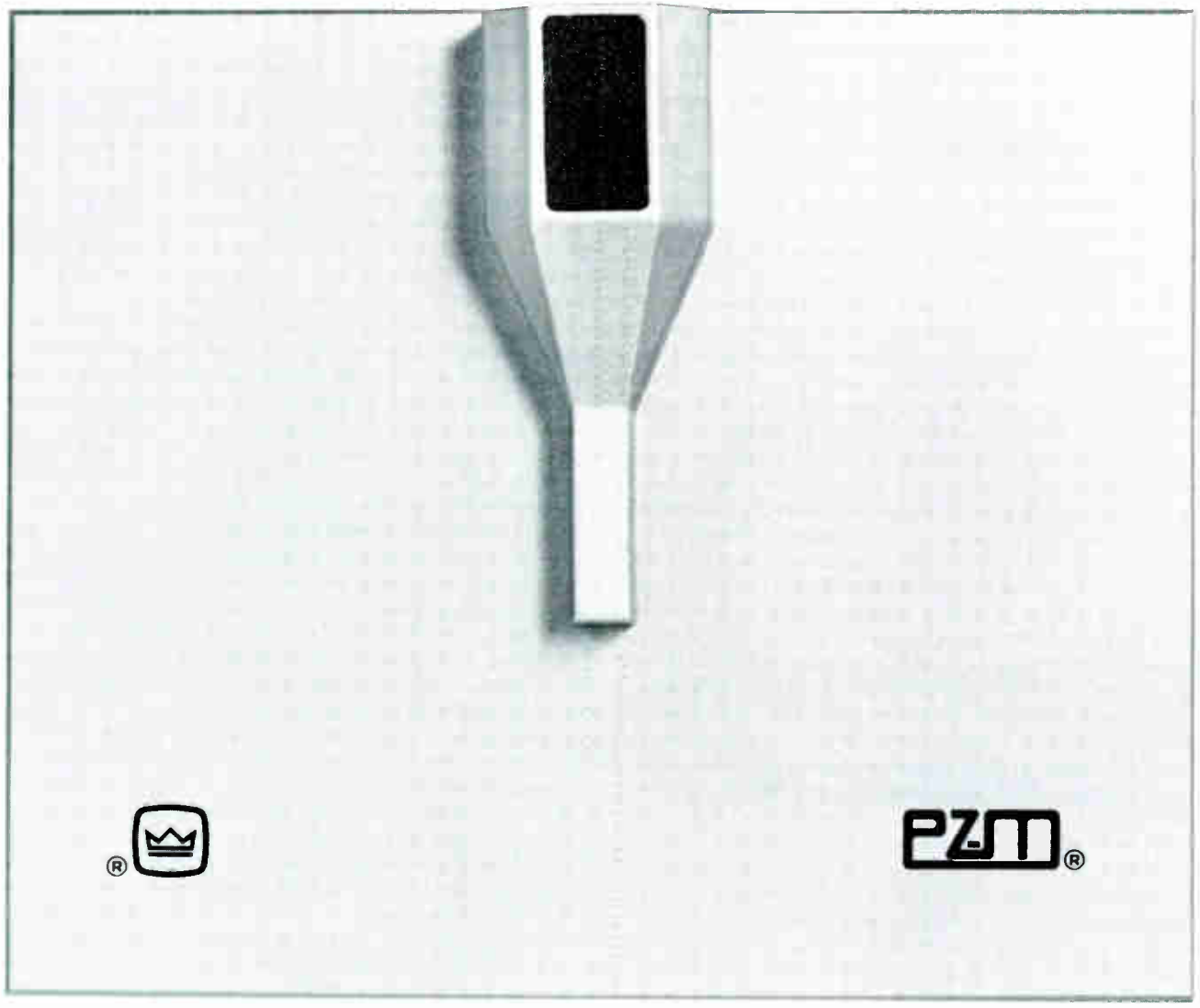

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APRIL 1984, VOLUME 29, NUMBER 12 Founded 1955

ARTICLES

10 Computer Aided Sound System Design
by David H. Bryan

32 Contractors Expo '84

48 Special Microphones for Special Occasions

58 The Impact of Bypass—Part 2
by Jerome G. Lucas

62 Fringe Benefits Give Employers an Edge
by Mark E. Battersby

66 Paging by Radio
by George Leon

68 A Quick Quiz on the Decibel
by Don Davis

DEPARTMENTS

4 Late Lines

40 New Products
Audio

46 Upcoming

47 Electro-Acoustics

51 Tip & Ring

52 New Products
Telecommunications

70 Classified

This month's cover: Atlanta's Civic Center boasts a sound system designed with the aid of computers. See story Page 10.

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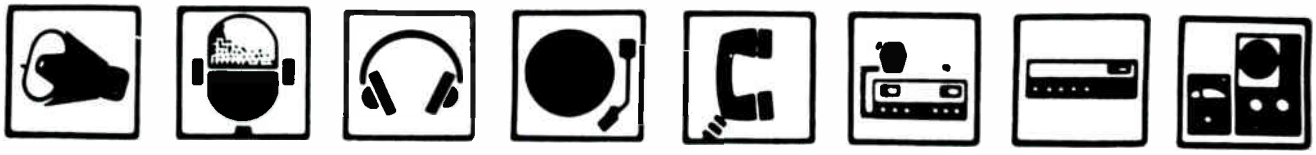

ADVERTISERS

Aiphone Intercom Systems....62
Argos Sound....24
Astatic Corporation....31
Atlas Sound....43
Audio Environments Inc....21
Audio-Technica U.S., Inc....5
Bertagni Electroacoustic Systems....6
Beyer Dynamic, Inc....65
BGM International....70
Bi-Tronics, Inc....66
Blonder-Tongue Laboratories Inc....Cover 3
Bogen....8-9
Cabletronix....70
Cetec Raymer....49
Cornell Electronic Products, Inc....65
Crown....1
Customtrax Inc....64
J.W. Davis and Company....44
Deltalab Research, Inc....42
Dukane Corp., Communications Systems Div....69
Dyna-Systems....26
Edcor....68
Electro-Voice, Inc....Cover 2
Electronic Industry Show Corporation....33
Famous Telephone Supply Co....70
Fisher Berkeley Corp....facing 26
Florence Corp....60
FSR Inc....39
Galaxy Audio....51
Grommes Precision Electronics, Inc....56
Hammond Manufacturing Co. Inc....19
House of Metal Enclosures, Inc....51
Ideal Wire Products Inc....70
Industrial Research Products, Inc....41
ITT Pomona Electronics....15
MacKenzie....58
McGohan Electronics, Inc....49
Music Supply Co., Inc....70
National Sound and Communications Association....38,70
Oaktron Industries, Inc....29
Opamp Labs Inc....70
OWI Inc....14
Panasonic Industrial Corporation....45
Paso Sound Products, Inc....36-37
P/H Electronics, Inc....70
ProTech Audio....22
Quam-Nichols Company....13
Rane Corporation....30
Ring Group of North America....61
Samson....50
Shure Brothers Inc....7, Cover 4
Sonic Systems, Inc....67
Sony, Professional Audio Products....25
Sound-Craft Systems, Inc....70
Studer Revox of America, Inc....64
Switchcraft Inc....23
Talk-A-Phone Co....50
Tape-Athon....63
TCE Electronics Inc....35
Tek Tone Sound & Signal Mfg., Inc....47
Time & Sound Company, Inc....46
Toa Electronics, Inc....59
Tone Commander Systems, Inc....57
Wheelock Signals, Inc....55
Williams Sound....48

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You're a sound and communications dealer who needs input from newer suppliers of product. You see computer sales mounting, especially the desk-top jobs, despite the daily reports of computer manufacturers going into Chapter 11 or quitting the business. You see local computer sellers moving into telephone sales, offering them as an extension of their electronic office packages. You're in need of some industry input from your contemporaries who've combatted this competition...they'll be in Las Vegas!

You're a sound and communications contractor who benefits—once a year—from the cross-polinization that comes from exchanging notes with your fellow contractors at a National Sound and Communications Association Conference and Show. This year NSCA meets at the Sahara Hotel, Las Vegas, April 24 through 26.

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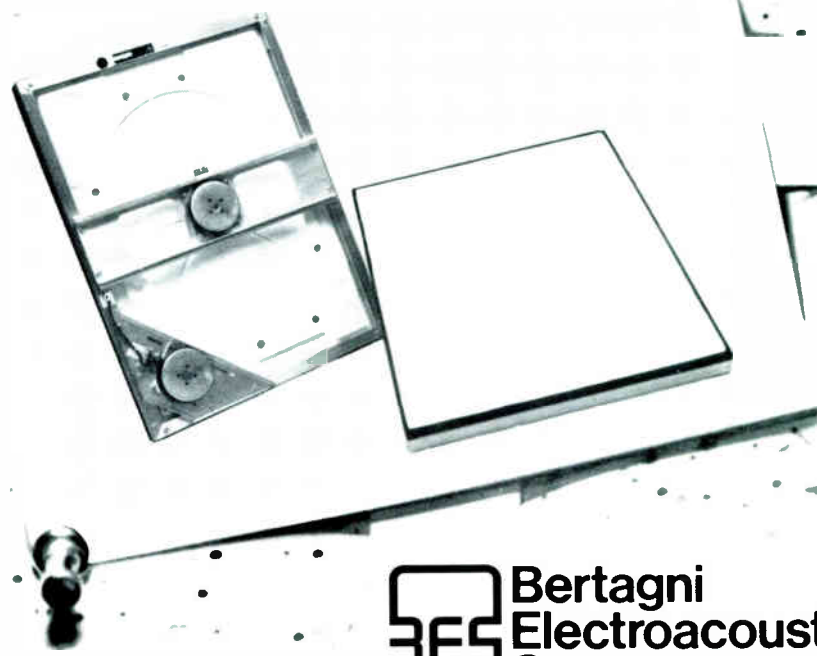

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benefits at EDS, convening at the Hilton Hotel, Las Vegas, April 25 through 27, for the overlap with NSCA provides mind-stretching ideas from presidents and sales managers of components and hardware for installation and construction work that combines newer features, better materials. Here is product and component that reflect ideas and suggestions arising from your field experience, and all pointing toward lower labor costs.

You're a sound and communications systems contractor who will be sought after by the newer entrants into the industry. Intercom systems with features that rival keysets; peripheral phone gear that automatically dials phone numbers; receives messages and reveals them on screen when challenged; a world of electronic products with microcomputer hearts for many industrial and commercial applications. The idea is simply this: if you're managing open-end leases, then you've got more product to sell the client, in addition to moves, repairs and additions. The plant that leases or rents paging and background music and security systems working on a co-ax cable, is giving you an expanded market for electronic equipment to provide test, measure and control devices. More, there are cabled systems which combine sight, sound and record operations that can be serviced by the sound and communications contractor. What exhibitors, booths and conference rooms contain are ideas for your survival as a businessman; they contain products and systems and accessories that stretch your selling horizons; they are repositories of technical information that can embellish your professionalism, when you make a short visit.

EDS and NSCA are wooing the sound and communications systems contractors with these blandishments: Come to Las Vegas for your business' sake. Come to Las Vegas for your own profit. Come to Las Vegas for the companionship of old friends, new friends among old suppliers. Come to Las Vegas for the sheer fun of it—you need a break from the routine!

Contact your travel agent.

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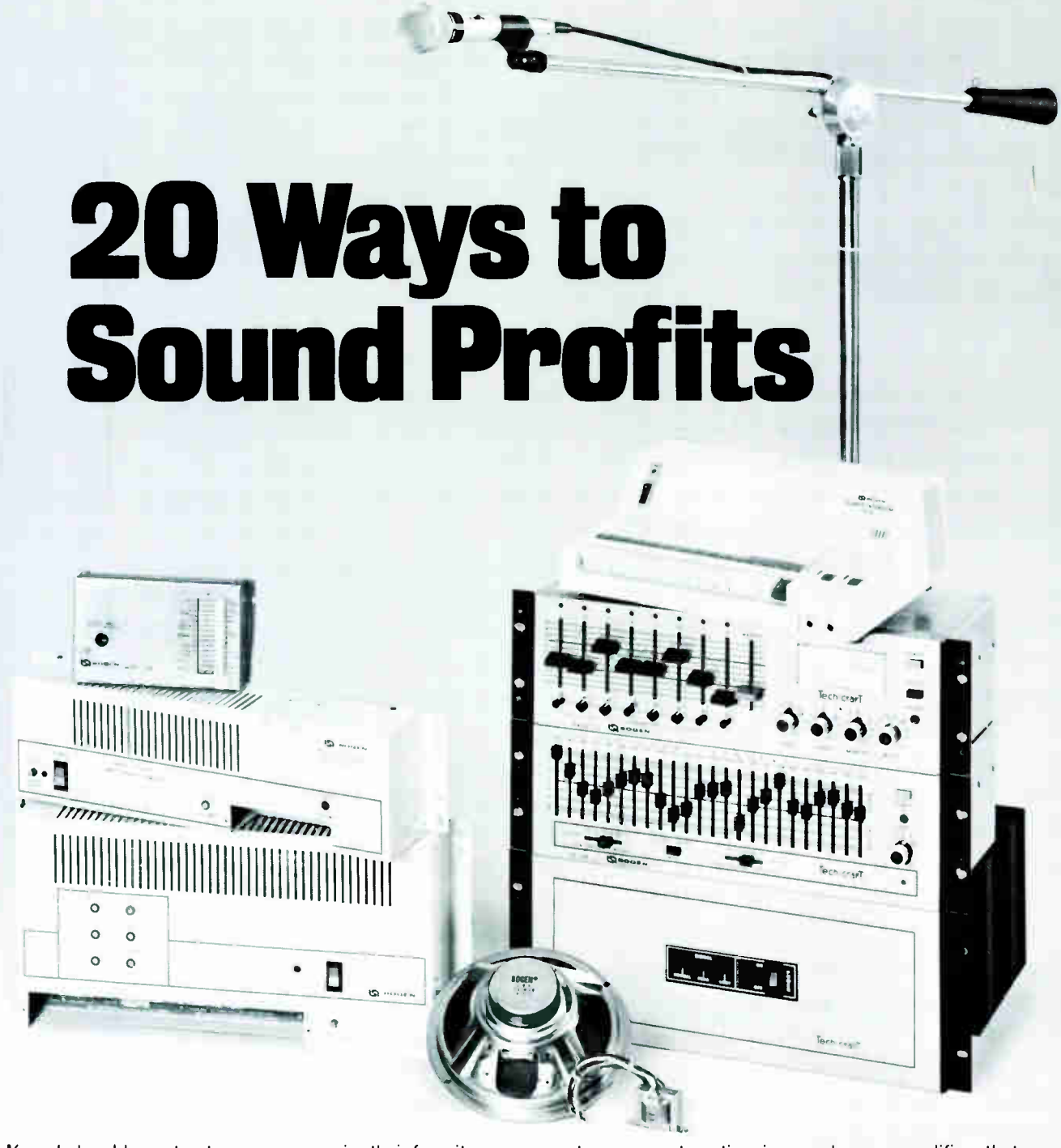

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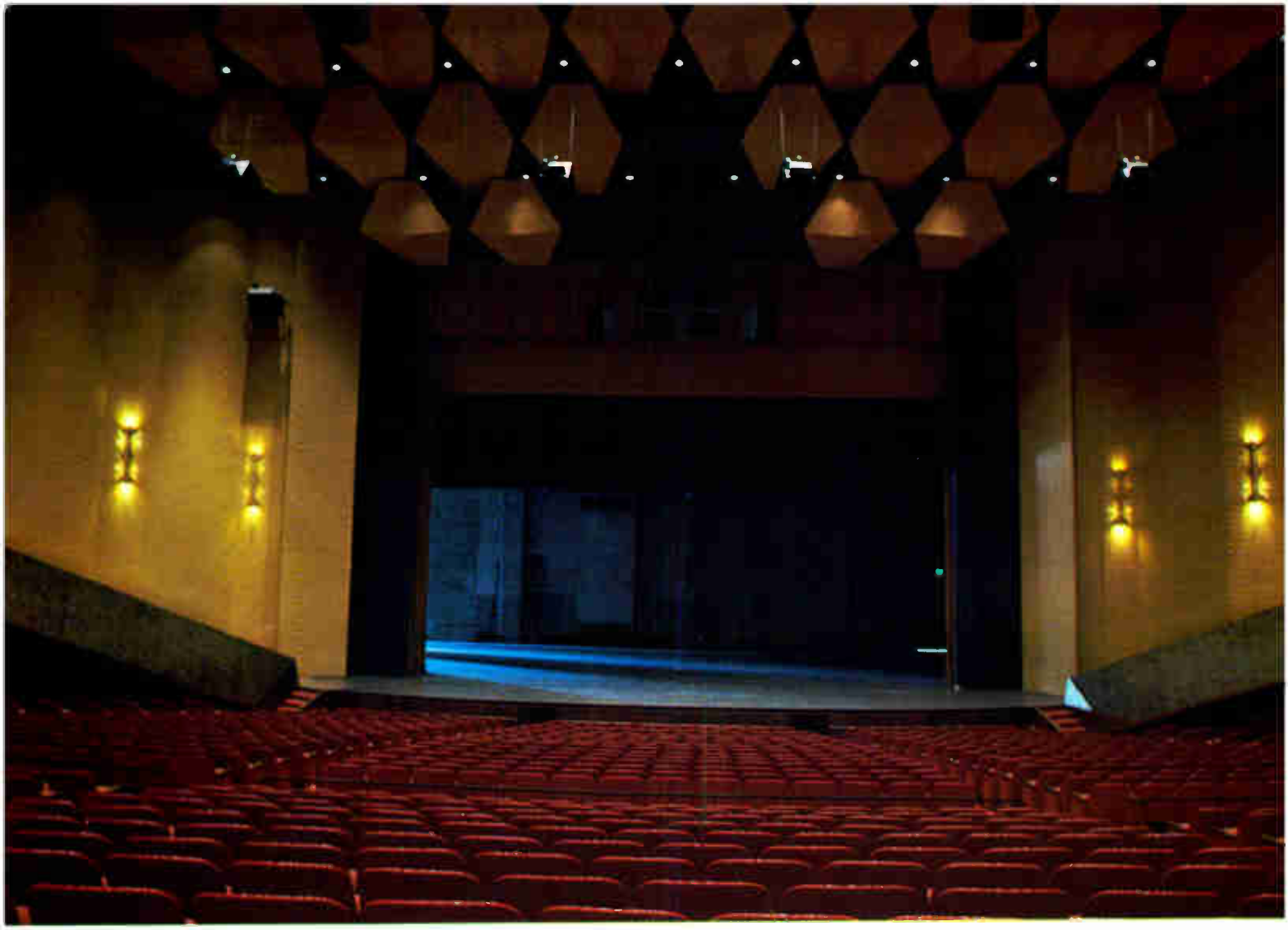


Computer Aided Sound System Design

by **David H. Bryan**

"We're getting flooded with computer programs for designing sound systems," says Larry Lutz. "They're sent in from contractors who wrote them, and now Altec has a free-exchange of programs going on." Peter More, Altec's Director of International Marketing, agrees: "Originally, our Ted Uzzle and Lutz wrote most of the programs for the Hewlett Packard Company's pocket sized computer, model HP-41CV; but then I found out our contractors had purchased a variety of machines: they had Apples for their excellent graphics; the desk-top Radio Shack TRS-80s, as well as the pocket models made for them by Sharp; Digital Equipment Corporations's PDP-11—all those were the most commonly used, so I converted the programs to fit. Today, almost regardless of what computer a contractor or consultant has, I don't think he'll have any serious trouble getting programs to speed up the design job for sound systems."

Asked how long the program conversion took him, More shrugs: "Oh, maybe half an hour to three quarters, but I added some extra features, too; that's because most desk-top computers have big CRT display screens and I wanted to use them to show, instantly, the redistribution of direct sound when a horn or cluster is re-aimed, and to show, too, the effects of moving the location of that horn or cluster." He credits a contractor for the graphics program-

Above: The Civic Center in Atlanta, Georgia boasts a loudspeaker array with computer aided design. Sound system by Eugene Patronis, Georgia Institute of Technology; architectural acoustics design by Bolt, Beranek and Newman. Photo by Lee Savoit of Altec.

ming involved.

Large and small contractors, today, are taking full advantage of computers; they're used for bookkeeping, accounting, tax studies, reporting and projecting, project scheduling, management planning with VisiCalc's "spreadsheets," electronic mailings to branch offices and to customers with computers, to get word processing done faster—contracts typed, letters and invoices too, for inventory control, and for engineering calculations, estimating, bid preparation, as well as for *sound system design*.

A small consulting firm in highly competitive Los Angeles was asked how much they depended on their computer—a firm where the few principals who did the design work also handled the installation by themselves. Their reply: "We don't believe anyone who doesn't use one can stay in business profitably any more. It would be impossible for us to do without it—absolutely." That company also wrote most of the programming themselves, but today that wouldn't be necessary—not for sound system design usage.

Altec Corporation, as most companies today, has quite a few computers in their West Coast plant. Ted Uzzle, their Manager of Market Development, says: "We have some computers in accounting, of course, and engineering has one—the graphics are so good we can use the plotter's output 'as is' for camera-ready printing copy—and I have about a dozen computers myself."

A dozen?

"Yes. Larry Lutz and I use them for our seminars. Actually, the attending contractors and consultants use them; they're pocket-sized and quite inexpensive: about fifteen percent of the cost of desktop machines. Here's one." He reached for a carrying case beside the table; the case was about the size of a lady's handbag. He unloaded it onto the worktable.

His HP-41CV system was complete with extra memory modules, a printer-plotter, magnetic card reader-writer and a vest-pocket-sized card carrying book of programs, an optical wand for reading bar charts, a battery pack and the carrying case for everything. He noted, "I think the whole package, everything a sound system designer would or could use, costs about seven hundred dollars at most computer stores today." Asked why he selected it for seminars, he replies: "It's a very good programmable computer—not just a calculator. It's been in production since 1978; it's completely portable, so a contractor can easily take it with him to a customer's location for design work and then give prices on the spot. It's really a convenience and a terrific speed-up for the work, and that alone helps contractors get more business. We get field reports all the time from contractors using 41-CVs for on-the-spot design and price quotations of medium-sized jobs, sound systems for small churches and schools; they tell us they don't often have to return later to make a justification to a committee or to church officials. Those contractors have told us they just design the system, perhaps several different ones, price them out, give the computer's print-out tape to the customer and leave. Apparently, the customers think the printed tape of possibly several alternate sound system designs is sufficiently convincing, and that further information isn't required for their decision-making processes."

Uzzle adds, "I've heard there are over six thousand financial, business, and scientific or engineering programs already written for this computer and they are available to users; that's probably more programming than all the manufacturers of other pocket computers combined could claim. Besides being inexpensive, it's both a business-financial and scientific-engineering computer, and that makes it appeal to users who operate small contracting-consulting firms, as well as the personnel of giant companies with main-frame computers—both of whom seem to like using a personal machine."

Admittedly, computer usage does save time in engineering computations, but the input data does have to be loaded or typed into the machine before it can go to work on the problem. In response to probes on this particular point, Uzzle picks up an Altec specification sheet and points to the bar chart printed on it. "This describes our product, as does the other printed matter; by using the optical wand reader on the bar chart, anyone can load the specs or a program into the computer, as fast as a modern supermarket's laser at the check-out stand can read the bar code on a can of peaches. It's so fast it's almost instantaneous; this bar code printed on our specification sheets saves each user a great deal of typing. It's fast!"

Can users make up their own bar charts from specification sheets of other manufacturers' brands of audio equipment? "Yes," says Uzzle, "the printer-plotter does it—that is, it will print out the chart all right—once the data is somehow typed into the computer, read from a magnetic card, or some source." Uzzle obviously thinks the manufacturer should save users the trouble of typing out a specification sheet; it's likely users of other brands of equipment will tend to agree with him. After all, bar charts appear on groceries these days; is it too much to expect them from the audio industry's suppliers?

Programs are stored on little magnetic cards, each about as big as half a standard businessman's card, cut lengthwise, and stored in a pocket of the small notebook. Uzzle and Lutz estimate their average program is contained on three such cards. Lutz says, "This pocket notebook contains *all* the cards necessary for *all* the programs we use. He demonstrated the reading and writing operations: it took the system about five seconds per card, including the time Lutz needed to take the card out, turn it around, and replace it in the reader for the reading of the second track.

Uzzle is pleased with his company's choice of the HP-41CV and apparently so are many of the people who have attended Altec's seminars—over seven hundred to date. He says, "I'd estimate well over half of those who have gone to our sound system design seminars have purchased their own HP-41CV computers. Usually, when we start up again after lunch, a portion of the group is missing—they're at the local computer store buying up the stock."

Asked if he minded demonstrating his sound system design methods for a particular room shape, Uzzle shook his head and said, "Not at all. It's no problem. Do you want an overhead cluster or horn system,

Ted Uzzle, left, using the HP-41CV computer; Larry Lutz is working with the thermal printer.

or a distributed sound system of many ceiling loudspeakers?"

Told both, Uzzle comments, "Well, it won't take long, about five minutes, except for the explaining time. Do you have plan and section drawings of the buildings handy?"

Altec's seminars are usually held in the summer months, because that's customarily the best time for contractors: to date, Uzzle and Lutz have run twenty-five sessions. At these meetings, both manual-graphic and computer-aided design techniques are revealed; attendees are brought thoroughly up-to-date on the latest practical methods of designing audio systems. Uzzle describes the material: "We delve into the functions of equations that describe how sound works; we take the equations apart in terms of showing the relationships between their components, but after that we prefer to let the computer do the actual computations for us." He reached for a thin book about the size of a desk blotter panel. "Look, since you haven't brought the building's drawings with you, I'd guess we can find something close to them right here." The book was *Architectural Case Studies for Acoustics*, and it was published by Altec Lansing. "We publish this workbook for our seminars; it's usually updated every year. See if you find a building shape there that is what you had in mind."

The workbook displayed plan views and sections of churches, some low ceiling rooms obviously selected for use with distributed sound systems of many ceiling-mounted loudspeakers, movie theaters with first and second balconies, boardrooms, an ice skating rink, a council chamber, a stadium, and a lecture hall. Apparently Uzzle and Lutz were completely prepared to demonstrate their sound system design methods for a wide variety of situations. The lecture hall showed a shape almost exactly what was wanted for our purposes: a difficult test of Altec's computerized design techniques. There were no dimensions on the drawing.

We sketched them in and remarked: "Assume Dr. Quincy of TV fame is doing an autopsy on a crime victim while lecturing on his findings to medical students seated in a keystone-shaped and inclined area off to one side of a rectangular room where Quincy is operating. There's continuously running water on his stage, so the doctor can wash up from time to time; there's other background noise, too, perhaps from an air conditioner. Most of the available seating is empty, but the few students there are scattered widely around, some are in the front row, others at the rear, all depending on how much they like autopsies."

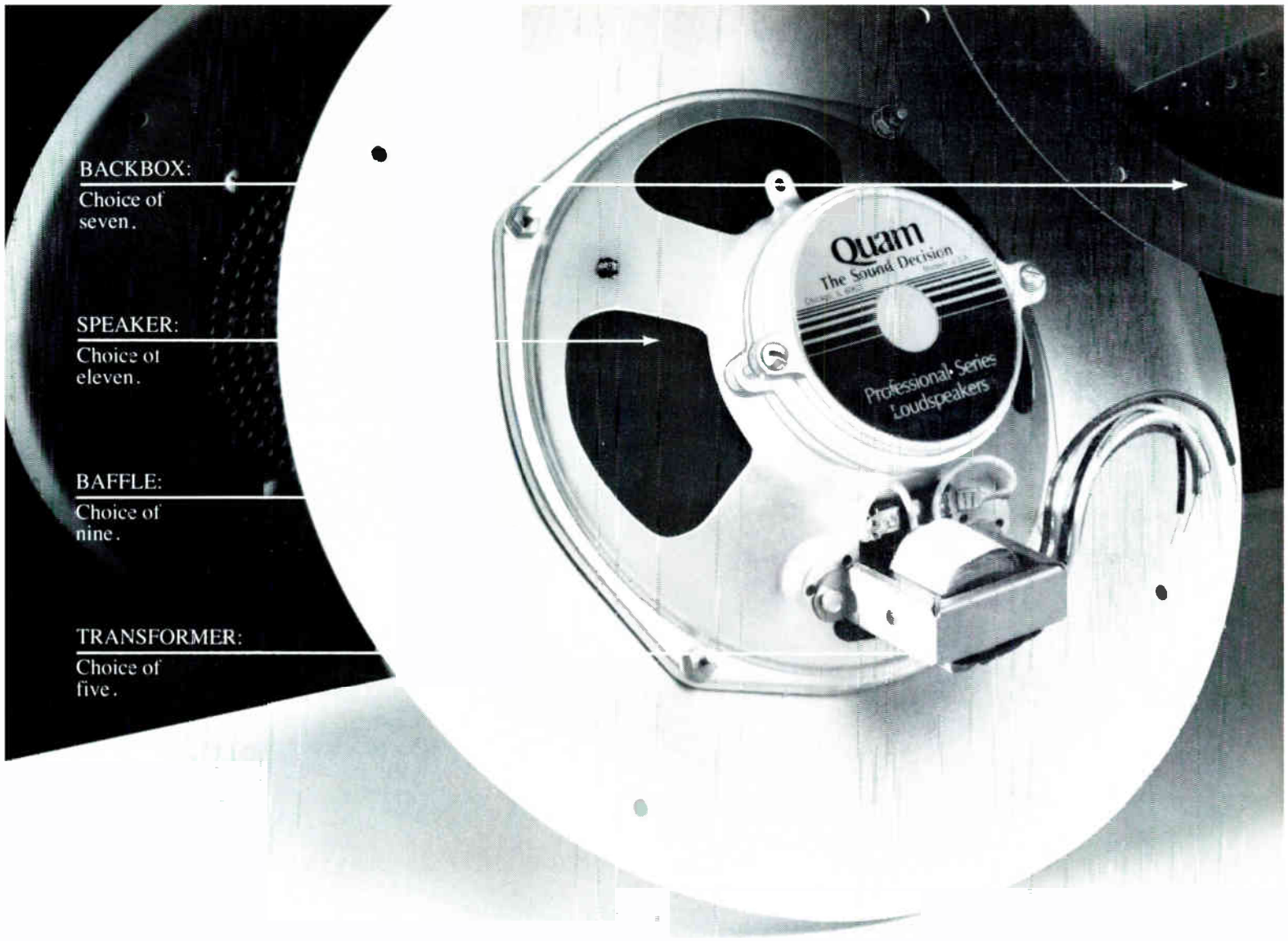
Uzzle asks, "What about the walls; how are they finished?"

"They're sort of a greenish yellow, smoothly plastered and enameled."

Uzzle shuddered. "Greenish yellow enamel on smoothly plastered walls. Hmm. Maybe your television set needs adjustment or something. Well, you've given us the dimensions already." He looked up from the drawing and asked, "What's the reverberation time? Shall we calculate it or do you happen to know it from a measurement?"

Told it was two seconds, Uzzle beamed with approval. "It's so much better to measure reverberation time with a hand-held RT-60 meter; you can use any existing sound system that happens to be there for the test, or bring in a portable system for the job. I think most contractors should measure reverberation time whenever possible; they can get it for five to eight frequencies in about five minutes."

Asked about the difficulty of accurately calculating the reverberation time, Uzzle replies: "We have a formula for it." His frown deepens, "To do it accurately takes quite a long time." He pauses, and then decides to make a point. "It just happens that the fundamental variable in reverberation was recognized in a paper published back in 1903: that's the mean free path. It turns out that all the several reverberation equations assume different mean free paths, and that's the difference between them. In 1979 Bell Telephone Laboratories made an accurate calculation of this mean free path using one of the *largest* computers they had: it took from Friday night at quitting time through the entire weekend and into the following Monday." As he talked, Larry Lutz got the HP-41CV computer system out of its carrying case and set it up on the table; then he nodded to Uzzle to show the entire computer system was ready to go to work, but Uzzle kept right on lecturing about reverberation time. Apparently, it was his favorite subject. He says, "All the textbooks state that mean free path is a simple idea and



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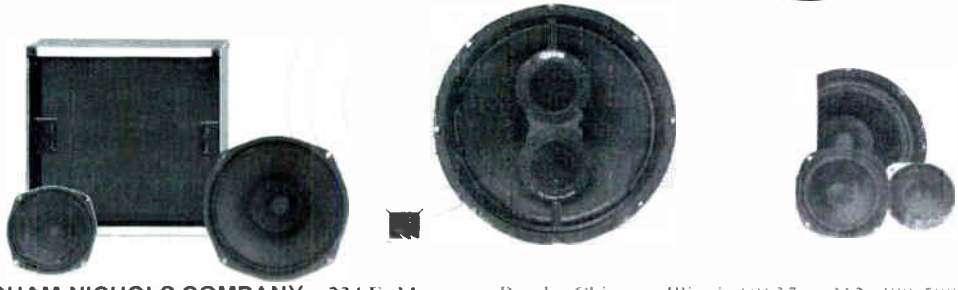

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they usually give an approximate calculation for it; unfortunately, they're wrong. We've known that since 1975, and that's why I'm pleased that in this particular case we are going to use a measured reverberation time."

He looks at the computer, types something into it, and says to all, "We're ready. The program just asked me what the reverberation time was and I told it, two seconds."

Lutz remarks, "We do have programs to work out the reverberation times according to the equations established by Wallace Clement Sabine, Carl F. Eyring, and Joseph Fitzroy; Fitzroy's is for rooms with an uneven distribution of absorptive material, and we use the calculation methods when the building isn't actually constructed yet." He looks at the lecture hall drawings, then takes several program magnetic cards out of the notebook and lays them beside the card reader-writer unit, saying, "We'll need these after a while."

Uzzle was discussing "a ringing success"—a reference to the howling that occurs in some sound systems—while he pencilled in an overhead horn directly above Quincy's head; then he marked nine points around the edge of the seating plan and numbered them. Number one was center rear, nine was center front, and the others were distributed along one side only of the seating, which was symetrical. "The problem now is to find out how this seating pattern looks to the horn in terms of the inverse square law losses with distance. We'll reference these losses to point one in the center of the back row, because most of the other points in the seating plan are closer to the horn's location; they'll consequently have less loss and will show a 'gain' in dB relative to the sound pressure level at point one—which we'll define as being at zero dB."

The secret of Uzzle's system, to get approximately equal direct sound pressure levels at all points over the seating plan, is to be able to visually compare the contour losses of a horn's output at various off-axis angles to the "gains" in sound pressure levels at the several marked positions on the seating plan. To make this comparison possible, the seating area as viewed from the horn's location must be mapped or plotted to the same scale and in the same manner as that used to display the horn's off-axis losses: *both* charts must be in angular coordinates."

Sound horns, radio transmission antennas, some kinds of light sources—these have traditionally been measured and described by contour maps: where angular coordinates above and below a horizontal axis, or left and right around a vertical axis, are used as "latitude and longitude" in degrees to locate points. Angular maps of horns show roughly oval lines connecting points of equal sound pressure; they're like isobars on weather maps. Altec's standard plots of horns' performances show the −3, −6, and −9 dB contours of off-axis losses on transparent plastic sheets to the scale of five degrees per quarter-inch divisions off the central axes.

Uzzle comments on the dimensioning they selected: "These lines, a quarter inch apart, are identical to quadrille paper markings. You can buy it at most stationery stores." He was pleased that Altec hadn't "invented the wheel" nor come up with some oddball dimensioning; the cheaper workpaper and the totally portable and inexpensive computer system made good sense.

If the horn's eye view of the seating area is drawn on a sheet of paper using an angular scale in degrees of latitude and longitude, that's the same as a horn's transparent plastic contour map (provided in Altec's seminars for their products), the losses of the horn's sound pressure for off-axis contours can be easily compared to the "gains" of the room's marked seating positions referenced to the center seat in the back row.

Uzzle says, "It's a visual comparison, and it's like counting on your fingers to compare inverse square gains of the seating positions to the horn's off-axis contour losses. Very easy and quick!"

One of his major contributions to this method is to utilize the HP-41CV computer to handle the masses of dimensional information regarding the relative positions of the horn to the seating area points of interest, translate the rectangular coordinate data into angular polar coordinates, figure the various ranges from horn to each seat position, and work out the resulting

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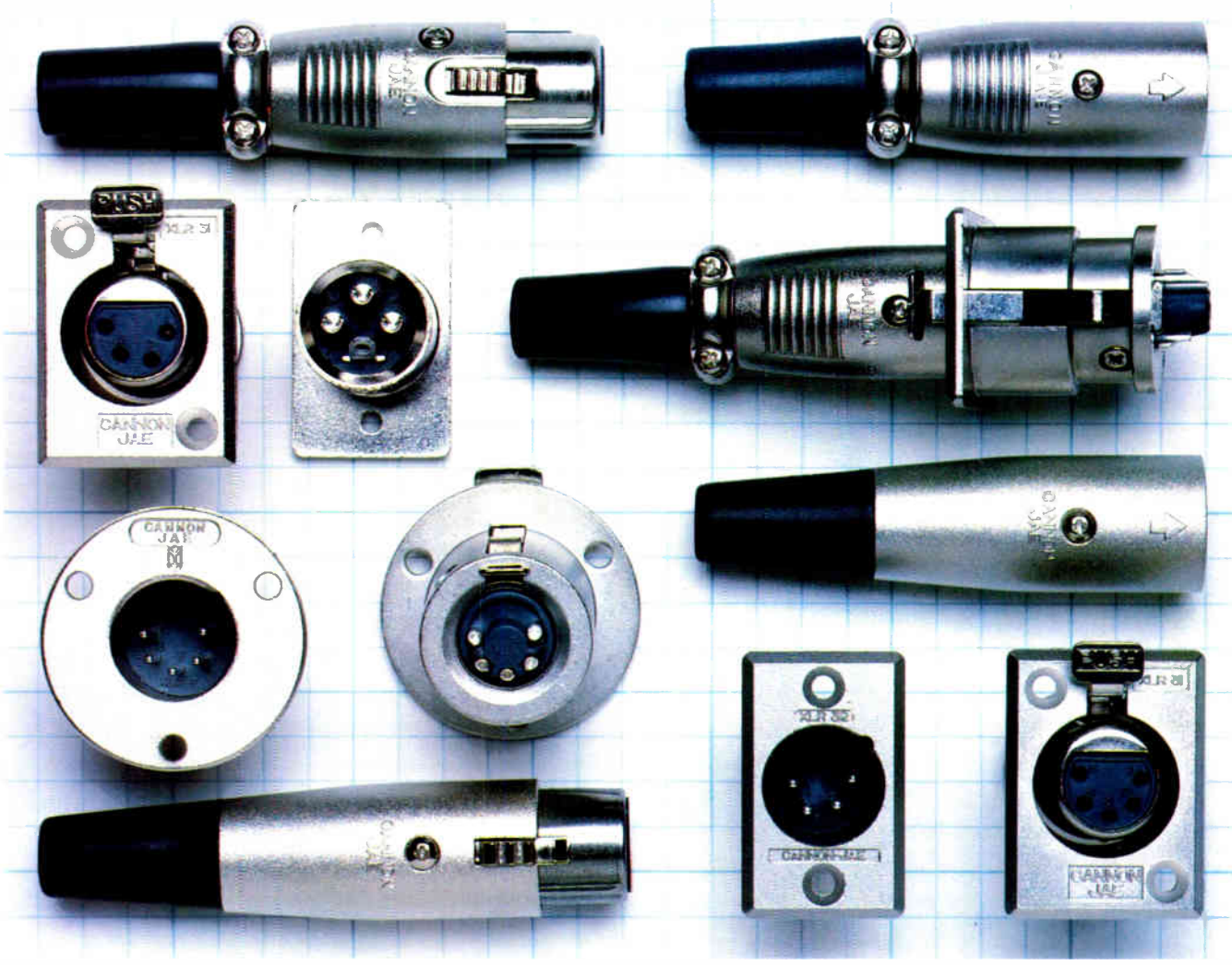

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VIDEO SECURITY SYSTEMS, by Keith Bose, is a work of increasing importance now that security systems are becoming more sophisticated and an integral part of the communications system for industry, commerce, institution, school, and the leisure/housing markets. The technical aspects of the CCTV camera and its peripherals are presented in word and picture—from installation tips to maintenance practices. Two chapters are of special interest: Cameras, Monitors and Video Recorders covers the range of tubes, signals, night viewing cameras. Signal Processing, Special Effects and Color deals with amplification, equalization; then special effects, screen splitting and character displays.

Hard cover.....$17.95

inverse square law losses and reference them all to point one. The little computer accomplishes all this in about one minute; and as it prints out the data on tape, Uzzle locates the points on a sheet of quadrille paper, tags each with its number and the associated dB gain. He connects the points he's plotted on the paper with a line. "This trapezoidal looking shape is an accurate and proper view of the seating plan as seen from the horn's location. Things look different to us when seen from different vantage points; that's just the way it is, but it's not wrong." The plot of the seating plan looked exactly like that shown by a camera using a wide-angle lens when looking down at a slight angle on a similarly shaped area.

The process that Uzzle demonstrated, using the computer to replot the seating area on a sheet of paper, would deeply interest customers if done in their presence; computers have a certain mystique, even today. For different locations of the horn, different horn's eye views of the seating plan could be drawn; perhaps three or four such maps could be made up in fifteen minutes. If the customers have a particular location for a horn or horns in mind, the contractor or consultant could quickly check them out using the method Uzzle demonstrated.

The equations involved? "It's just very simple trig and geometry," says Uzzle, "the only trouble is there's *too much* of it to bother doing manually with a calculator. It would take hours, maybe days. But the program does it so fast I've barely got time to write down the coordinates and sketch them on the pad."

He slides a transparent, printed contour map of the horn's characteristics over the quadrille pad drawing he made of the seating arrangements, looks at the sandwich as he slides the horn's contour up and down slightly. "We're just about done, will be as soon as I match up these inverse square law 'gains' to cancel as much as possible the horn's contour losses... Okay, this looks good; the horn is aimed about eighteen degrees below the horizon. See: the cancellation is about two dB off in the back row, only one in front—that's nine dB down from the horn's contour against an eight–dB gain from being so close to the horn up here in front. On the edges, well, it's always within two dB. Satisfied?"

In discussing the history of the development of the method he used, Uzzle gives full credit where credit is due. "My personal involvement with all this started back in 1978; that's when I wrote an article about how to determine coverage angles and when I made a mathematical model of architectural spaces. It was on the subject of dividing odd shaped volumes into combinations of cubes, blocks, prisms—don't ask me why, but apparently nobody had done it before nor published simplified results. In August of 1980 I worked out the present system used here, and all that took a month."

He adds, "I combined my thoughts and experience with an idea I'd seen published by T.G. McCarthy in his 1978 paper to the Audio Engineering Society; he'd done an architectural mapping technique and he showed what he said were horn contours. His article did help me, even though the details of my method in terms of exact tech-

Peter More, with Lutz, at More's personal computer. The horn data and contour above the computer display were originally created by the computer, then enlarged and mounted by Altec's art department.

niques and mathematical equations used are different." Uzzle pauses, thinking, then adds, "Then a long time later I saw a copy of an even older article by Ed Seeley; he and Mel Sprinkle had designed a sound system for the Giants' stadium in Secaucus, New Jersey, back around 1976. Seeley's paper showed an angular map of the stadium and also a horn's contour map; in my opinion, Seeley had 'put it all together' conceptually. But what he didn't have—and it certainly would have been a great convenience to him—was a simple mathematical model of the building's geometry and the use of today's digital computer."

He did it all by hand? Uzzle nods, "Yes. Seeley had picked a series of representative points in the stadium; they corresponded to the nine points I used in the seating plan of Dr. Quincy's lecture hall, but he apparently worked out all the mathematics by hand on a calculator." Uzzle sighs. "It must have been an enormous task!"

Uzzle believes his Altec method draws on previous work by others, but thinks his is the first published sound system design *method* using carefully measured contours of horns and the computer software to solve the mathematics involving the losses due to inverse square law and the transformation of the building's geometry in rectangular coordinates into angular results. Uzzle's methods were discussed in a paper presented to the Audio Engineering Society in June of 1981: *Loudspeaker Coverage by Architectural Mapping*; published in their June '82 journal.

Next he ran a program to find out the sound pressure and articulation loss of consonants, both on the horn's axis and at the six–dB off-axis contour which covered the entire seating area, except for the extreme front right and left seats. He says, "The program here uses two equations; I'll write them down."

"And for the articulation loss of consonants, we're using this:" He wrote.

$$\text{Articulation loss of consonants} = \frac{656 d_2^2 T^2}{QV}$$

He made entries as the computer's display requested them, the two-second reverberation time was one entry, the room volume (already worked out by the computer for an earlier piece of work) was another, as was the loudspeaker type. Lutz standing nearby remarks, "You see, most of the data is already 'on file' inside the computer; it saves a lot of re-entering on our part." After working out the results the computer asked: "Want to try another horn?"

Uzzle says: "The program here assumes the reverberant sound is constant throughout the whole room, and in the case here that's probably true, because of the greenish-yellow, glossy enamel painted walls." He shuddered. "However, in other cases where maybe there are panels of highly absorptive material in the room, we have another program to handle it. The sound system designer has to use good judgment all the time; the computer is a great little number cruncher, but that's all it can do. It takes a human being to design a good sound system!"

Having checked out a good horn location and angle, the sound pressure level and the articulation loss of consonants, Uzzle checks for feedback. "This program compares the gain needed by the sound system, NAG, or needed acoustic gain, to PAG, or potential acoustic gain; PAG is the feedback limit, and there should be a margin of six to ten dB between PAG and NAG to prevent the system from being a 'ringing success' so the students can hear Dr. Quincy's remarks instead of a

$$SPL = L_{max} - 10 \log \left(\frac{Q}{64 \text{ pi}} + \frac{81.8\,T}{V} \right) + 10 \log \left(\frac{Q}{4 \text{ pi } d_2^2} + \frac{81.8\,T}{V} \right)$$

Where: L_{max} = sound pressure level of horn and driver at maximum power measured on-axis from 4 feet.
SPL = sound pressure level re: 20 micro Pa.
Q = loudspeaker directivity factor.
T = reverberation time. (seconds)
V = room volume. (cubic feet)
d_2 = distance of farthest listener from the loudspeaker. (feet)

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howling system." Uzzle typed in the room volume, the reverberation time, the model of the loudspeaker he'd selected, and various dimensions related to the positions of Dr. Quincy, the microphone, the overhead horn, and the farthest listener. In a few seconds the computer display showed values for PAG and NAG and asked, "Try again?"

The tape printer showed PAG to be fifteen dB and NAG to be only 4.6: clearly there was a ten-dB margin of safety before a "howling success" could occur. Uzzle leans back in his chair and says, "We're okay, but the trouble with this system is that it really needs a little bass reinforcement—otherwise Quincy will sound to the students as if he's talking to them over a telephone; the horn's intelligibility is okay, but he'll sound weirder than usual without some bass support." Lutz agreed, and together the two men prescribed a suitable woofer for the doctor's system.

They'd worked on the total design for only half an hour, but that included a lot of explaining time. Asked how long the same design job would take if they hadn't been interrupted with questions, they smiled. Finally Uzzle says, "Customers ask questions too, you know; but I'd guess about fifteen minutes for this amount of work would be right for most situations." He adds, "That would include working up a total price for the installation. It all takes time."

Uzzle's view on computer aided sound system design is almost as if he's a bit "down" on these marvelous machines. "A computer can't do the design job; it takes a person with knowledge, good judgment and experience—and these words have specific meanings in the sound contracting business. Knowledge refers to the design techniques, understanding in great detail the equations involved in predicting sound pressure levels, feedback and ringing, an underestanding of what really limits intelligibility—those are things a competent sound designer just has to know. Judgment, well that's a comment on the fact that you can't have everything in this world—especially in system performance. For instance, the first row's coverage gets worse as the horn moves towards the listeners, but that cuts the chances of ringing. The positioning of that horn or loudspeaker, where Dr. Quincy's microphone is situated, the way we match up the inverse square law gains to the off-axis horn's contour losses—that's judgment, and there's no way in the world a computer can make those decisions. No way! Experience, that's probably mostly an interpretation of hardware, whether a particular company's product specifications were written from a carefully made piece of laboratory equipment or from test results of randomly selected chunks of hardware that came off production lines. It makes a big difference. I think a company's record in the industry is important, as is a man's own history of performance—those are things learned by experience. Anyway, a computer is just going to be an aid to good designers; it can never replace them."

Asked about the validity of using a horn's measured pattern or contours inside a room, he replies, "The pattern is okay as long as the dimensions of the room are large compared to the wavelength of sound, and that is the situation here. You see, intelligibility lies a couple of octaves around the 1.25-kHz point, and that's mostly above crossover for this horn, where the wavelengths are about a foot."

Lutz volunteers a comment: "Normally, every time there's a three-dB change in the direct-to-reverberation sound levels, there's a corresponding doubling or halving of the articulation loss of consonants. Since in this room we could safely assume the reverberant sound was constant all over, we didn't have to mathematically check for intelligibility everywhere." He smiles and adds, "So we just counted on our fingers, to quote Mr. Uzzle."

Contractors today are using computer aided design methods learned at Altec's seminars. Over seven hundred men and women have attended them, and other manufacturers are starting to offer similar programs; JBL has announced a computerized design of sound systems based on the IBM Personal Computer, and the company plans to issue their product specifications on magnetic discs instead of in the form of bar charts. Asked about future plans, Uzzle says, "I'm sure all manufacturers will continue to utilize the new methods now available; we'll do

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whatever saves time and is cost efficient. Speaking of saving time," he looks at Larry Lutz, "perhaps this is a good time for you to demonstrate the method of designing a distributed sound system?"

Lutz says, "The intended design of an array of ceiling mounted loudspeakers, usually pointed straight down, is to keep from blasting those people located directly under a loudspeaker, while still allowing those in corners and in areas with a lower sound pressure level to hear quite comfortably. Uniformity in sound pressure level is the goal.

"I think Altec's contribution," continues Lutz, "our design method of ceiling or distributed arrays of loudspeaker systems, began with Curt Emerson's work. He's with the Canadian telephone company, and he'd made an analysis of several traditional loudspeaker spacings and coverages: edge-to-edge, fifty-percent overlap, and edge-to-center. He'd worked out a mathematical model of these patterns, and he'd defined the density of spacing of loudspeakers in such arrays. I read about his analysis and asked Dr. Rex Sinclair here if we could make a computerized model of a ceiling array that would take into account *all* the loudspeakers and allow us to predict the sound pressure levels under it. His work was published by the Audio Engineering Society in November '82, and it's the basis for the design methods we use in our seminar."

Sinclair first determined a way to express the sound pressure levels, SPL, of a single loudspeaker pointed straight down, at various points in the ear plane. Then he established the maximums and minimums in the SPLs in the ear plane under a computerized array of almost 1,000 loudspeakers. Two formats were used: a square loudspeaker spacing pattern, and a hexagonal. Each of these patterns was examined at two and four kHz, and for three degrees of overlap or density.

Lutz explains: "The first problem, that of measuring the SPLs in the flat ear plane, a horizontal plane for a ceiling-mounted loudspeaker pointed straight down, is complicated by the fact that we normally measure loudspeaker performance in a polar coordinate system. Typically that's a curved surface like a bowl, with the bottom at the ear plane, and at off-axis points there's an additional loss from inverse square law effects between the bowl's rim and the lower down ear plane." Lutz continues by showing an equation that Dr. Sinclair developed by mathematical curve fitting: $L_T = a\ \theta^b$ in dB, and remarks, "We've tabulated these constants, a and b, for most of the loudspeakers we make that are intended for ceiling arrays. L_T is relative to the on-axis value: that's the reference of L_T to the sound pressure level."

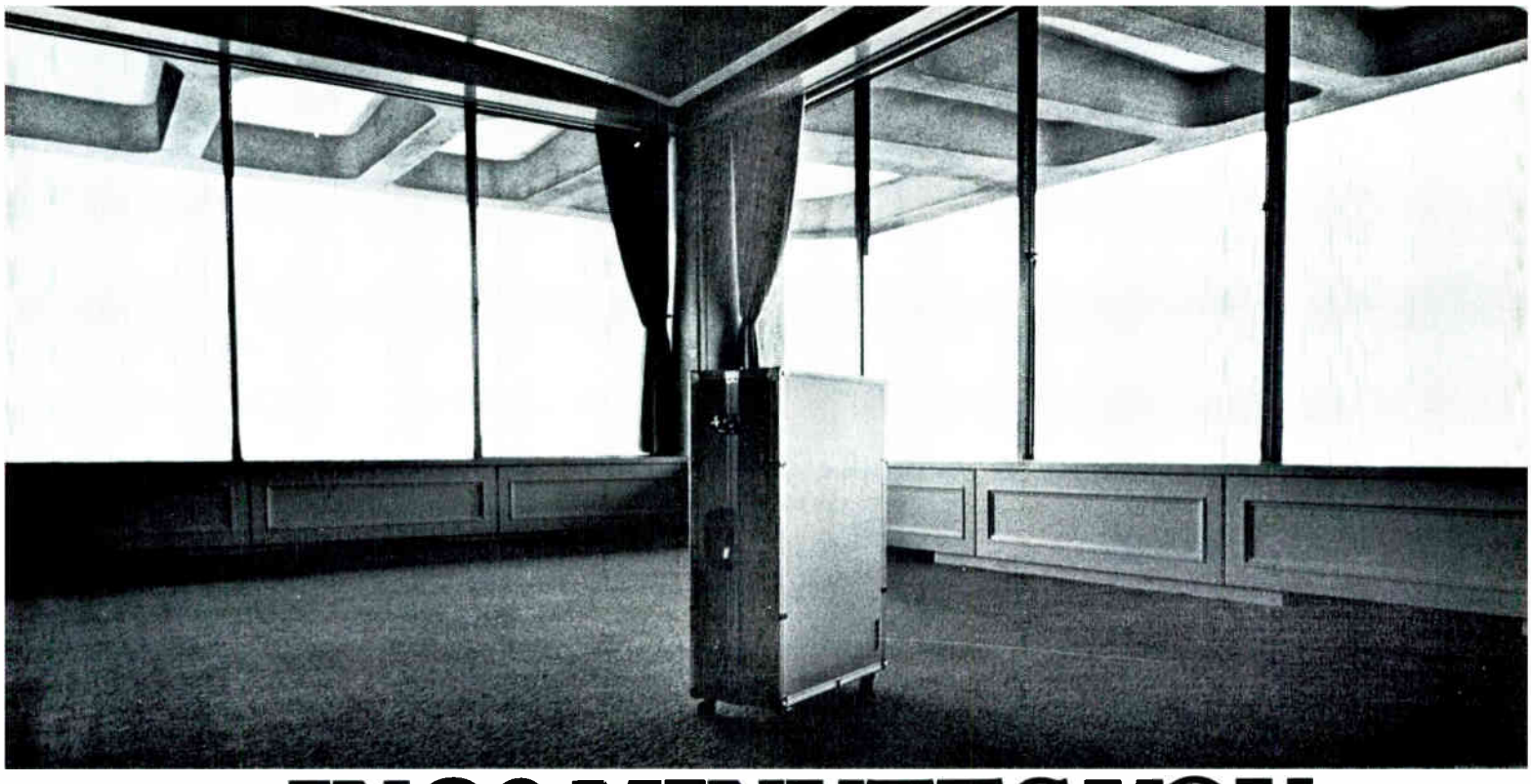
Lutz, getting enthusiastic about the practical applications of the work, says, "Also, we've tabulated this equation's angle at an SPL or −6 dB for various loudspeakers at both two and four kHz, which provides us with polar to planar corrections: with this information the designer is all set to do whatever scaling is needed, or he can let his HP-41CV or any other computer do it for him. This means he can standardize on circle drawing templates, whatever is convenient. Multiplying the r/h ratio, the tangent of the −6dB circle's half-angle, by h or the ear-plane to ceiling height gives the radius of the circle in feet and tells him the scale factor he needs to draw the ear plane's plan view."

In response to a comment about −6dB being quite a change from the on-axis value of about zero dB, Lutz nods, smiles and says, "Don't forget, there's going to be a lot of adjacent loudspeakers on the ceiling: they'll contribute to that otherwise −6dB SPL and reduce the difference to something manageable. Would you believe one-tenth of a dB?"

Just use more ceiling speakers, closer together?

"Right, Here's how." Then Lutz explains the second part of Dr. Sinclair's work.

Using vast "arrays" of up to 1,000 loudspeakers in computerized patterns, in hex and square formats, for two and four kHz, and for three amounts of overlap, Dr. Sinclair computed the maximums and minimums of the SPL under a centrally located group of four loudspeakers in the square pattern, or a group of seven loudspeakers in the hex layout, all in the ear plane. These were plotted graphically and *tabu-*



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Built around the suggestions of experienced interpreters working directly with the engineering staff at Sony, it's the most dependable, the most flexible, the easiest to handle, the simplest to install (actually adapting to any local power supply anywhere in the world), and therefore it's the most practical communications system you can buy.

To find out exactly where to buy it, or to simply find out more information about the compact Sony Communication System, write to Sony, Professional Audio Products, Sony Drive, Park Ridge, N.J. 07656.

SONY
Professional Audio

lated for most types of ceiling-mounted loudspeakers that Altec makes. Talk about getting your money's worth out a computer—this is it!

Here's the tabulation of Lmax, Lmin, and Lmax-Lmin for type 409 Altec loudspeakers in various patterns and frequencies.

	2 kHz			4 kHz		
Pattern	Lmax	Lmin	Lmax-min	Lmax	Lmin	Lmax-min
Edge-to-edge square	0.78	−3.37	4.15	3.03	1.14	1.89
Edge-to-edge hex	0.94	−1.18	2.75	3.25	1.82	1.43
Min overlap square	2.09	1.04	1.05	4.42	3.68	0.74
Min overlap hex	1.42	−0.09	1.51	3.80	2.85	0.95
Edge-to-edge center, sq.	4.58	4.53	0.05	6.49	6.31	0.18
Edge-to-center, hex.	5.20	5.11	0.09	6.98	6.88	0.10

A designer, knowing what limits he wants to restrict the uniformity to, needs only run down the Lmax-Lmin column for the frequency he's interested in to obtain the necessary density of loudspeakers in the array he's designing. For instance, at a one−dB limit to the spread or uniformity, operating at two kHz for a speech or voice system, he can see that the minimum overlap of the square format should be satisfactory at 1.05−dB difference. Altec provides as part of the materials for their seminars a convenient set of templates for drawing circles and for the spacing of loudspeakers in arrays—for all combinations. Their computer program accepts real plan view dimensions and spits out rescaled dimensional units, those of the little squares in a quadrille pad, for drawing the ear plane and loudspeaker coverages therein.

Uzzle remarks: "What we've got here is a very convenient method of redrawing the ear plane coverages and locations of all those ceiling mounted loudspeakers to get any degree of uniformity needed in the SPL at the ear plane. It's a plan of the ear plane and of the loudspeaker coverages there from the viewpoint of the ceiling-mounted loudspeaker array. The redrawn and rescaled plan view is what the array 'sees'."

Lutz points out that real buildings have all kinds of obstructions in their ceilings: lights, air vents, fire extinguishing spray heads, supporting posts—and that's another reason for the existence of both square and hexagonal patterns for the loudspeaker arrays. He says, "Usually, by changing to another pattern, or by rotating it, perhaps by ninety degrees, we can fit an array to difficult buildings."

In his Technical Letter, 258B, published by Altec, Dr. Sinclair comments on the contributions from loudspeakers in the array that are at a considerable distance from a particular loudspeaker under consideration: "The contributions are not only at a very low level but are delayed, and it can be argued they more closely resemble early arrivals of the reverberant field."

On a manual basis, the designer of the sound system selects a loudspeaker, looks up r/h for the −6-dB coverage limit, multiplies it by the ear plane to ceiling height to get the radius in feet. He selects a template for drawing this radius and immediately knows the scaling required: r inches on the template is proportional to r feet of actual plan view dimensions. Then on his scale drawing he positions the various obstructions such as light fixtures, posts and air vents, and slides the appropriate overlay over his drawing, rotating it as necessary, to get a practical array positioning. Or he can use the Altec computer design program.

The program starts off by asking the designer the ear plane to ceiling height, then suggests he pick a loudspeaker. After stating the SPL and power required, the program asks if the designer wants to try another loudspeaker. Further inquiries by the program get the designer to specify the frequency of interest, the real dimensions of the room; then the program tells the designer what overlay to use and what quadrille pad units or dimensions are to be used to draw the rescaled ear plane. It's quick work, because the computer *already has on file* all the particulars the designer would otherwise be required to look up for

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loudspeaking, direct-select intercom

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Loudspeaking, separate-channel intercom is an essential tool if your goal is to be efficient and profitable. Unlike intercom lines on your telephone, a second channel intercom that is loudspeaking has fundamental advantages simply not available anywhere else.

Master Station

Fundamental Advantages of Intercom

People who have never experienced a work situation with an intercom often ask (1) "Why have two instruments on your desk—a phone and intercom?" and (2) "I can get an intercom on my phone—why have a separate system?"

The answer is because a separate, loudspeaking intercom is *better* and here is why:

Intercom Speeds Communication

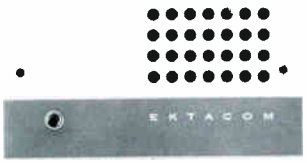
Intercoms are fast, phones are slow. By the time you dial a phone, it rings, your party picks it up and you start to talk you will already have your answer if you use an intercom—*it works faster.*

Two Channel System

Do you like to be put on "Hold" when you call someone? Neither does anyone else. With an intercom system you do not need to use the Hold button on your phone—unless you want to. Also, with a two channel system you do not need as many phones—put phones only where making outside calls is essential, otherwise use an intercom. This cuts down on phone bills. You can call inside without tying up outside (expensive) phone lines.

Short Conversations

Loudspeaking intercom conversations are short, unlike telephone conversations that almost always contain a lot of non-business trivia. Ask anyone who has used a loudspeaking intercom, and then monitor your own phone conversations for a day or two! You will be surprised at how much time is wasted on telephones.



Wall Remote

It Is Loudspeaking

This means when you are called you do not have to do anything—you just talk as if the caller were in front of you. And when you originate the call you push one or two buttons and instantly you are talking! Of course, privacy handsets are an option.

Desk Remote

It Is Simple

Many phone systems have become so *complex* that most of their features are not used because the users do not understand them. Ask anyone with a privately owned phone system that has built-in intercom. By having a separate intercom system, this confusion is ended.

Reduce Call Backs

How much do you spend a year calling people back? Both in terms of your time and the phone bills? With a second channel intercom you can generally get the information you need right now and avoid calling back. A big saving!

Rack Mount Master

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With the G Series you have a simple switch for each person you may wish to call. Above each switch is the name of the person—this way you do not have to remember their number, nor look it up! When you receive a call, a lamp and chime come on to announce the call. You may have a lamp that shows the **name** of the person calling you! Also the system has full privacy so there is no eavesdropping. Because the G Series has both incoming and outgoing volume controls and automatic reduction of extra-loud sounds, you always get Clear, Natural Sound.

G Systems may have from two to over 1,000 stations! Direct paging to one or more areas is available so you can locate people quickly. The G Series is justly regarded as the finest direct-select intercom in the world today!

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himself. Lutz says, "I think the real point of our seminar is to show how easy and fast it is to accurately design sound systems when aided by the computer." He adds, "I'm personally troubled by mathematics; so when I have to do it, I prefer to put it into the computer program so I'll never have to do it again. Also, of course, the computer does it right every single time. That's very important to a contractor when he's visiting a customer and doing a design job on the spot with a portable computer like this HP-41CV. That's happening a lot these days. On the other hand, when I'm using a larger, desk-top computer, I can draw everything in on the CRT display screen: vents, light fixtures, posts, whatever. Most desk-tops have larger memories and graphic capabilities, so plotting the extra points isn't a problem."

Distributed sound systems are normally used in rooms with low ceilings, those low enough to prohibit the use of overhead horns or clusters, but some applications use *mixed* systems of both horns and distributed arrays of loudspeakers. Asked about this, Uzzle replies: "In churches there're often areas under balconies where direct sound from overhead horns doesn't reach; that's where a distributed array system can do the job. If audio from *both* a distributed system and an overhead cluster can reach the listeners, it's usually necessary electrically to delay the distributed audio in very large buildings. In buildings with a long reverberation time, it's important to keep the total amount of sound energy down as much as possible, and that's another reason for the use of a mixed system: the distributed array won't put as much energy out as does a horn working from a longer distance." He pauses. "Maybe we should get into the design of distributed system for the case when the ceiling and floor planes aren't parallel. We have methods for these situations, too."

The first two, manual or computer aided, are exactly as in the case for parallel floors and ceilings, but the designer assumes and uses only the minimum ear-to-ceiling height regardless of the actual changing heights for various locations in the room. This assumption has the effect of automatically compensating for the different heights, provided all the loudspeakers are of the same model and receive the same power. "The difficulty," Uzzle notes, "is the ceiling ends up being peppered with loudspeakers. Most competent designers would prefer to use different kinds of loudspeakers in various parts of the room, because it's less costly and more efficient."

The remaining methods, also manual or computer aided, depend on the application of equations for the SPL, Lmin and Lmax-Lmin, defined by Dr. Rex Sinclair but extended to handle the consequences of the angular shifts introduced by the non-parallelism of floor and ceiling. These equations have been built into the program of the HP-41CV and have been made available, also, in the form of design sheets. These transparent printed sheets relate each loudspeaker model, the net angle of non-parallelism between floor and ceiling, the normal distance from ceiling to the ear plane, the angles subtending the coverage circles in dBs, and the circles covering uniformity limits in dBs. All for 2 and 4 kHz.

Lutz demonstrates the technique using these sheets. The initial rescaling of the longitudinal *section* view according to the lowest ear-plane-to-ceiling distance is as normal; the plan view is also rescaled accordingly. Then a loudspeaker is selected, or several for different heights involved, and the appropriate design sheets are used to lay off

the coverages on both section and plan rescaled drawings. Naturally, the angles shown on the design sheets determine the necessary spacing of the loudspeakers; and the relative power requirements are given, with respect to that needed by the lowest ceiling-to-ear plane height, by W = 20 log hi/ h1 dB; where h1 is the initial height figured, the lowest height of all.

These design sheets for the various Altec made loudspeakers, the computer programs for the HP-41CV, the program notes and related literature regarding the methods used—all are available to contractors, editors, and consultants who attend the Altec Sound System Design Seminars. The intent of the company is to make sure these techniques are widely distributed and thoroughly understood, and they believe the best way to guarantee this is to expose more people to their seminars. For this reason, the seminars are being offered in cities all over the United States and in a few European cities, too.

In a distributed system the maximum articulation loss, ALmax, is the smaller of:

$$AL = 9T\% \text{ and}$$

$$ALmax = \frac{656\ V\ \ T^2\ \ N}{S_c^2\ Q_0\ 10^{\cdot 1 L min}}\ \%$$

The minimum articulation loss is the smaller of:

$$AL = 9T\% \text{ and}$$

$$ALmin = \frac{656\ V\ \ T^2\ \ N}{S_c^2\ Q_0\ 10^{0.1 L max}}$$

Where V is the room volume in cubic feet, T is the reverberation time, S_c is the ceiling area, N is the total number of loudspeakers, and Q_o is the axial directivity factor of a single loudspeaker. There are other restrictions on these equations, which are clarified in Altec's publications.

Frankly, it's a lot of trouble to keep these various terms straight, look up the necessary information to use with the equations, perform the calculations, then check to see if the results obtained are within the design goals. All this is compounded by the pressures of doing the job right the first time and doing it fast.

Commenting on the results of this kind of pressure, spokesmen outside of Altec have said that sound systems for small auditoriums and churches are "traditionally" *done over several times* to satisfy the customers. These tend to be small to medium dollar value projects where the competitive situation and limited budgets prohibit doing a thorough design job by conventional methods. A contractor said, "The dollars just aren't there!"

The solution to this universal problem might be the approach that Altec and a few other manufacturers are taking: to utilize the speed and thoroughness of inexpensive computers to deliver product data and accomplish the routine calculations quickly and cheaply. Uzzle comments on this trend: "They're starting to. More and more suppliers are providing the right kind of data today; they're acting almost as if they expect contractors, consultants, and designers to be using computers to help out in the work."

While the 700 plus graduates of Altec's seminars may not all be Altec purists, many of them are following the trend: utilizing their computers more than ever before and benefiting by the resulting exactness and time savings. □

Contractors Expo '84

In anticipation of the National Sound & Communications Association's Contractors Expo '84, S&C invited some of the key figures behind the conference to submit personal messages to our readers. Here they are:

Have you ever seen a new product in a catalog—and had to write for more information? Or maybe you skipped right over that latest piece of "hi tech" equipment, because you thought to yourself: it can't possibly work! What if you were glancing through that catalog and a voice suddenly answered all your questions? Not possible? Well, the NSCA has developed the next best thing!

This April, we have the opportunity to attend the Contractors Expo '84—a trade show specifically designed to suit the needs of the electronic industry. You don't need to *write* for more information—see new products first hand!

Experience "state-of-the-art" equipment with over 100 suppliers from the electronic industry. This is a table-top-display-unit Expo. The exhibitors will be concentrating on "high technology" and "new technology" items, not on signs or decorations. They realize your goal is to get exposure to new products, not be invaded by advertisement. They understand you must stay current and up to date on new products to remain profitable.

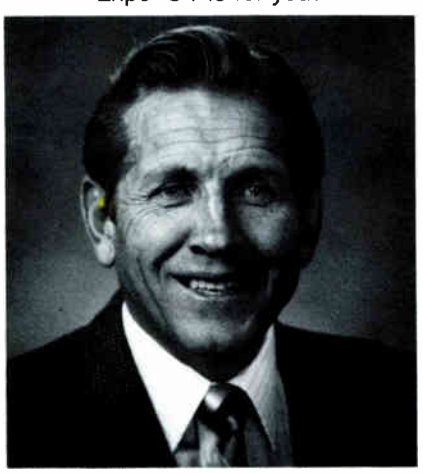
As systems become more and more sophisticated, it is necessary to have first-hand knowledge and experience with new products to be a leader in today's industry. Too often spec sheets and catalogs can't give you adequate information to make a profitable and knowledgeable business decision on a new product.

We are not just installers of equipment. Today, we are—and must continue to be—technical experts. We have the knowledge and background to recognize when a system is not designed to greatest efficiency. With constant exposure to new products, we can help make each installation as advanced as our ever-changing industry.

Expo '84 is an opportunity to see products in action, ask questions, and gain technical knowledge from experts in the industry. As Bud Rebedeau, Executive Secretary of the NSCA, said, "The technical expertise of an electronic systems contractor is the fuel that keeps the vehicle moving."

Whether you are interested in many new products, or just need in-depth information on a specific product—

Expo '84 is for you!



Per Haugen, President,
General Communications, Inc.

As a contractor and board member of your association, I urge you to attend the Contractors Expo '84, because we all need continual training just to stay even in these rapidly changing times. Among the new technologies of the past 15 years are:

Equalization: 1/10-1/3-1/2-2/3-octave band equalization, passive and active. Those contractors that didn't advance have been left behind.

Delays have become commonplace for many uses, including tape delays, tube delays, spring delays, anti-log, and digital delays.

Over this same time frame, signal processors have proliferated to who-knows-what will be next.

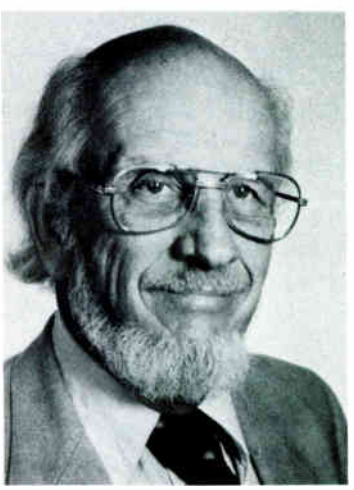
Ten years ago we hadn't even heard of automatic microphone mixers; now there are at least six, all made with different technology. I still meet contractors who do not understand "the (NOM) number of open microphones" theory.

Most commercial audio amplifiers were still using tubes less than 20 years ago. What has happened to the die-hard sound man who says "I like the tube sound"?

I predict that the changes of the next 10 to 15 years will be even more startling. For example, anti log will surely become a thing of the past for most high-quality systems. Digital won't just be a buzz word.

Come to the Contractors Expo '84. Be a participant in your association as a contributing member. Help yourself and the rest of us to learn by your experience and mine.

See you in Vegas at the Sahara.



Vic Hall,
President,
Communications Co., Inc.

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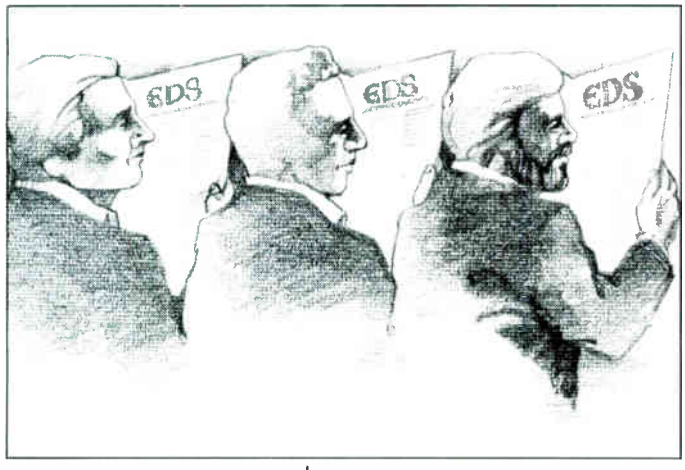

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As a contractor and board member of your Association, I urge you to attend the Contractors Expo '84, because here is the best opportunity of the year to learn about new products available from our participating manufacturers, design techniques from the consultants, and better operating methods from our fellow contractors. This unique pool of knowledge and experience will benefit each participant individually and our industry as a whole. This exchange of information and sharing of experiences takes place in the various formal presentations and in the individual conversations among contractors, manufacturers, consultants and sales representatives.

Algie Broome,
Vice President,
Sound and Communications, Inc.

As a contractor and board member of our Association, I think it is important for you to attend the Contractors Expo '84, because knowing more about the financial part of your business and how it compares to others *in the same industry* can mean the difference between success and failure.

When I look back over the last 20-25 years and think about the number of sound contractors that I've known and the people associated with them, I find that they fall into two categories:

A. those that are still in business;
B. those that didn't make it.

When I think a little more about them, one thing jumps out at me. Some of them that are still in business are strong financially, and staying in front of the new technology wave. Others are keeping up with the technology but apparently not doing too well financially, as evidenced by comments from a variety of financial, credit, and sales managers. Those that have left the sound contracting business have had financial management problems almost every time.

One of the benefits that our association is trying to provide for you is more financial information and "smarts." One of the methods that we are using is a financial analysis of sound contractors that do about the same amount of business that you do, and then a comparison to all other sound contractors. This comparison will be based on the percentage analysis that we asked you to do for your business. The information you sent to the certified professional accounting firm was and is held in absolute confidence, was entered into a computer that is programmed to accumulate all of the data statistically, analyze the data, and then prepare a copy of all the data, which they return to you.

So, you will get back your individual analysis, the average percentage figures for all other businesses in the same sales volume category, and a third set of figures that will be the averages for all of the contractors that have sent in their questionnaire.

I urge you to take along to Expo '84 a copy of the analysis that you get back from the accountant. Take it along to the seminar, "Contractor Profile—How Do I Compare?," use it to make notes on and jot down information that's passed out. I'll show you some interesting comparisons and analytical tools that you can use that just might make you more money than you spent on getting to EXPO '84.

If you have not taken the time to fill out the questionnaire, please drop what you are doing, grab a pencil and fill it out right now. The more people that send in the information—the better the results. Last year only eight companies submitted information and that is not a statistically significant sampling. If everyone does his part not only this year but each year hereafter, the information you get back will be worth thousands of dollars to each of you that puts it to work. If any of you have financial managing ideas that you think would be beneficial to us as an association, please drop me a note or see me at Expo '84. I'll do my best to get it worked into our program.

Melvin J. Wierenga,
President,
Ascom, Inc.

As a contractor and board member of our Association, I urge you to attend the Contractors Expo '84. Why? Because the computer has come to the fore in a variety of applications almost beyond anyone's imagination or belief.

There should be no qualified doubt in any literate sector of our society that we—most of us—are indeed alive and well in the Century of the Computer.

The authors of the non-fiction bestseller, *Megatrends*, point out that we have gradually evolved from an industrial civilization to a world largely engaged in and dependent upon the tools and techniques of communication. (Perhaps as NSCA members we could have helped them write the book.)

All through the Dark Ages, and up until about 1940 BC (Before Computers), when the concept was still a mere gleam in the eye of Thomas B. Watson, just about everyone in the business of buying and selling merchandise indulged in the year-end or monthly ritual of inventory. Conducted almost entirely by hand and brain, the taking of inventory was a monotonous, wearisome and mechanically cumbersome chore.

Mr. Watson's early IBM computers were by no means the sleek desktop PCs we know and use today. They were monstrous machines, each occupying some fifty square feet of floor space, constantly breaking down, chewing up paper, and requiring hoped-for genius-level operators and live-in service technicians.

Initial applications were inventory control, and what a blessing this

MILLBANK

PAC-SYSTEM

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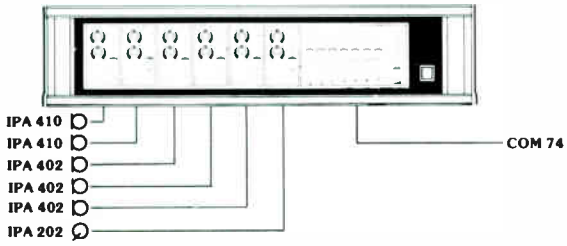

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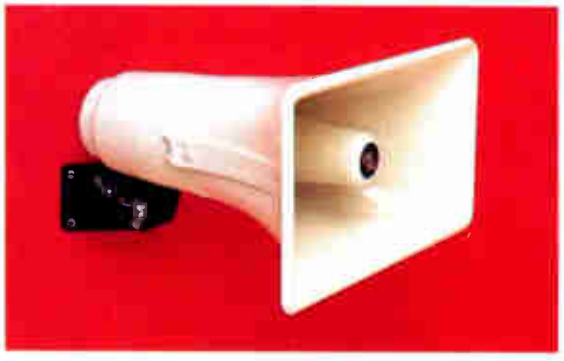

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turned out to be... when it worked. The experts continued to tell us: "Feed it correct data and you'll get correct answers."

Well, of course the machines got better and smaller and more dependable, and the operators increasingly skilled and professional. At Ancha Electronics we've found the PC an invaluable tool, not only for inventory control and customer dossier programming, but most exciting for us as sound contractors has been its use in design implementation.

The exciting thing about living in the Computer Age is the accelerating pace in which improvements, refinements and new techniques are being realized. Even at Expo '84 we can surely anticipate and witness more of the creative developments and advances by other talented engineers among our peers. We won't have to look far!

Robert F. Ancha,
President,
Ancha Electronics Inc.

As a contractor and board member of your Association, I urge you to attend the Contractors Expo '84 because it will help you with your estimating, which has such a critical impact on profitability.

In the past there was a time when if a few hours, or a necessary item were missed, it had little impact on the subsequent outcome of a job. A decent motel room could be secured for $8.00 per night, auto expenses were measured in a few cents per mile, and from most anywhere in our area to Chicago or New York was less than $75.00 RT.

Today's contracts, have substantially increased in dollar amounts. New products, new methods, new knowledge, have all been added to an overburdened bottom line that is expected to absorb the cost of growth, in addition to the factors mentioned above, and of course, a little to take home.

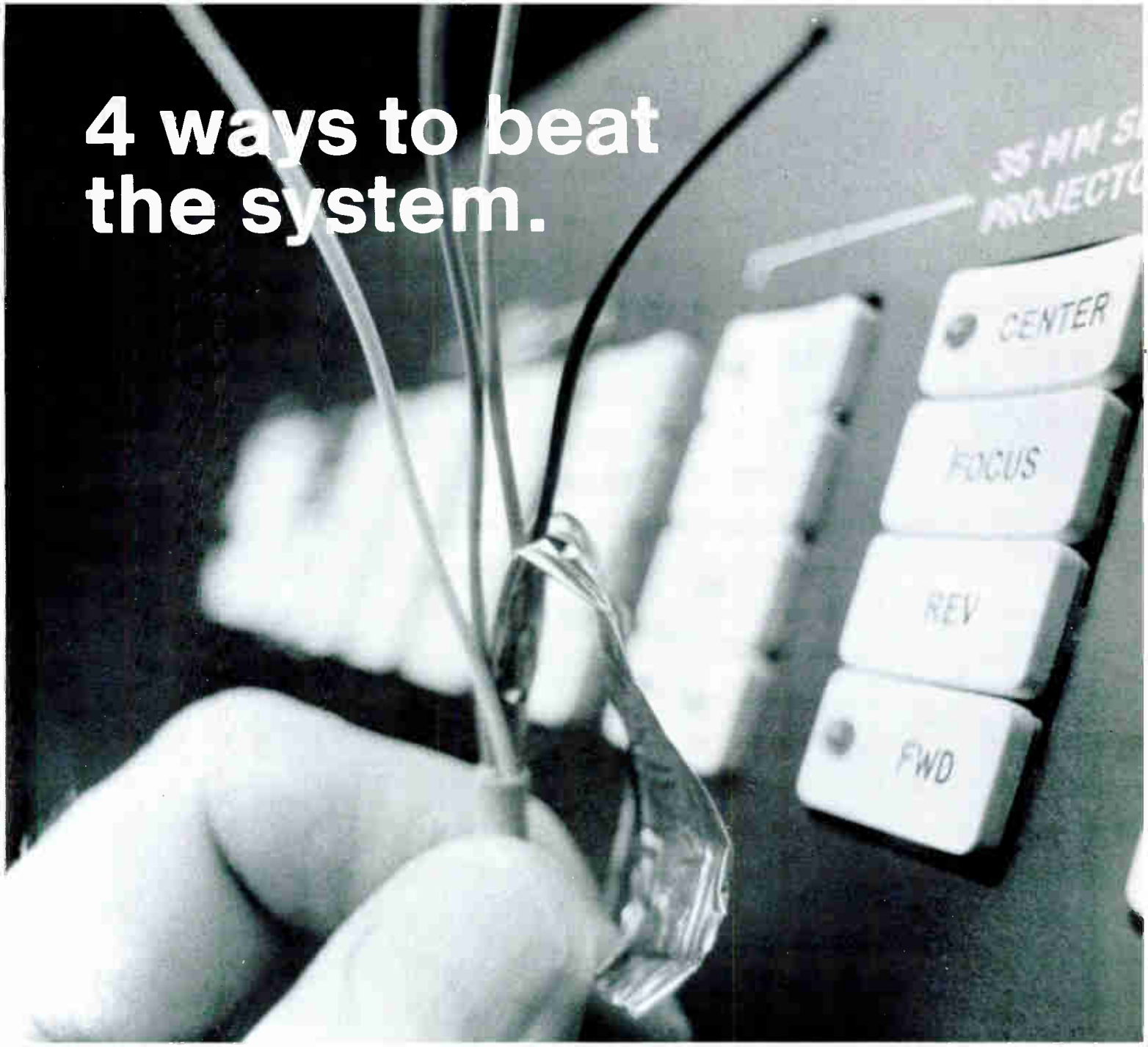
People who are knowledgeable in financial matters will emphatically stress the importance of knowing your costs. How to obtain and control these costs is one of the areas to be discussed during the NSCA '84. We recognize that all of the subjects and topics presented cannot be retained in our memory. To help you in the future, we recommend note taking, and copies of certain presentations will be available.

The interchange of ideas in group meetings, or just talking on the convention floor, quite often lead to suggestions and hints that can be put to good use in your own organization.

When you bring to the estimating worksheet all of your skill and training, add to it your product knowledge and knowing your costs, you have a formula that not only might assure you of a low bid on a job, but will have every chance of producing the necessary revenue to make your business profitable.

With the proliferation of consulting engineers, expanding technology and other factors which exist today, it is virtually impossible for the average contractor to be knowledgeable in the many areas of modern sound contracting without spending some time learning and training himself. The NSCA '84 offers this opportunity.

Jack Redd,
CMI Electronics



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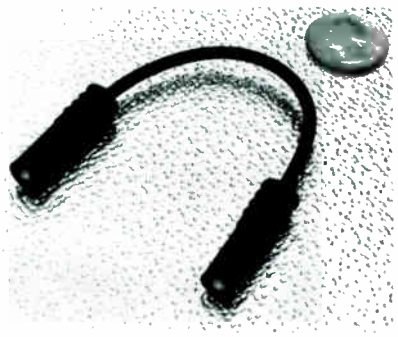
NEW PRODUCTS

PATCH CORD



A banana-plug patch cord with a fixed sheath, Model 4913, meets or exceeds the latest criteria required by ANSI document C39.5. The unit features a nickel-plated, beryllium-copper contact with a polypropylene tip, to help prevent accident shorting. Durable polypropylene insulation on the plug and a PVC covered 18 AWG wire complement the design features of this patch cord and also help to prevent shorting if it is accidentally dropped. Available in nine lengths, ranging from 102mm (4 in.) to 1829mm (72 in.), the cord can be ordered in red or black. It is also available in eight other colors by special order.

☐ For more information write 604 on the inquiry card. Or write: ITT Pomona Electronics Div., 1500 E. 9th St., Pomona, CA 91766.

ELECTRET MIC

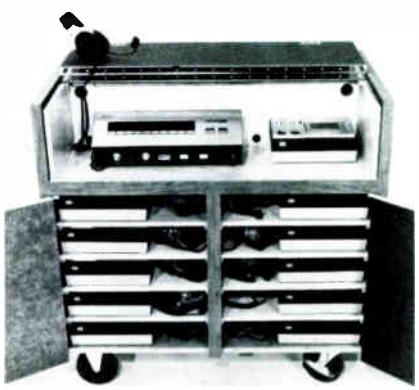
The EM-2020 electret microphone consists of a belt-pack control unit and a lapel-clip mic. The user can set the gain control at maximum, or adjust it as necessary during use to control the sound level. The control unit houses a single 9V battery, an on-off/level control, and a balancing output transformer. The output is adjustable from off to −65 dBm, with no audible on-off "click." Frequency response is 20 Hz to 20 kHz, with a smooth high frequency rise to compensate for the position of the lapel microphone. The EM-2020 can be operated up to 900 hours on its internal 9V battery, or phantom-powered from a mixer or preamp.

Output is via an ultra-flexible shielded cable, hard-wired to the control unit for reliability. There are four models available, with a choice of a 2 or 8-meter cable, and a male or female XLR connector.

☐ For more information write 605 on the inquiry card. Or write: Williams Sound Corp., 6844 Washington Ave. S., Eden Prairie, MN 55344.

LEARNING LAB

Compact and portable, the Sony Mobilab is a 10-position language learning setup that uses touch-button operation for such functions as monitor, intercom and program distribution. The expandable system features lightweight headset/microphones; the student recorders and program unit may be quickly connected to the console by cable. Any A/V-type mobile cart can store and move the Mobilab.

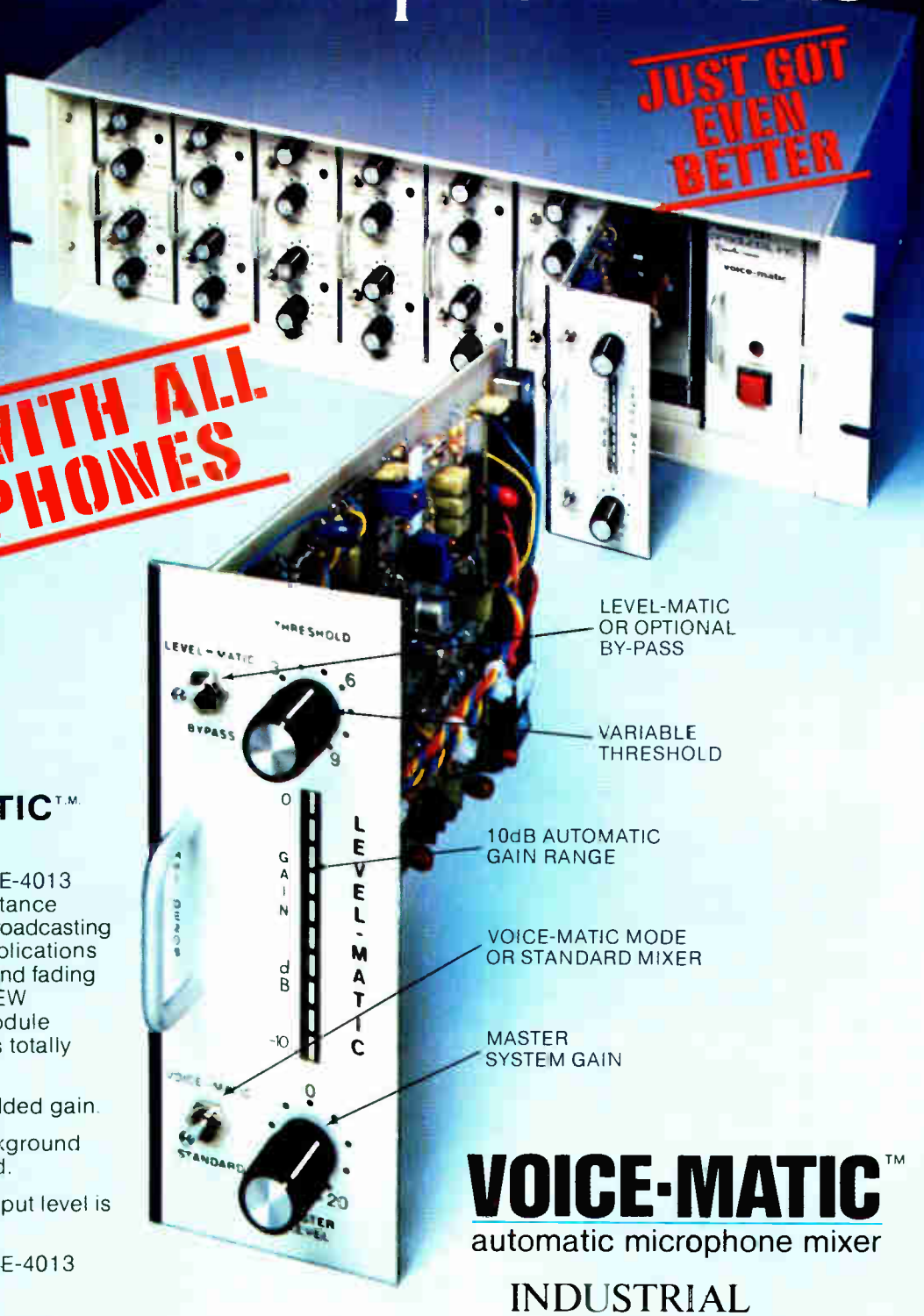


☐ For more information write 606 on the inquiry card. Or write: Educational Electronics Corp., 213 N. Cedar Ave., Inglewood, CA 90301.

The VOICE-MATIC™ Automatic Microphone Mixer

JUST GOT EVEN BETTER

WORKS WITH ALL MICROPHONES



LEVEL-MATIC OR OPTIONAL BY-PASS

VARIABLE THRESHOLD

10dB AUTOMATIC GAIN RANGE

VOICE-MATIC MODE OR STANDARD MIXER

MASTER SYSTEM GAIN

Introducing the LEVEL-MATIC™ module option

The Voice-Matic Model DE-4013 has received wide acceptance in sound reinforcement, broadcasting and teleconferencing applications by eliminating feedback and fading sound levels. With the NEW LEVEL-MATIC master module option, the Voice-Matic is totally automatic.

- Soft talkers receive added gain.
- Loud talkers and background sounds are attenuated.
- A smooth, uniform output level is the result.
- Retrofits all existing DE-4013 mixers.

Once you hear it, you won't want your sound system without one.

Call or write today for more information on how the Voice-Matic mixer with the Level-Matic option can improve your sound installation...automatically!

Videotape demonstration of LEVEL-MATIC available upon request

VOICE-MATIC™
automatic microphone mixer

INDUSTRIAL RESEARCH PRODUCTS, INC.
A Knowles COMPANY
321 Bond Street • Elk Grove Village, IL 60007
(312) 439-3600

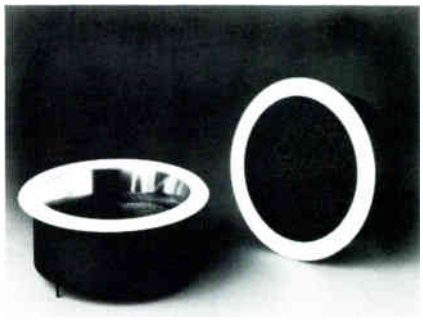
FEEDBACK STABILIZER

Model No. 741XR, a feedback stabilizer, is a frequency shifter for the reduction and stabilization of acoustical feedback in public address and sound reinforcement systems. By inserting this instrument in the line between the mixer and the power amplifier, the frequencies of the entire program material are shifted away from the ambient resonances, so that the recycling process (multiple round trips of the sound from the speaker to the microphone and back) is interrupted, thereby eliminating the howl and facilitating an increase of the usable power by an average of 4 to 7 dB, and as much as 10 to 12 dB in some cases. The unit has all of its

major function controls on the back panel, to make it tamper-proof. The B-Series of this model features a rotary switch to select 6 shift frequencies, from 1.5 to 6 Hz; a toggle switch for up or down shifting; a level control; a barrier strip for connecting the instrument to the system; and two octal sockets to accommodate optional plug-in transformers for balanced line operation. The front panel controls are limited to the line switch, the fuse and a switch for selecting the direct (unity gain bypass) or frequency shifted mode. In addition there are two LEDs, one for the power and one indicating the mode of operation (bypass or frequency shifting). The frequency response is 20 to 20,000 Hz, maximum signal level is plus 18 dBm, and the S/N ratio is typically 80 dB (unweighted) referenced to maximum level. The unit features a 3½ x 19-inch standard rack mount panel and is 8¾ inches deep (without the controls). A modified version, the Model 742XR, features all of its controls on the front panel and is designed for single ended (unbalanced) operation.

☐ For more information write 607 on the inquiry card. Or write: Bode Sound Co., 1344 Abington Pl., N. Tonawanda, NY 14120.

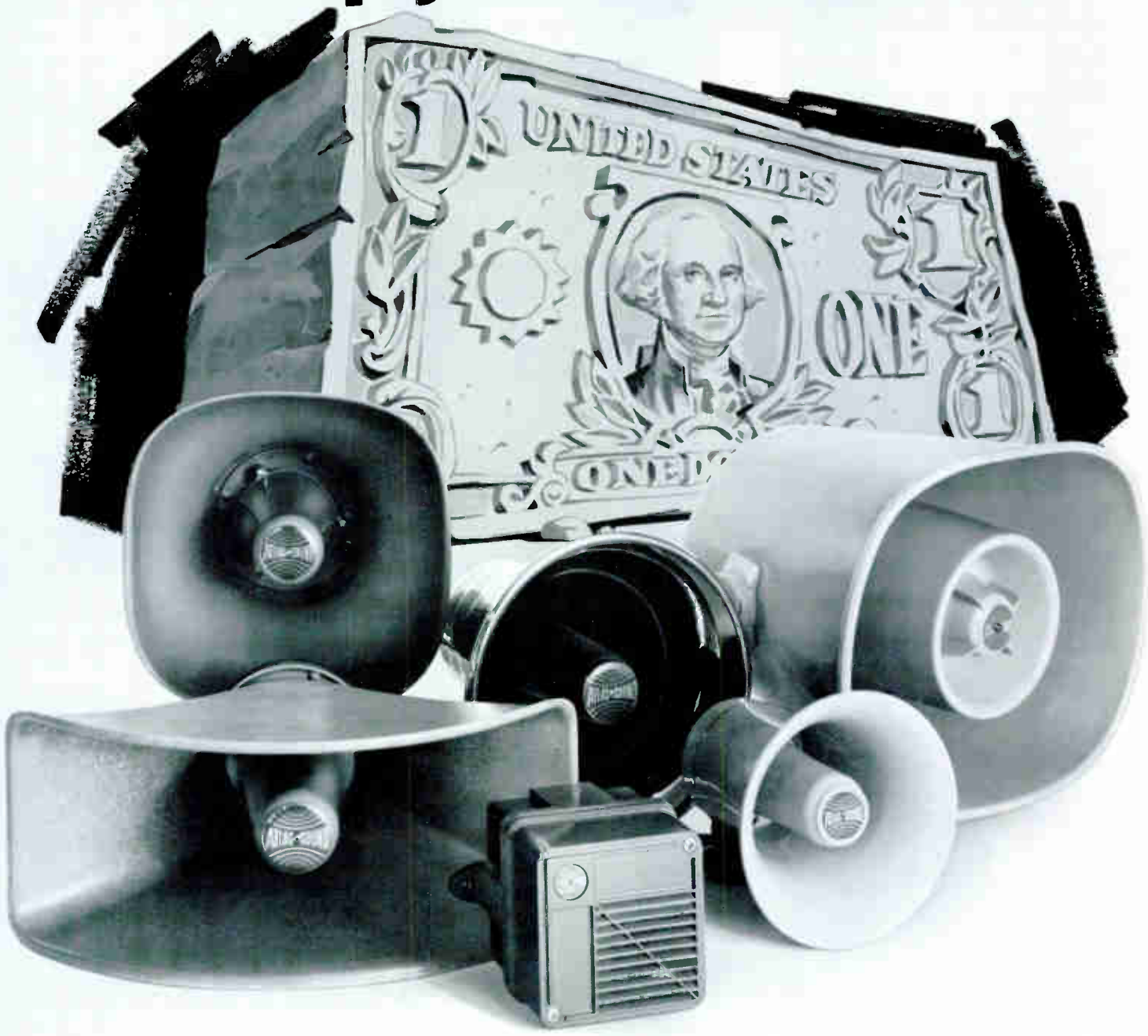
CEILING SPEAKERS



A line of ceiling speakers features decorative baffles designed for applications where styling is particularly important, such as executive offices, boardrooms, etc. The concept was developed to match high-hat lighting, making a complete custom look possible. The sturdy acrylic baffles come with black, white or aluminum risers, trimmed in a variety of colors, or with mirror. A foam grille conceals the speaker. The baffles may be ordered with 8-inch drivers and four ¾-inch ferrofluid dome tweeters, offering a frequency response of 35 Hz-20kHz, 50 watts RMS. They may also be ordered for other 8-inch 35 Hz-20 kHz, and 5¼-inch speakers.

☐ For more information write 608 on the inquiry card. Or write: Creative Acoustics, 197-17 Jamaica Ave., Hollis, NY 11423.

We've got more ways to keep your dollar sound.



When it comes to solid value, no one has more ways than Atlas Sound to keep your installed-costs down. That's because we're application and service-oriented, and have been for 43 years.

You've seen the results. Pace-setting features... such as vandalism-resistant armored cable adapters and the integral Vari-Tap control/connect center that let you chip away at the time, labor and peripheral costs of assembly, mounting and adjustment. Higher efficiency and sound-projection capabilities proven in tens of thousands of industrial and commercial sound and intercom installations, indoors and out. Plus, the construction and performance reliability your alarm, security and life safety systems need.

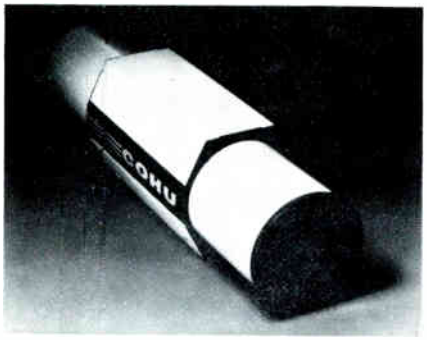
You've also seen the alternative—the "bargains" that need extra speakers, more wiring and more amplifier power, just to get the same coverage we provide right away.

To see how Atlas Sound inflation-fighters can help keep your dollar sound, call us for marketing and technical information at (201) 887-7800, or write us at 10 Pomeroy Road, Parsippany, New Jersey 07054.

ATLAS SOUND

CCTC CAMERA

A high performance, environmental TV camera, Model 5800, will function in adverse climates (−40° F to +140° F), high humidity (100%), or thirty feet under water. It can be equipped with most one-inch image tubes and, other than that image tube, it is fully solid state. The unit offers a choice of synchronization, input voltage, and many optional features. The 5800 has a 55-dB typical signal-to-noise ratio, offers up to 900 TV lines of resolution, and can provide full video at 1.3×10^{-5} footcandles.



☐ For more information write 609 on the inquiry card. Or write: Cohu, Inc., P.O. Box 85623, San Diego, CA 92138.

TV RECEIVER/MONITOR

Two TV Receiver/Video monitor combinations can provide both security surveillance and entertainment. The TV sets are solid-state chassis with integrated circuits for low energy consumption. They have keyed automatic gain control (AGC) and sensitive reception. Both sets incorporate a tunable RF modulator, which is normally preset on Channel 3. It can be easily tuned manually, however, between channel 2 and 6.

The sets also incorporate a standard UHF (PL 259-type) input which will accommodate any video camera for surveillance purposes. These sets are black and white and available in two sizes: nine-inch and twelve-inch. The TVM 9D (nine-inch) unit operates on 110 VAC as well as 12 VDC. The TVM 12A (twelve-inch) unit operates on 110 VAC only.

☐ For more information write 610 on the inquiry card. Or write: Crest Electronics, Inc., 4921 Exposition Blvd., Los Angeles, CA 90016.

AMPLIFIERS

A line of 70-volt amplifiers for sound reinforcement and public address applications includes 50-watt, 100-watt and 200-watt versions, Models 270, 370 and 470, respectively. They feature high reliability and extremely low distortion, (less than .01% 100 Hz to 20 kHz, less than .1% at 20 Hz, full power). The amps offer modular construction, overdrive indicators, and the availability of various options.

☐ For more information write 611 on the inquiry card. Or write: Bryston Ltd., R.F.D. #4, Berlin, Montpelier, VT 05602.

Let a leader in sound technology lead you through the commercial sound barrier. Introducing Panasonic Commercial Sound Systems.

For more than 40 years, the parent company of Panasonic, Matsushita Electric, has supplied the international commercial sound market with products. Dependable, quality products that are the result of the engineering expertise, sophisticated testing and rigorous quality-control standards of Matsushita — one of the largest and most innovative electronics companies in the world.

And now, Panasonic is introducing a line of quality compact sound amplification/paging units that offer some of the most advanced features available today.

Our 30, 60 and 120 watt 5-input Mixer Power Amps (Models WA-735P, WA-745P, WA-755P respectively) feature a built-in AM/FM tuner, three low impedance microphone inputs, a transformer balanced auxiliary input for telephone paging, a voice-activated priority circuit and a tone generator for sound level setting. Plus a two-tone calling chime for paging.

Many of these features are offered without an AM/FM tuner in our other 60 and 120 watt 5-input Mixer Power Amps (Models WA-740P, WA-750P).

Our 15 and 30 watt 4-input Mixer Power Amps (Models WA-300P, WA-320P) feature two low impedance microphone inputs and a transformer balanced auxiliary input for telephone paging. And both can be powered by a DC 13.2 volt source for portable operation.

Remember: Panasonic is a leading name in advanced sound technology. So, if you're looking for Commercial Sound System equipment, follow a leader: Panasonic.

For more information on Panasonic Commercial Sound Systems, please contact: Commercial Sound Systems Department, Audio-Video Systems Division, Panasonic Industrial Company, One Panasonic Way, Secaucus, NJ 07094.

Panasonic®
Industrial Company

UPCOMING

April 24-26: **1984 Contractor Conference & Expo,** Sahara Hotel, Las Vegas. (National Sound and Communications Assoc., 5105 Tollview Dr., Rolling Meadows, IL 60008. 312 577-8350)

April 25-27: **Electronic Distribution Show & Conference '84,** Hilton Hotel, Las Vegas. (Electronic Industry Show Corp., 222 S. Riverside Plaza, Chicago, IL 60606. 1 312 648-1140)

May 4-7: **Society of Telecommunications Consultants 1984 Spring Conference,** Sahara Hotel, Las Vegas. (S.T.C., 1 Rockefeller Plaza, New York, NY 10020. 212 582-3909)

May 14-17: **International Conference on Communications,** RAI Conference Center, Amsterdam. (Dr. T.A.C.M. Claasen, Philips Research Laboratories, 5600 MD Eindhoven, Netherlands. 31 40-742131)

May 15-17: **USTA/USTSA Southeastern Telecommunications Showcase,** Georgia World Congress Center, Atlanta. (U.S. Telecommunications Suppliers Assoc., 333 N. Michigan Ave., Chicago, IL 60601. 312 782-8597)

May 15-17: **Electro/84 High Technology Electronics Exhibition and Convention,** Bayside Exposition Center, Boston, (Electronic Conventions, Inc., 8110 Airport Blvd., Los Angeles, CA 90045. 213 772-2965)

May 15-17: **Mini/Micro Northeast-84 Computer Conference and Exhibition,** Hynes Auditorium, Boston, (Electronic Conventions, Inc. Address above)

June 10-14: **Associated Telephone Answering Exchanges 40th Annual Meeting & Convention,** Hotel Vancouver, Vancouver, B.C. (A.T.A.E., 320 King St., Alexandria, VA 22314. 703 684-0016)

June 12-14: **Ohmcon/84 High Technology Electronics Exhibition and Convention,** Franklin County Veterans' Memorial Auditorium, Columbus, OH. (Electronic Conventions, Inc. Address above)

August 6-11: **National Professional Electronics Convention,** Sheraton Hotel, St. Louis, MO. (National Electronics Sales & Service Dealers Assoc., 2708 W. Berry St., Fort Worth, TX 76109. 817 921-9061)

September 11-13: **Midcon/84 High Technology Electronic Exhibition and Convention,** Dallas Convention Center, Dallas, TX. (Electronic Conventions, Inc. Address above)

Electro-Acoustics

PYROTRONICS, Cedar Knolls, New Jersey, has introduced a new voice alarm system which provides remote telephone communication, alarm annunciation, paging modules and full supervision of the system. It features audible evacuation and alert signals and 2-way fire fighters' or warden's station telephone communication. Voice paging and evacuation signal sections may be configured to provide alarm or evacuation simultaneously throughout the entire installation, or on a selective speaker zone basis.

DEARBORN WIRE & CABLE COMPANY, Rosemont, Illinois, has established a new outlet for sales and warehousing of its products, at 14182 Central Ave, Chino, California.

ILP MANUFACTURING INC., Downsview, Ontario, has been established for the production of toroidal power transformers. This is the outgrowth of negotiations between ILP Electronics Ltd. of Canterbury, England and EDG Electronic Distributors Inc. of Downsview.

ILP Electronics is the largest manufacturer of toroidal transformers in England, shipping in excess of 200,000 units yearly. The establishment of the plant in Canada will allow ILP transformers to be supplied in volume for OEM requirements in the three countries covered by the agreement: Canada, United States and Mexico.

EIA'S ELECTRONIC INDUSTRIES FOUNDATION received a congratulatory letter from President Reagan upon the success of its program to help disabled persons find jobs in private industry. The letter was sent in recognition of the 2000th disabled person to be employed through EIF's Project With Industry (PWI) network.

The 2000th person placed was Robert Van O'Linda of Plymouth Meeting, Pennsylvania, who went to work for the General Electric Space Systems Division in nearby King of Prussia, where he is employed as a personnel clerk.

The EIF/PWI national program is funded through the U.S. Department of Education, the U.S. Department of Labor, state grants and corporate contributions of executive time, equipment and money.

More than 580 employers, including many non-electronic companies, currently participate in the EIF program, along with over 690 community rehabilitation agencies. Since the project passed the 2000 mark last August 1983, an additional 250 persons have been placed into gainful employment.

Special Microphones

Figure 1.

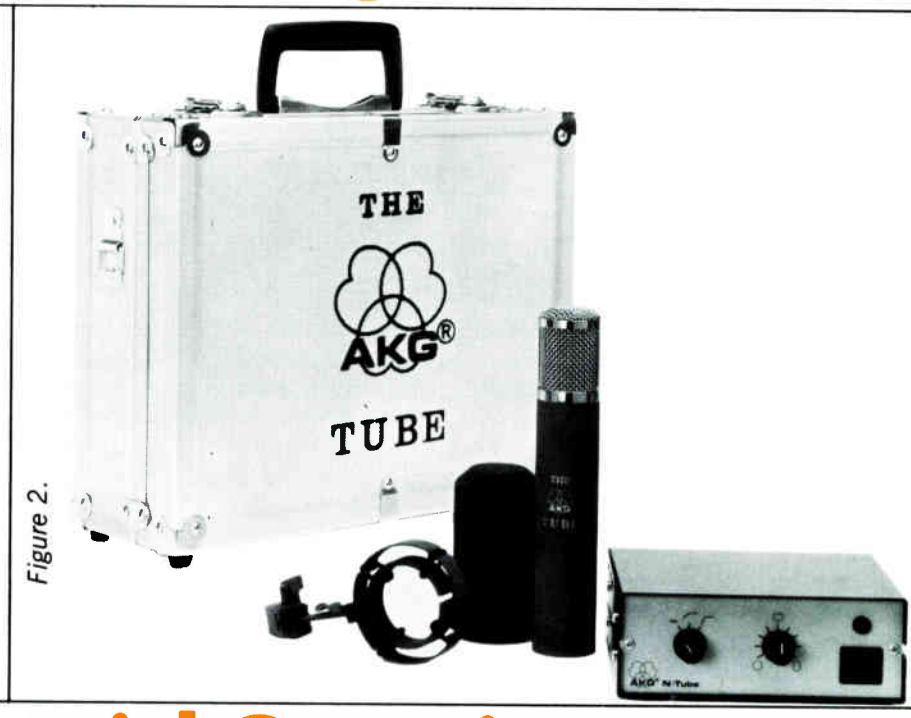


Figure 2.

For Special Occasions

When Pope John Paul II visited Austria recently, his entourage provided Viennese microphone maker—AKG—the opportunity to display four new electro-acoustical products: three microphones and a transistorized telephone transmitter to handle his publicasting system requirements.

AKG provided more than 100 of their new D 541 dynamic gooseneck microphones, designed to meet the special requirements of sound reinforcement systems. The most important considerations, explained a company spokesman, Norbert Sobol, are uniformity of polar pattern and insensitivity to noise.

The D 541 (Figure 1) is shock-mounted, hence the transducer is unsusceptible to structural vibrations and rejects handling noise (caused by readjusting the gooseneck) and is tailored specifically for speech transmission. A single-hole mounting feature allows the D 541 to be fixed to mixers and lecterns, talkback stations, vehicles, and to table or floor-stands, with 3/8" outside thread. The gooseneck is 1 foot long. However, custom lengths can be supplied.

The second microphone introduced was the C 567 E, a condenser clip-on unit, which is a miniature condenser transducer said to deliver distortion-free reproduction even at high sound pressure levels.

Norbert Sobol, professional products manager, explained that wherever miniature microphones are required, uncolored reproduction must be of high order. Professional work calls for robust microphones, and therefore the AKG condenser transducer and the integrated low noise FET are housed within a die-cast zinc-alloy indestructible housing.

The transducer is elastically suspended, ensuring suppression of handling noise. The sound entry port is made of sintered bronze material. A miniature self-locking wire mesh windscreen is standard, to reduce noise by as much or more than 20 dB, permitting trouble-free outdoor recording. A 4-foot flexible cable connects the microphone to the output module containing the regular circuit, output transformer, and the 3-pin standard XLR connector (balanced wired). The C 567 E is designed for Universal Phantom Power supplies (9 to 52 volts acc. to DIN 45 596) and may be fed from a mixer, tape or from a battery or mains phantom power supply. Current consumption is below 0.5 mA.

The third microphone Norbert Sobol displayed was the AKG Tube, shown in front of the carrying case in Figure 2, and consisting of a shock elastic suspension mount, a power unit and a foam-type windscreen. The knob on the left controls a 2-position roll-off bass cut circuit which can be controlled from the microphone if desired. The knob on the right handles 9 polar patterns (omni, cardioid, figure-eight, and six intermediate response steps), all adjusted silently and remotely from the microphone and the powering unit N-tube. There is no on-axis sensitivity change for all adjustable polar patterns.

Among all microphone designs known, the tube has always been regarded as one of the most personal sounding alternatives. According to many, Sobol said, this distinctive sound has never been equaled by any solid-state design. He explained that many tests all over the world led to the "AKG Tube" of the 80s. Around the original AKG 6072 tube,

state-of-the-art components were arranged to meet the demands of modern circuit design. As a result, in Europe the Tube has become a recording tool of specific sound reproduction qualities for tube enthusiasts who "know why."

Kurt Stamm, AKG Telecom products sales manager, uncovered the latest acoustical development—the transistorized dynamic capsule telephone transmitter. The product, currently, is being sold in Western Europe and Japan.

Characterized as the DKO 48 transistorized telephone transmitter since 1975, this represents the first improvement in telephone transmitters since the introduction of the carbon microphone in 1861.

The carbon capsule frequency response depends on sound pressure. Low voices sound muddy, loud voices sound shrill. Besides the fact that the carbon capsule is susceptible to humidity, its sensitivity will decrease rapidly during a prolonged call, while harmonic distortion and "splashiness" rise. Also, the carbon microphone would be completely useless in future PCM systems, because its constant instabilities could lead to signal identification errors.

Of course, any successor to this grandfather of telephone products would be expected to have none of these disadvantages. When AKG tested all current transducers for suitability, the dynamic system clearly demonstrated superiority. It is rugged, easy to produce to close tolerances, and can be acoustically tailored to the narrow speech frequency band.

THe DKO 48 is a straightforward design, a time-tested dynamic microphone capsule used in millions of microphones of most varied types, modified to withstand environmental conditions, yet more severe in telecommunications than on the stage or in the studio. All parts must be free of corrosion, specifications may deviate only minimally over wide temperature, air pressure, and humidity ranges, and the system should reject hum interference.

The DKO 48 can be adapted to fulfill neary every country's telecommunications standard, said Stamm, by altering the housing and the electrical dimensions of the amplifier on the p.c. board. □

TIP & RING

AMERICAN TELECOM, INC., ANAHEIM, CA, HAS ALTERED ITS DISTRIBUTION PATTERN ON ITS FOCUS 50 SERIES OF PBXS AND HYBRID SWITCHING SYSTEMS, by permitting interconnect contractors to purchase their PBXs directly from the manufacturer, as well as through supply houses.

At the same time, American Telecom is negotiating new distribution agreements with North Supply and Centel Supply, and working to expand distribution for the hybrid version of the switch to include a larger number of interconnect contractors.

John Combs/vice president-sales & marketing, American Telecom, said that the firm intends to sell the PBX directly to its 65 authorized dealers and to the BOCs Southwestern Bell, Pacific Telesis and Bell South. Combs noted that expanded distribution among new interconnect contractors for the hybrid version only will be stepped up, while new negotiations with North Supply and Centel are aimed at those two telephone company-owned supply houses, to handle the hybrid system rather than the PBX, in the future.

Interconnect contractors have been actively pursuing arrangements to purchase directly from the manufacturer, bypassing the distributor supply houses with their mark-ups, which tend to restrict independent sellers' abilities to compete.

The supply houses are actively seeking sources of their supplies, to obviate this growing trend of one-step distribution—maker to the interconnect contractor. The supply houses' aim is to locate and keep a guaranteed source—perhaps an exclusive arrangement—for PBXs, hybrids and keysets.

LANIER BUSINESS PRODUCTS/HARRIS CORPORATION, ATLANTA, GA, HAS BOWED IN AS A SUPPLIER OF KEY SYSTEMS, offering three unnamed Japanese-made Series VI, XII and XX telephones—6-line/12-station, 12-line/36-station, and 21-line/52-station models. Price range: $3,000 for low line sizes to approximately $20,000 for the large line sizes.

The systems will be marketed by Lanier's Thought Processing Division, which makes dictating equipment. The key systems will be phased into the Division's 300 offices nationwide as their sales force becomes familiar with the product line.

THEODORE F. BROPHY/CHAIRMAN OF THE BOARD & CEO, GTE CORPORATION, SPEAKING BEFORE THE 95th ANNUAL NARUC CONVENTION, told his audience what telephone companies will provide within the LATA (Local Access Transport Area); the competition they will experience; and regulation's changing role. He explained that the telcos will offer the traditional services (local exchange, extended area, message toll, and private line) within the LATA, and also access services. Thus, Brophy observed, "the telcos become in a real sense the only suppliers of last resort" and they "must bear the expense of reaching the customer in the remote and difficult-to-serve areas."

Brophy remarked that the telcos will face competition much broader than just bypass and that it is the duty of the regulators and utilities to see "that in the long run the public is the major beneficiary...of the new competition..." He believes that "a whole new approach to regulating telcos will be required" if the telcos are going to survive "as effective and efficient providers of service."

Mr. Brophy observed that future regulations must include "a sensitivity to the cross elasticities between telephone company-provided services and the services of the competitors and the long-term impact on telcos' costs and prices, if they are not permitted to be competitive." Furthermore, "adequate and competitive capital recovery is essential to the survival of the telcos...to the best and lowest cost service for the customer in the long run," according to Brophy.

NEW PRODUCTS

PABX

Featuring an integrated office communication system designed for small businesses, the OMNI private automatic branch exchange can handle up to 256 voice and data ports, and would typically serve firms with between 30 and 200 employees. The compact system has a Data Switching option that will provide asynchronous data support up to 19.2 Kbs for a wide variety of terminals, printers and computers.

This option will provide a transparent interface and communication path through the system to selected customer terminals or host computer.

☐ For more information write 597 on the inquiry card. Or write: GTE Business Communication Systems Inc., 12502 Sunrise Valley Dr., Reston, VA 22090.

SWITCHERS & RINGERS

The Beta Series of 60-watt single-output switching power supplies has outputs of 48 and 24 volts. They are available with ring generators to complement advanced telecommunication systems. The devices incorporate 100-kHz FET technology, to reduce the number of components and increase reliability. Both the Beta switchers and ringers are one-half the size and one-third the weight of linear power supplies. This smaller unit results in additional room for more function modules in existing rack space. A special ring generator features a single 117-vac, 60-Hz wall plug. No additional hand wiring is required. It supplies 10 watts of power and a continuous sine wave to ring up to ten telephones at a time. KTU mounting is also available for both the switchers and the ringers.

☐ For more information write 598 on the inquiry card. Or write: Contact Energetec Systems, Inc., 2204 Wellington Ct., Lisle, IL 60532.

CALL ACCOUNTING

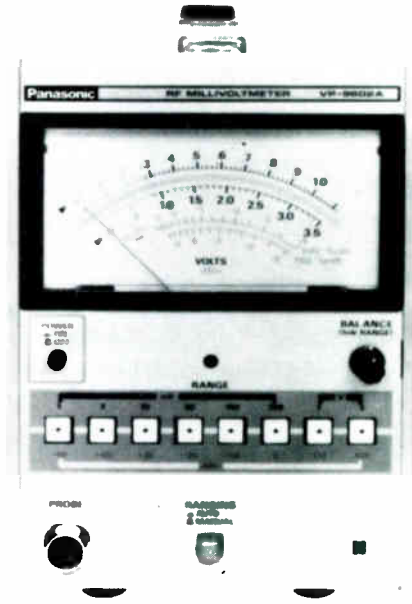
The Forced Account Code Tracking System, or FACTS, works with a company's existing phone system to provide phone usage reports. With FACTS, a company no longer has to wait until the end of the month to reconcile phone bills for client billings. The system is particularly

suited for legal offices, real estate agencies, telemarketing centers and other companies that rely heavily on their phone system. It records individual user account codes, the numbers dialed, the start and duration time of each call, and the date that each call is made. An optional rating and sorting module computes the charge for each call. Surcharges and percentage markups also may be included in the calculations. The unit fits easily on a desk. The accompanying printer features an RS232 interface and is capable of printing up to 60 characters per second.

☐ For more information write 599 on the inquiry card. Or write: Control Q, 15042 NE 40th St., Redmond, WA 98052.

VOLTMETERS

A series of analog voltmeters includes psophometers, noise meters, auto voltmeters, electronic voltmeters and AC voltmeters.



Model VP-9602P is a highly sensitive RF milivoltmeter designed for measuring voltage 1 mV to 3 V full-scale, covering 10kHz to 1 GHz. The meter is also graduated in dB with 0 dBm equal to 1 mW into either 50 or 75 ohms, thus providing level measurement from −57 dBm to +24 dBm (50-ohm load). The meter is especially useful in adjusting and testing general communications equipment. In addition to AC voltage measurement, the VP-9602P provides AC-DC conversion.

☐ For more information write 600 on the inquiry card. Or write: Panasonic Industrial Co., Instrumentation Dept., 1 Panasonic Way, Secaucus, NJ 07094.

THE FLASHIEST PLUG-IN PHONE ACCESSORY YET!

Introducing the Wheelock Telephone Strobe. The first self-contained visual phone signal that's pluggable with a standard modular jack.

Ideal for alerting the hearing impaired, it emits a high intensity flashing light (70,000 peak candlepower) when the telephone rings. Use it with or without a ringing bell for quiet areas in hospitals and broadcast studios. In data processing and newsrooms. In open office areas, to identify which phone is ringing. And in industrial areas where distance or noise makes it difficult to hear a ringing phone.

Its built-in solid state relay operates on 90V, 20Hz ringing voltage. It mounts easily to any surface. And simple AC and modular jack connections allow hookup in a flash . . . so it can be resold directly to do-it-yourself consumers.

The Wheelock Telephone Strobe opens countless new market opportunities for your business. Which is what you would expect from the industry's primary source of auxiliary telephone signals for over 40 years. To find out more, contact your local Wheelock Distributor.

The Wheelock modular telephone strobe.

wheelock
THE SIGNAL SOURCE

Wheelock Signals, Inc.,
273 Branchport Ave.,
Long Branch, N.J. 07740;
phone (201) 222-6880,
TWX 710-722-6510.

Authorized Distributors:

Anixter Communications, All Locations • **Buckeye Telephone and Supply Company,** Columbus, Ohio 43228 • **Centel Supply Company,** Lincoln, Nebraska 68505 • **GTE Automatic Electric/Supply Services Division,** All Locations • **Graybar Electric Company, Inc.,** All Locations • **Lincoln Telephone Service and Supply Company,** Lincoln, Nebraska 68501 • **Midwest Telephone Supply Inc.,** All Locations • **North Supply Company,** Lenexa, Kansas 66219 • **Power & Telephone Supply Company, Inc.,** All Locations • **Southern Telephone Supply Co.,** All Locations • **Texocom,** All Locations

See us at Booth #R-18

POWER SYSTEMS

A line of cellular power systems includes battery chargers/eliminators ranging to 200 amps at 24 or 48 VDC; inverters; converters; battery plants and associated panels.

The systems are housed in 23-inch standard racks. Each power unit may be configured to a specific site; complete turnkey installations are also available.

☐ For more information write 601 on the inquiry card. Or write: C-E Elgin Electronics, 5533 New Perry Hway., Erie, PA 16509-3570.

TELEMARKETING

The Lynx 2000 ties an existing phone system into the user's computer and enables the computer to take over many of the routine and time-consuming aspects of telemarketing. One Lynx is also capable of supporting anywhere from one to approximately 500 work stations.

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including the status of individual line/agent positions, CO trunks and dial-up data modems. Specific frames may then be generated in hard-copy form. The system is designed for easy use without the need for special training, and all reports are produced in easily understood language and formats. The system incorporates RS232C ports for convenient interfacing to CRT and printer terminals, as well as modems. The TMIS II uses a standard RJ-22X connector for each group of eight CO/PBX lines. Secured against tampering or manipulation that could result in erroneous information, the system has a battery back-up to ensure data protection in the event of power failure.

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TONE COMMANDER

The Impact of Bypass

Part 2

by Jerome G. Lucas

This article is derived from a seminar offered at the recent NATA Convention. Mr. Lucas is president of TeleStrategies Inc.

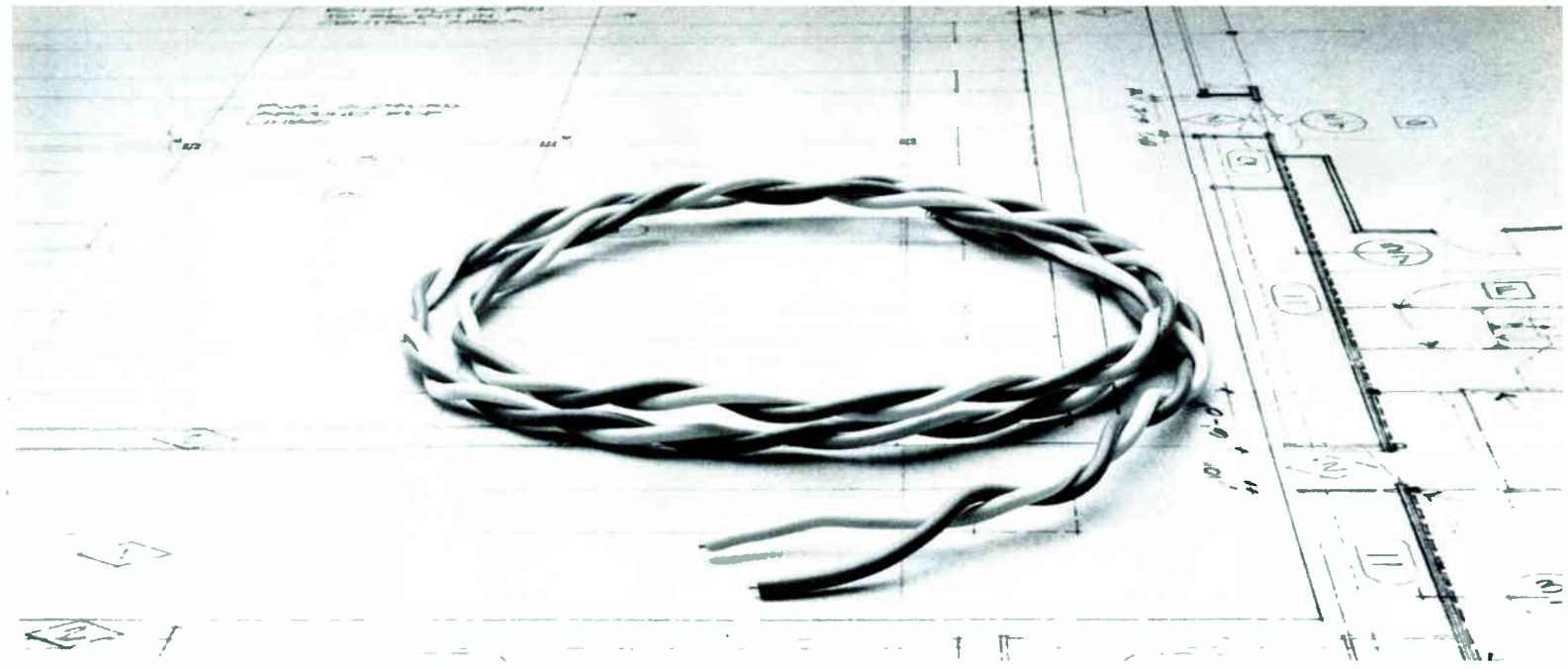
Now let's look at teleports, another bypass technology. As recently as 1981, virtually no one had heard of teleports. It wasn't until 1982, when Merrill Lynch announced their joint venture with the Port Authority of New York and New Jersey, that the term started to mean something. I had started working on a teleport concept with Merrill Lynch Cable in '78. It took about three years to get all the workings to a public institution, namely the Port Authority of New York and New Jersey, and to go ahead with the project.

There are two schools of thought on teleports. One side says it's an antenna. A teleport in Washington is basically for long-haul access to video areas, specializing in common carrier, especially in earth station complexes, many ground stations and antennas, linking inner city via microwave. But that's strictly telecommunications and there's a number of those ongoing.

That's one kind of teleport. My feeling is that only in the top markets can such teleports be successful. The other kind is a teleport of the Merrill Lynch type. Merrill Lynch isn't interested in carrying uplink signals. What they're interested in is getting into real estate development, because that's where the dollars are. That's what you should be looking to do now, to use the satellite earth stations in a link to the inner-city, to create a need for real estate.

Real estate is the thing you're looking at. In fact, you're looking at a $50 or $100-million complex that can afford to put in $10-million worth of communication equipment and charge small incremental increases in rent. That's the way you can sort of underwrite the cost of telecommunications. But the important thing with telecommunications is not the fact that the teleport exists. The teleport is a way to create jobs. Let me generalize, because teleports are only one type of market segment in an area where we call telecommunications enhanced real estate. What you can do in a teleport you can do in an office building, and you can do it a lot simpler.

Telecommunications enhance real



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estate. What you're doing is, essentially, going into a building and *you* are going to be the local telephone company, putting in a PBX and sharing it among the tenants. It can provide them long-distance telephone service; it can provide a message service. Those three things alone, long-distance resale, message service and shared PBX, are 80% of your revenue. That's profitable right there.

You can then begin to get into a fully enhanced building, where you provide shared word-processing, shared data-processing, facts terminals and so forth. How in the world can you ever provide shared data processing? You buy a big IBM computer and start programming it? It's very simple—what you do is pipe in time sharing services from another company. You just put your own label on it. The only thing you're doing is demonstrating to the user how to access somebody else's computer, and the user doesn't care that it's not your computer.

You're the middleman—it's like telephone resale. In telephone resale you don't have to know anything about microwave computing. It's the same thing here. Almost any telecommunications service can be shared.

Telephone resale will move from the single operation, where you're bringing in your calls from a local calling area, competing with AT&T and in some cases bringing in traffic from other cities. Bypass is very important for resale that is right on your customer's premises. You're the cheapest long-distance service for the tenant, and you're immune to access charges. Access charges can go up, and they go up for the tenant regardless of whether he's on your service or not. Same thing on the outgoing side: once you get the traffic in, what you're doing is bundling this service for the tenant. You're going to find the right mix of blocks, FX lines to DDD.

A few more comments on teleports. The concept is, you buy a cheap piece of real estate in the suburbs and make it an inner-city by long-distance telephone resale, local networking and capability of complex, earth station uplink, so that you're really moving computers from a place like New York City, where you're paying $60 or $70 a square foot, to a teleport where you're paying $15 to $20 a square foot. It's a lot cheaper and you have facilities that are specifically designed for computer operation, but what you'll find skimming out of these teleports are things like optical byway networks... this is a teleport site, but not just teleport. Satellite is linking fibers into all these buildings, and, in fact, we're linking down to other teleports.

Why are teleports needed? Well, there are roughly 55 transponders available today. That's a computer and a satellite. When you look at the growth over the next ten years, you're going to see almost a tripling of the number of transponders, and each of them has its own separate network. Who's going to link all those satellites together? Well, that's where a teleport comes in. It provides one access to all those various transponders.

One more bypass technology which is very important is starting a microwave radio-telephone service. The key thing with radio-telephone is that until recently local telephone frequencies numbered around 24 to 30 channels in a major area, with cellular between 24 and 30 channels. At 24, you can serve about 60 subscribers adequately and that takes you up to about 1400 subscribers per city. For cellular we use a technique which is from 24 channels to literally hundreds of thousands of channels, and you're really talking about a system that can be almost as ubiquitous as the local telephone. That's where cellular is going to play its major role in regard to bypass.

The important thing with cellular is that once you have roughly 312 channels per system, there are actually two systems. There's a long-line system and a wireline system, wireline being the telephone company's entering, non-wireline meaning anybody else.

People need mobile communications to conduct their business—that's traveling salespeople, the construction industry, the public service sector, health care and so forth. When such people leave their office, they take the cellular radio system with them.

This is a bypass: right now, it's cheaper to use a cellular radio-telephone in all the rural areas.

Bypass strategy today means that carriers basically have to link this business to remain competitive. □

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Fringe Benefits Give Employers an Edge

by Mark E. Battersby

Sound and telecommunications contractors, like any other type of business, occasionally have difficulty in attracting and retaining talented employees. How can your sound and communications operation attract and retain the type of personnel you need to flourish—at a price that you can afford?

Cash is the most common form of compensation and, for most employees, the most desirable. Regular raises go a long way toward building employee loyalty, but can you really afford to compete with your larger competitors in a salary war?

A second answer is to improve employee benefits, and this strategy need not be expensive. In fact, some benefits are actually generated by the employees themselves. These benefits build loyalty and may mean more to your employees—present and future—than raises that you cannot afford.

First, consider the basic wage paid to employees. The first of several scheduled hikes in payroll taxes took effect on January 1, 1984. The payroll tax increases will affect all employers and employees. Hikes in the self-employment tax rate will add a considerable burden to sole proprietorships and partners.

Employers and employees both pay into the Social Security system. At the old rates, an employer withheld 6.7 percent of each employee's pay for Social Security (FICA) tax. The employer matched this with an additional contribution of 6.7 percent for a 13.4 percent total (on wages up to a maximum of $37,500 each year).

Thanks to the Social Security Amendments Act of 1983, the employer's share of tax will increase to 7 percent in 1984. Further increases in both the employer's and the employee's share of the tax are slated for 1985, 1986 and 1990. By 1990, the employer and employee will each be paying 7.65 percent for a total Social Security contribution of 15.3 percent.

In additional to Social Security taxes, employers also pay Federal Unemployment Tax (FUTA). The current rate is 3.5 percent of the first $7,000 of each employee's annual wages. On January 1, 1985, this rate will jump to 6.2 percent. And,

remember, no part of the FUTA tax may be withheld from the employee's pay; it all comes from the employer.

While employers will not be able to avoid these increased payroll taxes, it may be possible to lessen the burden somewhat by offering fringe benefit programs instead of, or in combination with, pay increases. Certain employee benefits are not subject to payroll taxes, which obviously works to the advantage of the employer. Even better, in many cases the employee can receive these benefits without increasing his or her tax bill.

Not all types of employee benefit plans are suitable for small sound and telecommunications contractors, of course, but some of the simpler programs are feasible and deserve attention. For instance:

MEDICAL INSURANCE. Probably the most valuable benefit that an employer can offer to a group of employees with diverse personal needs is a good medical insurance plan. The amounts that the employer pays out on premiums are not subject to payroll taxes and employees are not required to pay income tax on the value of health care they receive under the plan.

The smaller sound and communications contractor actually has an advantage in the marketplace for medical coverage, because many companies tailor policies to businesses with one to 10 employees. It is quite possible to realize significant cost economies with higher deductible amounts ($250 minimum with $500 preferable).

Dental insurance is increasingly desirable. You may be able to tie in with a pre-pay plan from a large dental operation. This is usually less expensive then dental coverage added to a total health care package, because there are a growing number of dental clinics and dental groups offering pre-pay at very reasonable rates for the care involved.

DISABILITY INSURANCE. Disability coverage is an important benefit and is available in two major types: income disability and overhead disability. Income disability pays you and your employees for time off. It is a critical benefit for skilled key employees. Should they be laid up for a short term, the insurance benefits help defray those bills. This promotes loyalty and a desire to return to your operation once well.

Overhead disability is meant for the owner and other principals. It provides your contracting firm with income to meet bills during the time when you and other money-makers are laid up. This is separate from personal disability and can insure the life of your sound and communications business if a problem arises.

LIFE INSURANCE. Most sound and communications contractors cringe at the mention of insurance, since the cost of fire, theft and liability coverage is so high. However, life insurance premium payments are not subject to payroll taxes, while insurance benefits received by employees are not subject to income taxes.

Independent insurance agents can usually provide the most creative benefits. Term insurance is the least expensive coverage you can offer employees for life insurance. Obviously, you will save money by having the actual amount of certain forms of coverage you provide, such as term life insurance, vary with the employee's salary or job description.

An alternative is to vary the amount of your contribution so that longevity and productivity can be rewarded by your operation picking up an ever-increasing share of all

insurance costs.

EDUCATIONAL BENEFITS. Educational benefits can be offered to reward service and to enhance performance within your sound and communications operation. For example, courses in marketing, advertising, accounting and any number of similar courses will add to your employee's value.

There is also internal education which can be offered as a fringe benefit. Allowing employees to learn new skills as they become interested is often over-rated in our unionized society. But most employees can be trained in additional skills. Then if the employee demonstrates aptitude and interest, your firm can begin developing that employee for a more prestigious—or better paying—position.

Internal education makes everyone feel a part of a team effort. It also ensures that you are maintaining the self-respect of non-skilled employees who may otherwise feel neither needed nor important. A sense of self-worth and importance as part of the contractor's staff can lead to greater employee loyalty and costs the employer little or nothing.

CREDIT UNIONS. Credit unions are among the most popular and least understood of all employee fringe beneifits. Resembling company banks, they offer high interest savings accounts, certificates of deposit and numerous other benefits. Employees pool their money in order to make loans among themselves and usually have an easier time obtaining those loans than they would from outside lending institutions.

To get a credit union started it might be necessary to join together with several other sound and telecommunications contractors, a group of local businesses or members of a trade association. All contractors and, in fact, most businesses face the same benefit/salary problems and would profit from a low cost benefit such as credit unions.

Contacting the non-profit, Credit Union National Association (P.O. Box 431, Madison, WI 53601), will give you all the information necessary for you and your employees to form a credit union. They will also provide you with the names of local experts who can offer ongoing assistance as necessary.

The only cost to your business will

be the use of space, the location of which would be determined by all participating businesses, and a set amount of paid time off for employees active in the credit union. This usually means an hour a week for each employee involved with organization and operations.

INCORPORATING. The way you incorporate your business can help provide employee benefits for your operation's key employees. Arrange for what is called an umbrella corporation, even if you currently only have a small business. With an umbrella corporation, which costs no more than the incorporation of a single business, you can form other corporations which operate independently but are under that original umbrella.

While the technical details can be left to the lawyers and accountants, an umbrella corporation means that you can give your key personnel the chance to have their own businesses by letting them run branches of the existing operation. They usually receive a salary, commission for sales over a predetermined dollar volume, and a chance to own stock in "their corporation." They become full partners, over time, in the single corporation, while you take an income from the profits of each of the businesses under your umbrella.

OTHER FRINGES. Other fringe benefits which might be offered employees include employee discounts, employee parking, a subsidized eating facility, or even an on-premises athletic facility. However, it might be wise to await the new tax laws Congress should pass this spring. The Bills now waiting for Congressional passage contain rules that may affect the tax aspects of these other fringe benefits. The basic fringe benefits outlined earlier will not be affected by any new legislation now pending before our lawmakers.

Benefit planning is extremely important for every sound and telecommunications contractor. With careful attention to your operation's gross income and the type of employees you wish to attract, you should be able to afford far more than you think. Such fringe benefits help insure employee loyalty even when the realities of your firm's income prevent you from paying salaries competitive with those of other area businesses. □

Paging by Radio

by George Leon

The days of the quill pen are long past; the accountant described by Charles Dickens, laboriously adding up endless rows of figures for long, patient hours has also disappeared. Messenger boys are no longer in demand. Today's business is based largely on fast, if not instant, communications.

A large organization—especially one spread out over a wide area or with several buildings—constantly faces the need to locate individuals absent from their desks or stations.

There are several ways of accomplishing this. A secretary might hold the phone while someone looks for the absent person. Or the secretary can put the caller on hold while trying another number where the person wanted might be. Both mean the caller is wasting money on the call; long-distance charges add up quickly. If the caller is a customer, he may resent the wait—the money and time spent.

A third possibility is to tell the caller the call will be returned as soon as the "callee" is located. The result is a delay in communications and the expense of the call-back.

A public address system in such a situation, while possible, is not always the best solution. Due to its disruptive effect on everyone, it can become counter-productive.

Radio paging has been found to be the answer to most internal communications when the need arises for locating someone quickly.

Jack Ford, president of teleCourier, is enthusiastic about the advantages of radio paging. Ford heads the wholly-owned subsidiary of Tateco, AB, a Swedish manufacturer of radio pagers.

The teleCourier System consists of three parts: a keyboard/encoder console, a transmitter and a number of receivers. The units operate on VHF—FM—FSK—in the 30- to 50-MHz band. The overall frequency is 35.94 MHz. Frequency shift keying (FSK) is a type of frequency modulation in which the modulating wave varies the output frequency between set values and the output wave contains no phase discontinuity.

Ford pointed out that the radio pager is often confused with the walkie-talkie. The W-T has the distinct advantage of providing two-way conversations. It allows security personnel, for example, to talk to each other without the intervention of the console attendant. The R-P is designed to reach a designated person only on a one-way basis. It tells the person being called that he should contact or call a previously agreed upon number. The R-P is smaller and lighter than the W-T and is "hands-free."

The teleCourier System 800, microprocessor-controlled, provides a 4-digit LED readout with a visual display lasting three seconds after the beep signal. The receiver responds automatically to speech transmission. A previously arranged coded tone can mean, "Call your office," or "Come to the office," whatever has been agreed upon.

The tiny chip seen in Figure 1 with the receiver, permits changing the receiver without preparing new codes. Ford explained, "The design of the receiver is such that while it can be damaged by being dropped on a hard surface"—he was quick to point out that it had to drop a long way to really smash the receiver—"the code plug itself will rarely be in non-working condition." This means the plug is removed from the damaged receiver and slipped into a new one without any change at the console. The battery is easily detached for change or charge, depending on its type.

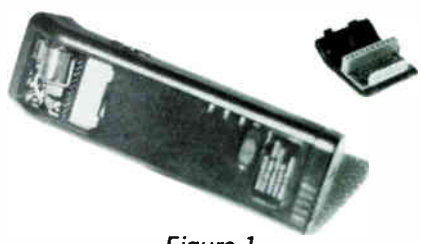

Figure 1.

Where the noise level is such that a tone could not be heard, or would be disruptive, a vibrating receiver is then advocated. The vibration is felt only by the wearer. It has proven to be especially useful for waiters in

restaurants.

Twenty simultaneous pagings are possible, with 11 digit code transmissions and two externally activated channels to provide versatility. Paging with speech transmission opens only the speech channel, with privacy assured. None of the ongoing pagings will be blocked.

"Our units are designed for on-site. The site can be an oil refinery covering several acres. If there are 'dead spots' within such an area, or in a tall building, all we have to do is add a transmitter or two without boosting the transmitting power. Certainly some high buildings will have places where a low-power signal won't reach. But the solution is not by boosting the power to such a point that the signal goes out for miles around. This is forbidden in Europe, as it interferes with other transmitters."

System 800M is the "baby" of the units with a built-in transmitter. Power is one watt. The console is self-contained (Figure 2). Ford pointed out, "All you have to do is open the package, pull out the rubber antenna, plug in the unit and you're ready to go." The keyboard allows paging one receiver at a time with a capacity of 30 receivers. But up to 100 receivers can be added as an option.

Figure 2.

System 800C is designed to cover a larger area with its five watts of power. While programmed for 30 receivers, up to 1,000 can be added in 100-unit increments.

The system can be plugged directly into a PABX. An interface allows paging a person merely by dialing his call number on the telephone or entering it on the intercom keyboard.

Parts and labor are guaranteed for 90 days. The local dealer is usually responsible for the installation, with a one-year guarantee. The usual dealer/installer is one who is carrying a line of sound equipment and is thus familiar with the local wiring codes and cognizant of good wiring practices. □

A Quick Quiz on the Decibel

by Don Davis

Here's a simple quiz about the subject you feel you know so well.

1. Prior to 1923 what was the unit of gain and loss in the telephone industry?
2. Between 1923 and 1929 what unit was used?
3. Where did the multiplier "10" come from?
4. Where does the multiplier "20" come from?
5. Can you write the general case algebraic equations descriptive of any decibel problem in both its logarithmic and power ratio forms?
6. What does the term gain refer to?
7. Are there ever voltage ratio decibels?
8. Using natural logarithms (ln), can you write the ratio of 2/1 to the base five?
9. If a change of 2 to 1 in distance in a free field results in a change of 9 dB, can you write the correct equations for the instant solution to a change in distance of 3.5 to 1?
10. Explain how an anechoic chamber accomplishes 99% absorption of the acoustic power while returning 10% of the sound pressure level.

All of these questions are basic, minus trickery, and if you solve them all correctly, you have the fundamentals of the decibel fairly well in hand.

ANSWERS

1. The unit of gain and loss used prior to 1923 was "the mile of standard cable" (MSC). One mile of standard cable (19-gauge open-wire cable with 88Ω per mile and .054 mfd per mile) was approximately 6% higher in level than the decibel.

$$.947\ (\text{MSC}) = 1\ \text{dB}$$
$$\text{or:}\quad 1.056\ (\text{dB}) = \text{MSC}$$

2. In 1924, W. H. Marten wrote in *The Bell System Technical Journal* an article entitled "The Transmission Unit and Telephone Transmission Reference Systems" wherein the transmission unit (T.U.) replaced the mile of standard cable.

3. Where the multiplier "10" came from is easily the least understood facet of the decibel. When the T.U. was defined in 1924, it was decided that when two *powers* were in the ratio of $10^{.1}$ they would be called one transmission unit (T.U.).

$$\frac{P_1}{P_2} = 10^{.1} = \text{T.U.'s power ratio}$$

$$\text{thus:}\quad \frac{P_1}{P_2} = 10^{(.1)(\text{T.U.})}$$

$$\text{or:}\quad \log_{10}\left[\frac{P_1}{P_2}\right] = \log_{10}10(.1)(\text{T.U.})$$

$$\text{and since:}\quad \log_{10}10 = 1$$

$$\text{then:}\quad \frac{\log_{10}\left[\frac{P_1}{P_2}\right]}{(1/10)} = \text{T.U.}$$

$$\text{or:}\quad 10\log_{10}\left[\frac{P_1}{P_2}\right] = \text{T.U.}$$

4. The multiplier "20" comes from the fact that decibels (the T.U. was renamed the decibel [dB] in 1929) are always and only *power* ratios. Thus, if measuring a change in voltage, current, sound pressure level, etc., at a *single* point in the circuit (each reading across the same resistance), then the power ratio is found by:

$$10\log_{10}\left[\frac{V_1}{V_2}\right]^2 = \text{dB}.$$

By taking the logarithm of $\left[\frac{V_1}{V_2}\right]$ first you can then write:

$$2 \times 10 \log_{10}\frac{V_1}{V_2} = \text{dB}$$

or simplified $$20 \log_{10}\left[\frac{V_1}{V_2}\right] = \text{dB}$$

Always remember, the multiplier "20" is simply squaring the voltage-like ratios to obtain power ratios.

5. Decibels and power ratios can be described as follows: any power ratio "a/c" is equal to a base "b" raised to an exponent "N" times a multiplier divided by the multiplier.

$$a/c = b^{\left[\frac{NM}{M}\right]}$$

then: $$\log_b a/c = \log_b b^{\left[\frac{NM}{M}\right]}$$

since: $$\log_b b = 1$$

then: $$\log_b a/c = \frac{NM}{M}$$

or: $$M \log_b a/c = NM$$

where: NM is the decibel
b is the base 10
M is the multiplier 10 or 20
a/c is a ratio

6. "Gain" or "loss" always and only refer to the change in *power* at the output of the system. There is *never* voltage gain or loss. Changes in voltage are properly called voltage amplification.

7. NO! Voltage ratios may be found from decibels, but it is done by converting power back into a voltage.

8. Natural logarithms (ln) to the base (e) = 2.718281828... can be used to find logarithms to any base by using the general case logarithm equation.

$$a/c = b^N$$

$$\ln a/c = \ln b\ (N)$$

thus: $$N = \frac{\ln a/c}{\ln b}$$

or in the case at hand:

$$N = \frac{\ln 2/1}{\ln 5} = 0.43$$

proof: $$5^{0.43} = 2$$

9. Here is a case of using the general case equations again.

$$M \log_b a/c = NM$$

or: $$\chi \log_{10} 2/1 = 9 \text{ dB}$$

$$\chi = \frac{9 \text{ dB}}{\log_{10} 2/1} = 29.9$$

proof: $$29.9 \log_{10} 2/1 = 9 \text{ dB}$$

10. This is the classic case of identifying power ratios and then converting them back into an equivalent voltage ratio across a *fixed* resistance.

$$10 \log_{10} 99/1 = 20 \text{ dB}$$

Therefore, if 99% of the power is absorbed, it will be 20 dB lower in level (all levels). Thus, the sound pressure level (L_p) will also be 20 dB lower.

$$20 \log \chi = -20 \text{ dB}$$

or: $$\chi = 10^{\left[\frac{-20}{20}\right]} = .10$$

or: 90% of the sound pressure level is absorbed so 10% is reflected.

The decibel is fun, fundamental, but frequently flunked. We hope you enjoyed this short reminder of a few of its key properties. □

Cordless

Simultaneous Interpretation System

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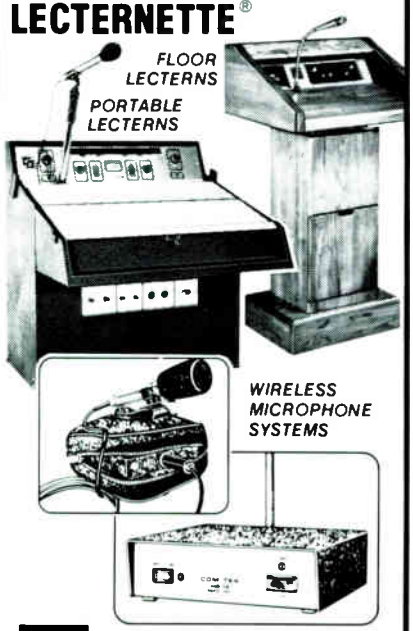

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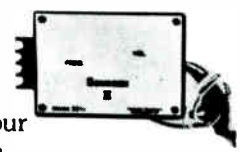

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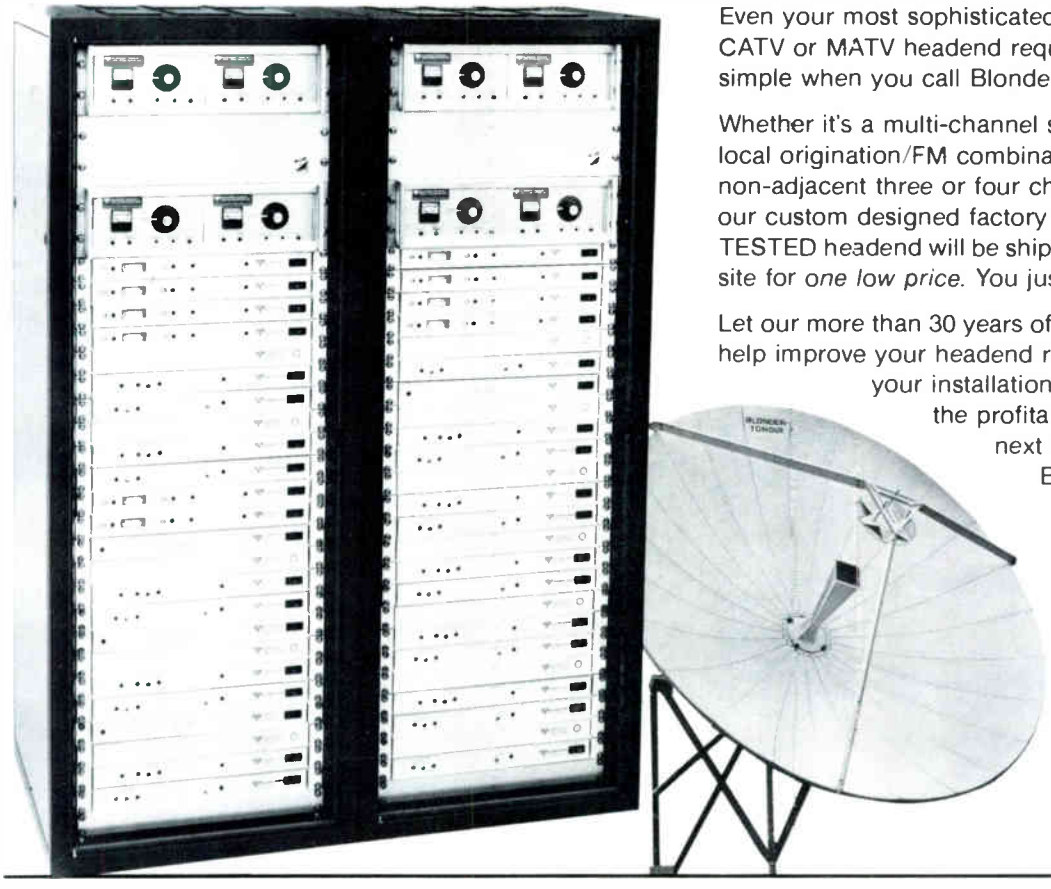

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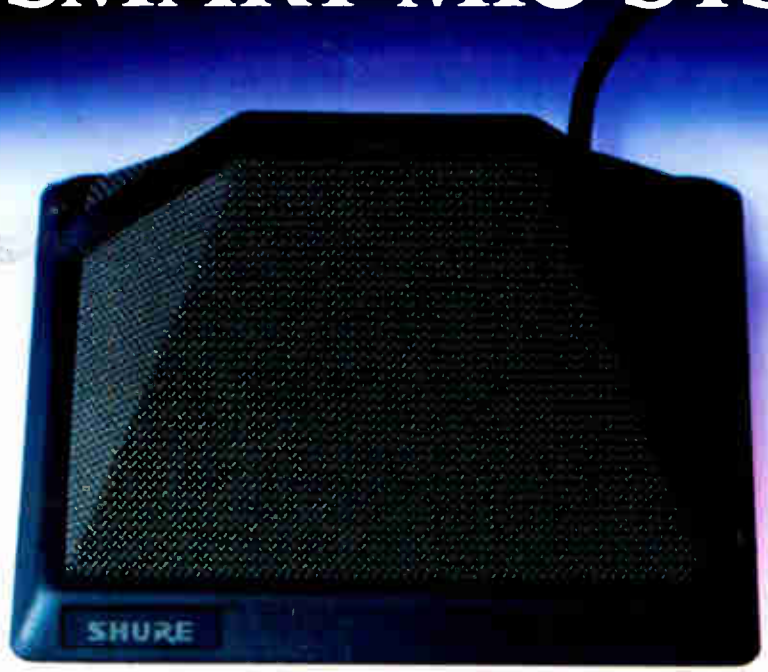

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