

SOUND & COMMUNICATIONS

**NSCA
ISSUE**

Volume 36 Number 4

April 16, 1990

LAS VEGAS SOUND

This town's newest hotel — The Mirage — has a spectacular sound and display system. With fast-track design and over 1,000 purchase orders issued, the job came in on time.

39



IN THIS ISSUE: SNAKES

The snake gets smarter, as digital and optical theory gets translated into real systems. **70**

CONSULTANTS

Consultants predict the industry of the nineties. Our series continues. **76**

3-D SOUND

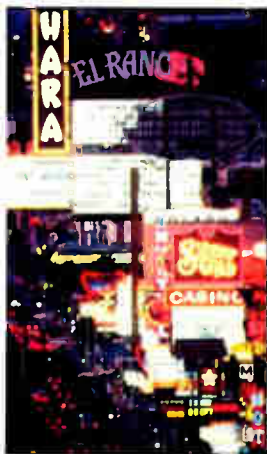
The future of audio? The leading lights of 3-D sound discuss the possibilities. **90**

Sound and Hearing

The audio community's responsibility in the hearing and health field. An update on recent studies of the relationship between loud sound and hearing loss. **12**

Expo '90

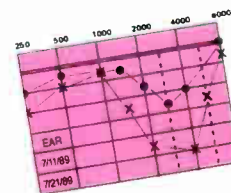
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this year's Expo '90 the most comprehensive highlights of the educational program. **32**

NSCA

The National Sound and Communications Association: Where it's been and where it's going. We talk to some of the movers and shakers. **26**



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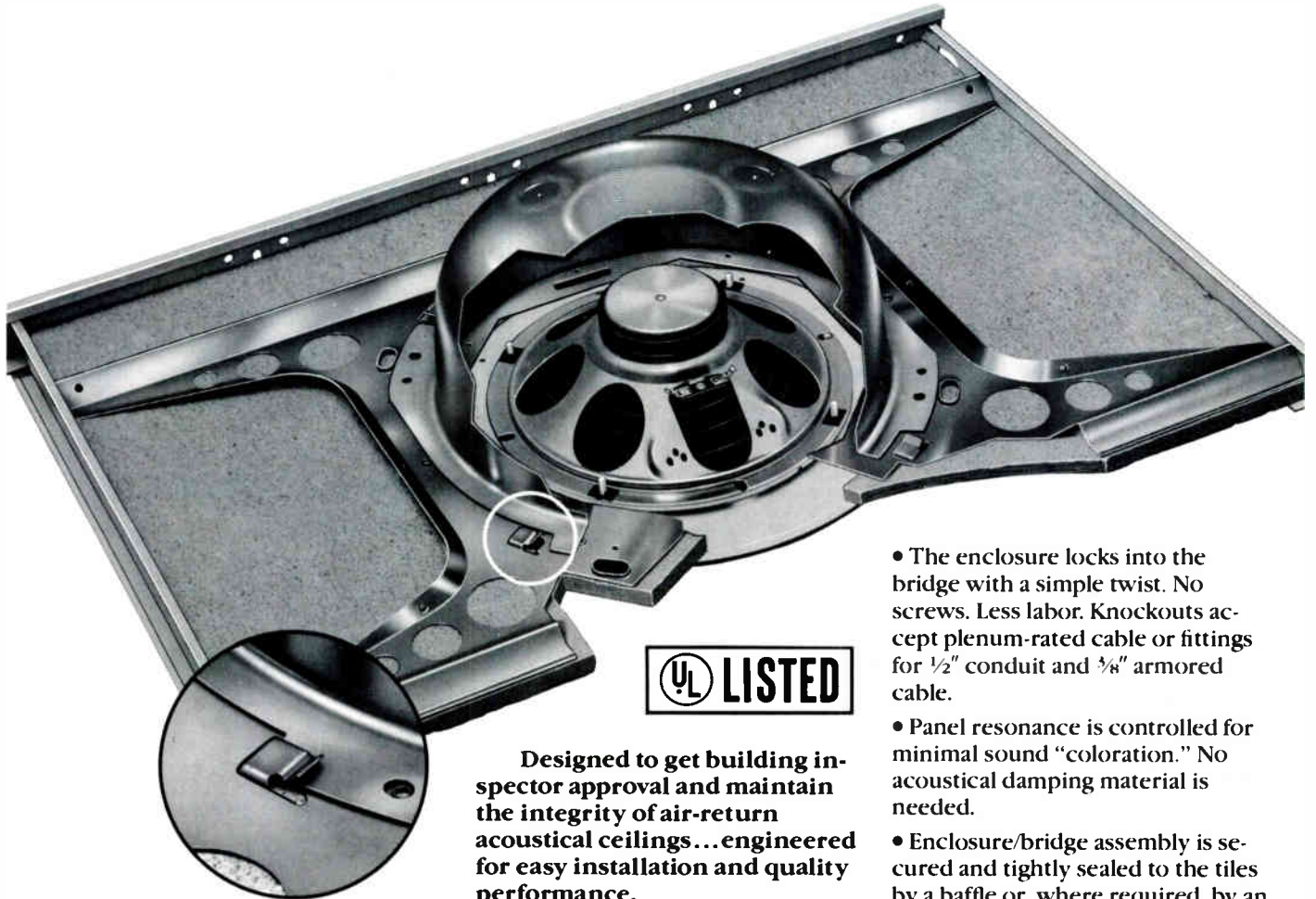
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39



58

FEATURES

- 26 THE NSCA AT THE BEGINNING**
By Suzan Prince
NSCA's pioneers look back at the beginnings of the expo, some 11 years ago.
- 32 NSCA EXPO '90: A LEARNING EXPERIENCE**
By Pamela Michael
A preview of the educational programs at this year's NSCA Expo.
- 39 LAS VEGAS' MIRAGE HOTEL**
By P.J. Goodman and Robert Patrick
One of the largest hotels in the free world, the Mirage took less than 27 months and \$630 million to complete.
- 50 MTF TEST SIGNALS**
By Arthur Noxon
With today's electronics and transducers, the weakest link in the audio chain is the playback room. How do you test the room as a link in the audio chain and what should be the specification?
- 58 ST. LUKE'S EPISCOPAL CHURCH**
By T.G. McCarthy
At first glance St. Luke's appeared ordinary. But, at closer look this Minneapolis church presented many challenges.
- 67 AN OVERVIEW OF HIGH RESOLUTION INSTRUMENTATION**
By Mike Klasco
Part 2 looks at the latest in analyzers used for testing and instrumentation purposes.
- 70 HIGH TECH SNAKES**
By Mike Klasco
They say there's a revolution brewing for the installer of the previously low-tech field of snakes for permanent installations.
- 76 WHITHER THE NINETIES: THE CONSULTANT'S VIEWPOINT, PART 3**
The responses from the consulting field keep coming to our inquiry about the future of the industry.

- 90 3-D SOUND SEMINAR**
Five stars in the field of 3-D Sound discuss this hot topic from the last AES Convention.

COLUMNS

- 7 LETTER FROM THE EDITOR**
- 12 GUEST COLUMN**
By Mort Altshuler
- 14 ANSWERS**
By Don Davis
- 18 TESTING AND MEASUREMENTS**
By Don Davis
- 82 TRADE SHOWS**
- 115 DR. WOKKA**

DEPARTMENTS

- 9 NEWSLETTER**
- 103 UPDATE**
NEWS FROM AROUND THE INDUSTRY 103
PEOPLE 106
CALENDAR 107
PRODUCTS 108
- 116 MARKETPLACE**
- 118 AD INDEX**

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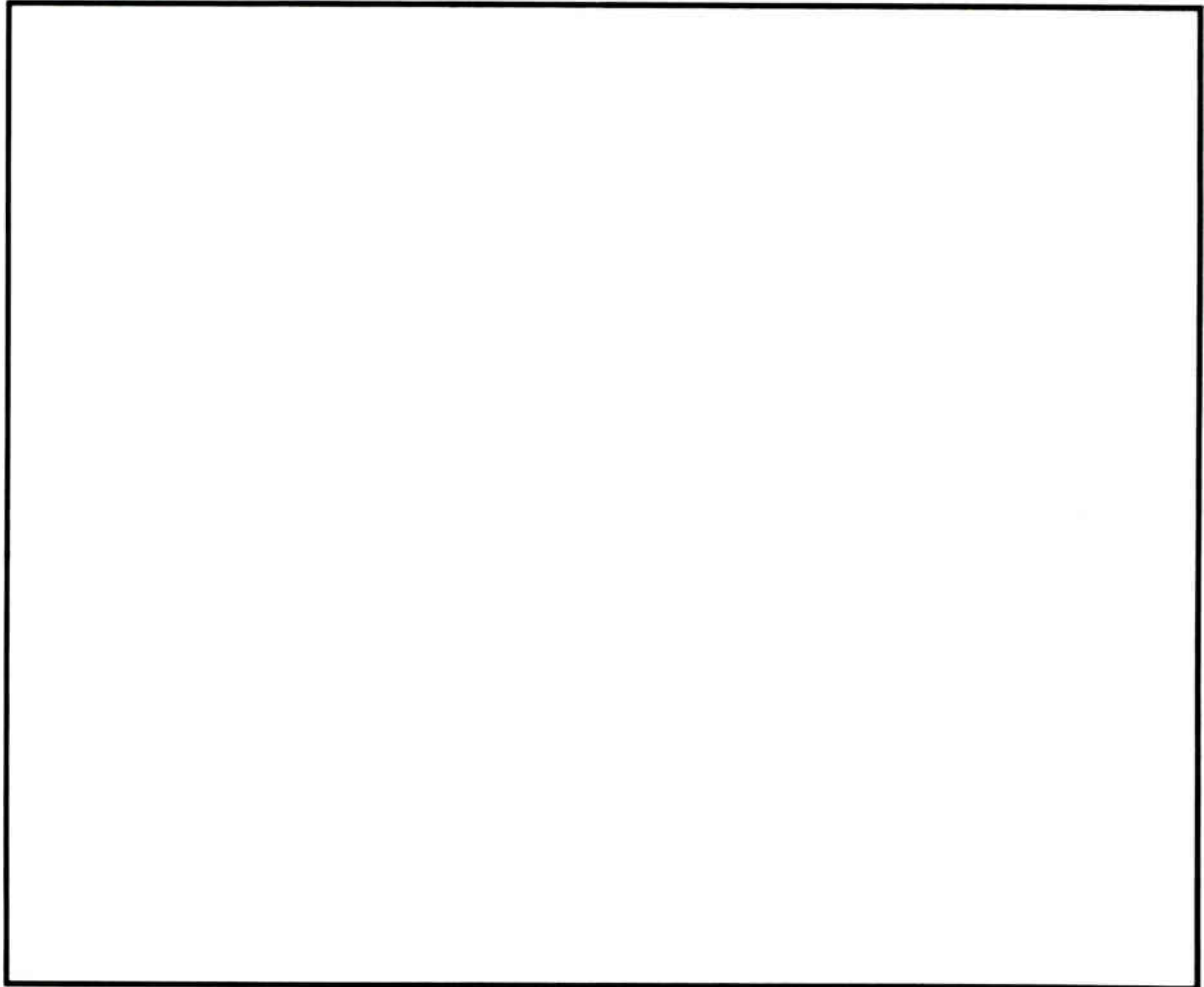
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LETTER FROM THE EDITOR

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If you've noticed an addition to our masthead, you're correct in taking notice. SOUND & COMMUNICATIONS is proud to formally announce that Michael Klasco has become Technical Editor of this magazine.

Mike has been writing for SOUND & COMMUNICATIONS ever since it was purchased by Testa Communications. He has been, and remains, the leading and most knowledgeable reviewer of design software for this business. His contributions to this magazine have made it the paramount source of information on design software. And that stance will remain.



Technical Editor Mike Klasco visits an exhibitor's booth at Infocomm.

But there's more, folks. Mike is now actively directing the technical coverage of this magazine, and his in-depth knowledge and concerns are and will be working to place this magazine in the forefront of technology. We've known Mike for many years — back to when he was the founder of GLI, a pioneer discotheque company. He holds a number of patents in variable speech control technology; and he has been the acoustical consultant on such projects as the 1986 Asian Games and the 1988 Summer Olympics. He has done engineering designs for various manufacturers, and is currently the special session chairman of the session on Acoustical Modeling at the 1990 Los Angeles AES Convention. Mike is working on his doctoral thesis in "Signal Processing for Audio Time Compression" at New York University.

There are other additions in the world, of course. And if you've noticed an addition to Las Vegas, you're right again. The Mirage Hotel has been the talk of The

Strip for several years now. And the buzz didn't die down once the hotel opened this fall. It's mammoth and it's spectacular. The sound system was done by Acromedia. And in this issue of SOUND & COMMUNICATIONS, the people who did the sound system give us an overview of it. It's one of the most comprehensive systems you'll ever come into contact with, and we're proud to present our comprehensive overview.

The Mirage Hotel is in keeping with our thoughts on Las Vegas. Of course, the reason we can not only read about the Mirage this month, but see it too, is that

the National Sound and Communications Expo is taking place at the Las Vegas Hilton, a hop away from the Strip. And the annual marketplace is an important factor in the way this business does business. In this issue of SOUND & COMMUNICATIONS, we include some background on the organization of NSCA and the show itself, along with some highlights of the educational programs being presented. Because we don't believe in pre-show rundowns of product being exhibited (after all, an April issue of a magazine has to be prepared well in advance — and well before many manufacturers are sure of exactly what they will have on exhibit), we'll follow up with a comprehensive report on exactly what was seen and heard at this premiere convention for this industry.

Have a good show.

Sincerely,

Judith Morrison

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THE IEQ PROGRAMMABLE EQUALIZERS

Available in 15 and 31 band versions, the IEQs offer Smartcurve for virtual elimination of adjacent band interaction. One controller can remotely operate up to 15 satellites. .009% THD, 102 dB signal-to-noise ratio.



THE PD3 SPEAKER ALIGNMENT DELAY

A 1-in-3 out digital delay with a 64 kHz sampling rate for utterly flawless signal reproduction at a price hundreds less than comparable units - 20 Hz-20 kHz bandwidth.



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Utilizing the same revolutionary filter technology as the IEQs, the H-D EQ's offer a new standard in audio performance. Available with XLR, 1/4 inch and terminal strip connectors, they offer complete flexibility in professional applications. There is minimum phase shift and no center point drift regardless of fader settings. Automated computer manufacturing has reduced the cost to less than half of comparable units! Freq. response 2 Hz-153 kHz, signal-to-noise ratio -115 dB (R.E. +20 dBm), THD < .005%.

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NEWSLETTER

MARK IV ACQUISITION

Mark IV Audio has acquired a major interest in Dynacord GmbH. The long rumored acquisition of a "European company" by the conglomerate was completed at press time. Dynacord is exhibiting under the Mark IV Audio marque at the NSCA exposition in Las Vegas. Sales of Dynacord products for 1989 were in excess of \$25 million. Cooperative marketing is expected to be developed between University and Dynacord's commercial sound business. Dynacord products have been distributed in the U.S. through Dynacord Electronics Inc. in Los Alamitos, California and the PCA Series power amplifiers and DRP-20 digital reverb and effect processor will presumably be continued under distribution through the Mark IV division.

MARSH PROMOTED

David E. Marsh has been promoted to Vice President, Acoustics and Technical Systems at Pelton Marsh Kinsella, Inc. in Dallas. Marsh has been with PMK since 1985. He has recently been instrumental in securing contracts for acoustical and sound systems design work at the Opryland Musical Theme Park in San Antonio, Texas. The project involves three indoor performance venues and five amphitheatres. PMK, Inc. specializes, in addition to acoustics and technical systems, in architectural and environmental acoustics, industrial noise and vibration control and hearing conservation.

SONY PERSONNEL CHANGES

The broadcast, professional video, and professional audio marketing of Sony Corporation of America has undergone some readjusting. Richard K. Wheeler has been named president of Sony Operations and Technical Services in San Jose, California. Mark Gray has been appointed president of Sony Communications Products Company. He had been president of Sony's Peripheral Systems Company and was previously with Harris, Tektronix and Ampex. Harry Taxin has been named president of Sony Systems and Technology, responsible for R&D systems development in San Jose, and also for Sony's Advanced Video Technology Center. William Connolly continues as president of Sony Advanced Systems, responsible for business development related to application of HDTV technology in the United States.

MATRA BUYS INTECOM

Matra Communication and Wang Laboratories have signed a letter of intent under which Matra Communication would acquire InteCom, Inc., a wholly owned subsidiary of Wang and a manufacturer of integrated voice/data switching equipment. Matra, headquartered in Paris, has sales of over \$850 million and is France's second largest telecom supplier. InteCom is a supplier of voice/data switching systems and manufactures and markets the Telari and Integrated Business Exchange systems.

SEMICONDUCTOR SYMPOSIUM

A symposium on semiconductors will be among the programs presented at the 1990 Electronic Distribution Show and Conference April 25 in the Las Vegas Hilton. Panelists include Craig Barrett, executive vice president of Intel, L.J. Reed, vice president of Motorola AISC Division and Marshall Butler, chief executive officer of AVX. Two distributors, Robert Rodin of Marshall Industries, and David Herring of Projections Unlimited will also be on the panel. The symposium "reflects a decision of the EDS Board to add more substantive programming to the EDS agenda."

SLIDES ON FIBER OPTICS

Bellcore of Livingston, New Jersey has developed a package of 188 slides on fiber optics. The package features the history, trends, transmission principles, operations, applications and the future of fiber optics. The product is being shown at the International Communications Association Exposition in New Orleans May 22 through 24.

NEWSLETTER

AGFA AWARDS

Agfa Corporation, Magnetic Tape, has announced the winners of its Sales Awards. The Vice President's Award was presented to Bob Zamosciany, regional sales manager, Atlantic region. First place in the sales contest for technical sales representatives was awarded to Jim Rouse, Pacific region. Outstanding Performance Award was presented to Wayne Desmond, technical support engineer. According to National Sales Manager Andrew Da Puzzo, "Our entire sales staff deserves tremendous credit for their achievements. Because of their efforts we have maintained our dominant market share in audio duplication."

VISIONS '90

The SMPTE Mini-Conference for 1990 is being held April 27 through 29 at the Sheraton Centre in Toronto. The theme is "Visions — 90." The SMPTE Mini-Conference is an annual event jointly sponsored by the Montreal/Quebec, Ottawa, Rochester and Toronto Sections of SMPTE.

ERA BREAKFAST

The Electronics Representatives Associations is sponsoring a breakfast seminar meeting for NSCA attendees, tentatively scheduled at 7 am on April 18. The ERA has a booth at the NSCA Expo with informational and Lines Available Services.

SOLID STATE SYSTEMS SOLD

Solid State Systems, Inc., a wholly owned subsidiary of National Telecommunications plc., has become a part of the European-based Alcatel Group. Charles R. Cadle, previously the Chief Financial Officer, has replaced Edgar C. Mills as president of the company.

GORDON FORMS OWN FIRM

Colin Gordon, formerly with Bolt Beranek and Newman, has established an independent consulting group under the name Colin Gordon & Associates. The group provides consulting services in vibration and noise control and acoustics and is located in San Mateo, California.

WOOFER UPGRADE

Digital Designs is offering a one time woofer upgrade/trade out program, allowing customers to "change out your woofers at your location and still maintain warranty status."

WIN STOCK ACQUIRED

WIN Communications Corporation has announced that its shareholders Nissho Iwai American Corporation and Nissho Iwai Corporation have completed the purchase of the 49.9 percent interest in WIN formerly held by Walker Telecommunications Corporation. The purchase was completed on March 6. The purchase price was approximately \$2.75 million.

TWENTY-YEAR WARRANTY

Bryston Limited has announced that it has instituted a 20-year parts and labor warranty program. The policy is retroactive and includes all audio products previously manufactured and sold under the Bryston name. Bryston will pay shipping costs one-way. All parts costs and labor are covered by the warranty, which is fully transferable. The announcement was made by Martin Bartelstone, V.P. of Bryston Vermont Ltd., the U.S. distributor of Bryston.

MEYER PROMOTED AT PEIRCE-PHELPS

David G. Meyer has been promoted to Audio Sales Manager of the Audio/Video Systems Division of Peirce-Phelps, Inc. Meyer joined Peirce-Phelps in 1983 as part of the newly formed Audio Systems Division. Since that time, he has had responsibility for broadcast, hotel/casino and corporate accounts. Most recently, he has been an account manager for videoconferencing customers.

THE SINGLE BOX SOLUTION:

BGW SPA-3 Signal Processing Amplifier

About two years ago, BGW decided to take a long look at the then-current state of the art in amplifying systems. And when we did, we saw room for improvement. The typical installation included several channels of amplification, of course, along with quite an accumulation of add-in and add-on boxes: An electronic crossover or two, a couple of time alignment delays, plus assorted EQ's, filters and more.

What's wrong with that? Well, all those separate boxes wired together require lots of rack space, cause inevitable installation hassles, and create an ongoing potential for reliability problems. Not to mention the cost of all those boxes.

That's why we created

ever need for virtually any application. It's a *complete amplifying system* in a single 5¼" rack cabinet—completely self-contained, completely flexible and completely reliable.

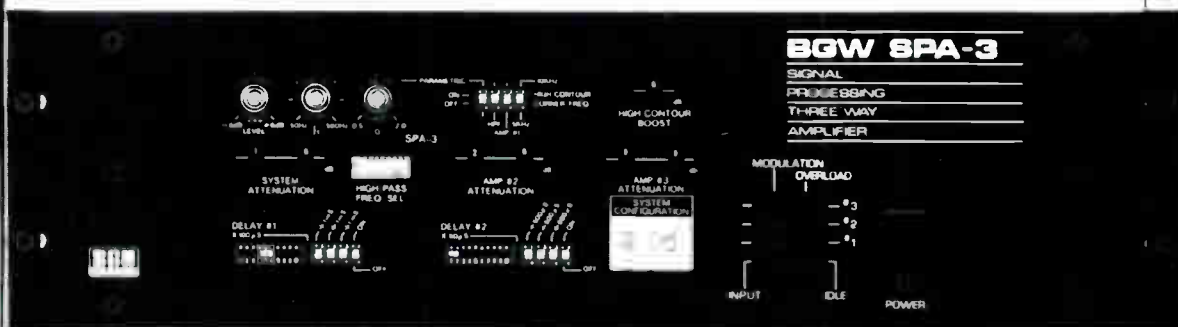
At the heart of the SPA-3 are not-two-but three 200 Watt (@ 8 ohms) channels of BGW-quality power amplification. Among the signal processing elements included are Low Frequency Parametric EQ and a High Frequency Contour Filter, a Switch-set™ High Pass Filter, a 3-way Electronic Crossover Network, two adjustable high-quality Delays for time alignment, even a full complement of Buffer Amps and Digitized Level Attenuators.

In minutes, the SPA-3's multi-pin "jumper header" plugs-in to let you set up the unit for dozens of different

wouldn't build it any other way!

The superior design, reliability and performance of the BGW SPA-3 has already proven itself in major installations from the Orange County (CA) Performing Arts Center to the OMNIMAX theatre in Australia. By the way, there's also a two channel Model SPA-1 with signal processing capabilities tailored to make it an ideal subwoofer amplifier. It's a time, space, aggravation and money saver too.

The logic of the SPA approach speaks for itself. But there's lots more to know about all the incredible capabilities of the BGW Signal Processing Amplifiers. For a full info pack, call us Toll-Free at 1-800-468-AMPS, (in CA 213-973-8090), or see your BGW dealer.



the BGW SPA-3 Signal Processing Amplifier—the single box solution that restates the state of the art. It's much more than just an amplifier, because the SPA-3 includes all the signal processing elements you'll

configurations, in the shop or in the field. The design is so flexible, you can even change the location of the attenuators, delays, etc. within the signal flow. And every processing function offers superb quality. BGW



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Noise Update

By Mort Altshuler

So here we are, early in the 1990s, and we see that "rockers" are admitting to some hearing loss, several legal suits have been mounted relative to noise induced hearing loss, and professionals in the field have, at last, realized that if we don't govern ourselves, some "groups out there" are going to impose some improbable restrictions that we "ain't" going to like one bit. I was thinking the other day, knowing full well that I should not strain myself on a Saturday afternoon, that if the medical profession, in an attempt to help people stop smoking, can show "yucky" pictures of dissected lungs, maybe some of us can illustrate, in "non-yucky" ways, what effects can visit upon our wonderful bodies if we stick our heads up our speakers for too long!

First, some numbers that are always foisted upon us, but rarely move us to action: It has been reported that more than 20 million people are exposed to noise levels that can be injurious. The Electronic Industries Association (EIA) tells us that 23 million stereo headsets will reach the market this year. Dr. David Lipscomb, an Audiologist, reports having tested 1,000 incoming college freshmen and he found that 60 percent of them had hearing loss that was typical of oldsters.

Second, some interesting facts to ponder: Researchers at Johns Hopkins found that exposure to much smoking, even if you are a so-called "passive" smoker, can exacerbate hearing damage. It was found that loud noise and carbon dioxide mixed together causes more damage than either one alone. The literature also reveals that alcohol causes the same type of "addictive" effect on hearing damage and lo and behold, cannabis — that old devil "Mary Jane," produces the same situation . . . increased hearing loss . . . more than noise alone

would produce. Please note that there are many other substances reported to reduce the blood flow. Butyl nitrate ("poppers") and some nasty stuff in boat paint and pesticides are examples. See??? Everyone always said that all that stuff was bad for us, didn't they? It appears evident that any substance that decreases blood flow renders us more vulnerable to noise induced hearing loss. Although the inner ear is rich in blood flow, and hence oxygenization, the vessels are terribly minute and it doesn't take much to diminish this much-needed blood flow, for the hair cells in the inner ear must have increased blood flow as noise increases.

Third, some "non-yucky" illustrations of what kind of toll is paid when noise exposure is too loud and too long: Figure 1 depicts a 19-year-old male the morning after attending a Who concert on July 10, 1989. The young man described a very loud concert in addition to a young female directly to his left who "screamed all during the show." He further reported that he had a feeling of fullness and "ringing" in both ears, no history of noise exposure and no past hearing loss or ear disease. Figure 1 shows some of the test results of July 11, 1989 and July 21, 1989 after treatment and time interceded. The patient and his parents were very concerned

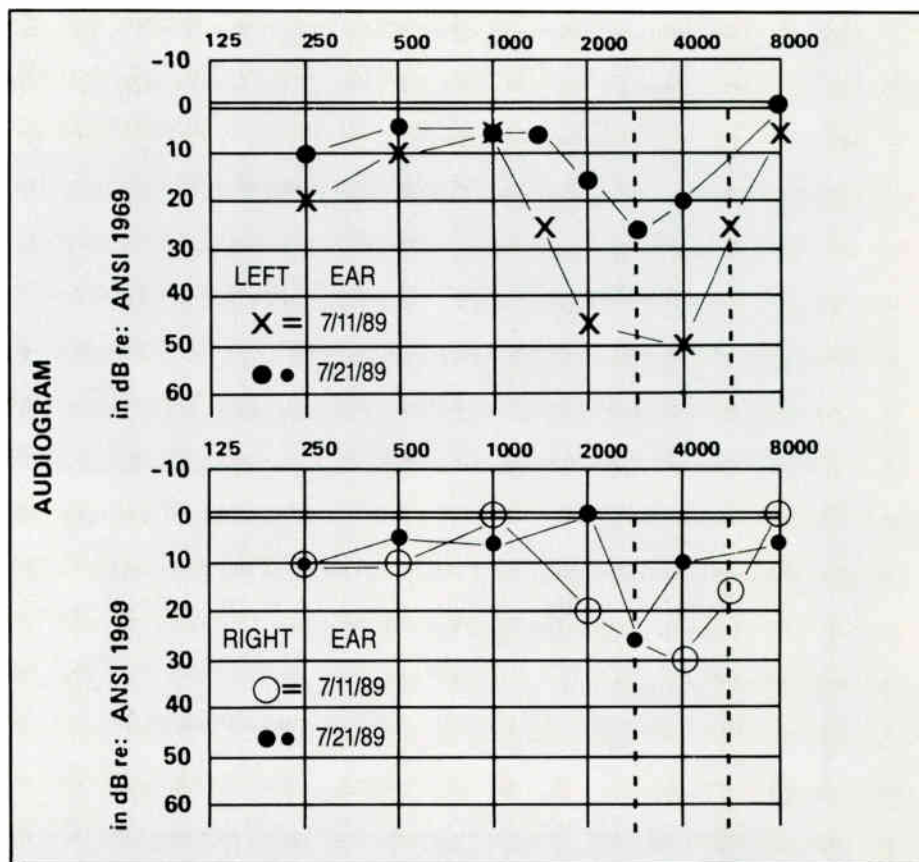
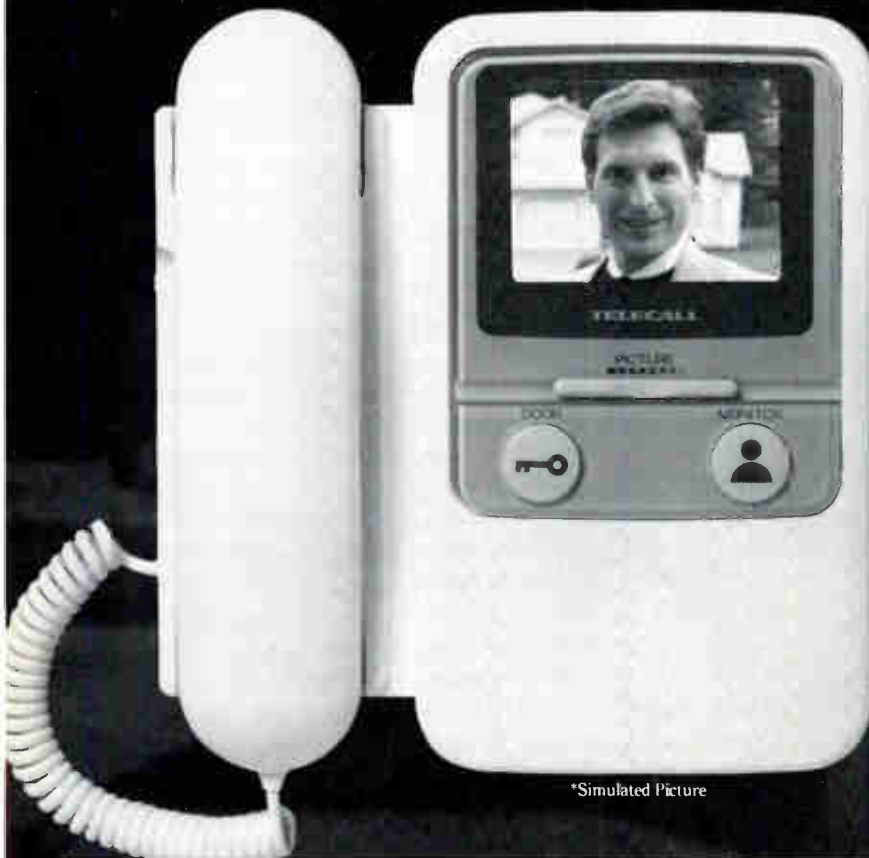


Figure 1

The advantages are as clear as night & day.



*Simulated Picture

Whether it's night or day, Telecall's new video intercom surpasses the human eye.

Introducing the TD-1NW 2-wire video entry intercom offering the most reliable, affordable security, and features such as:

- Requires only 2 wires to carry both audio and video signals.
- Infrared MOS camera is sensitive enough to transmit in almost total darkness. Requires just 1 Lux of light.
- 3.5" Back-lit LCD screen shows a clearer picture than tube screens.
- Monitor button enables home owner to view door area independent of call button at door.
- Door release button can be connected to electric door for remote control release.
- Best of all, it's backed by Telecall's 40 years as a leader in intercom technology.

TELECALL

For more information, call toll free
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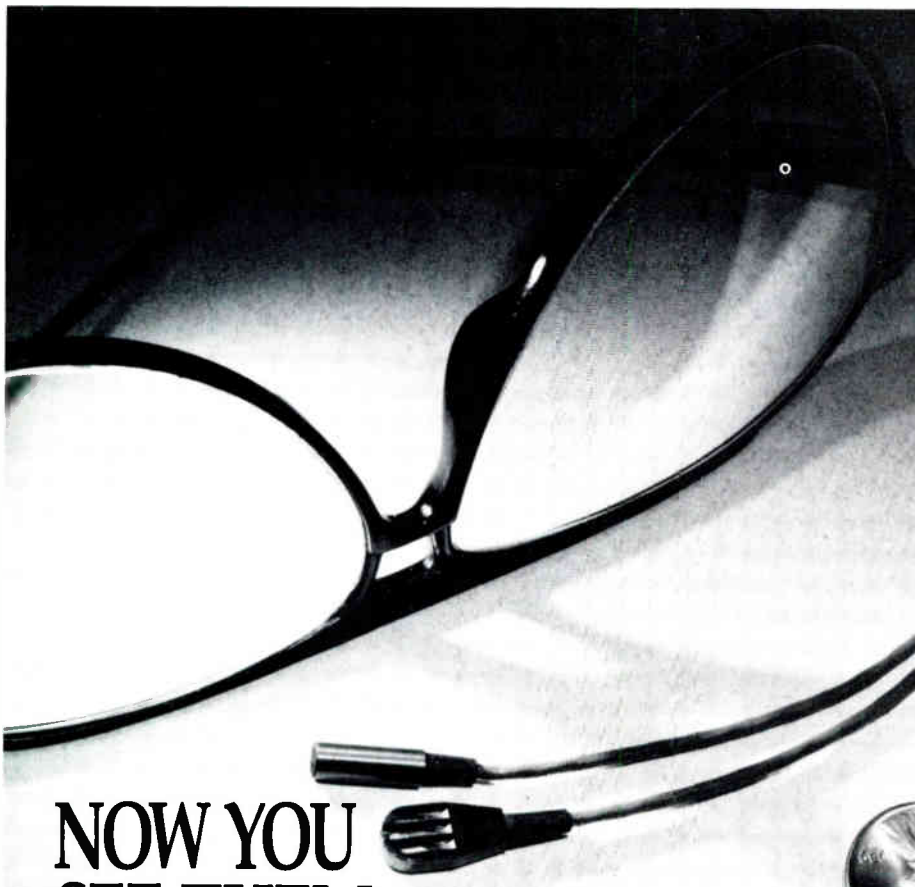
Circle 209 on Reader Response Card

NOISE UPDATE

and rightly so, for what you see as the July 21 results is now, probably, permanent. Fortunately his discrimination for speech remains very good. If this young man is not very conservative about future noise exposure he will be troubled with a progressive, debilitating loss. Figure 2 illustrates the adventure of a 29-year-old, male sound engineer who traveled with some large, loud, notable groups throughout the

Date	LEFT EAR						Speech Perception	RIGHT EAR
	250	500	1K	2K	4K	8K		Normal throughout
10/18/72	10	5	0	0	10	20	100%	
10/30/72	75	75	65	55	35	30	44%	
11/2/72	40	60	55	60	10	20	32%	
11/8/72	20	35	50	50	5	25	40%	
11/22/72	15	25	45	35	5	15	48%	
2/21/74	35	50	50	45	10	30	48%	
10/30/75	45	60	50	45	15	20	56%	

Figure 2



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U.S. He experienced a sudden loss of hearing in his left ear at the end of a long and loud tour. He called me from New York with the problem and he was directed to return to Philadelphia immediately and get what little help he could. Please note that the first line of the figure is his "prior-to-incident" base line of hearing which we obtained eleven days prior to the loss. This patient continued to work in the same capacity with sporadic ear protection until the end of 1975. These data indicate clearly what was happening with his acuity and his understanding of speech over this period. It is indeed a pity that we cannot "recone" his ear, because he's stuck with what he's got forever. FOREVER!

It is imperative that we support the groups that are devising some suggestions regarding noise exposure guidelines. Let's listen to them carefully so we can listen carefully in the future. ■

ANSWERS

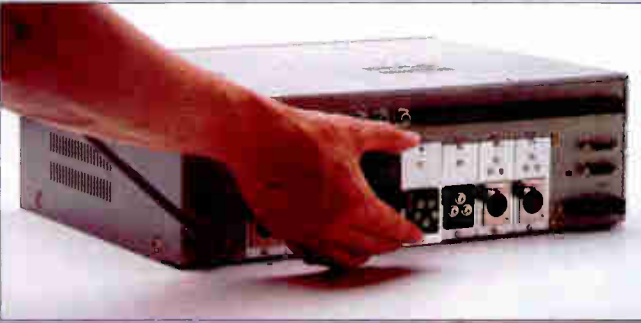
These are the answers from Don Davis' Test Questions that appeared in the March issue of *Sound & Communications*.

1. dB — (C)
 dBm — (A)
 dBV — (B)
 dB_(0.775) — (D)
2. (2) $R_S = R_L$
3. (4) Power
4. (4) .001 Watt
5. (2) R_S greater than R_L

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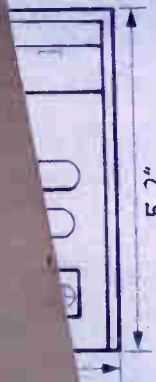
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THE POSSIBILITIES

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



F

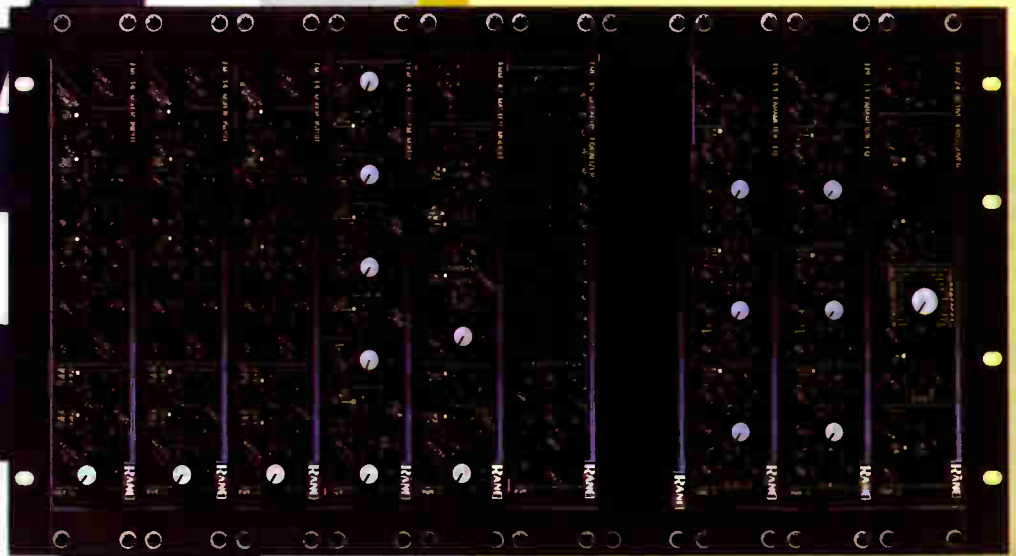
lexibility, no matter how you spell it, means power. It's the power to meet varied needs. To meet budgets with optimum performance. To efficiently accommodate system growth. Long into the future.

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

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

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

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



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World Radio History

ARE STAGGERING!

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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Acoustic Measurements

By Don Davis

Just as possession of a guitar does not make one a musician, and the possession of a rifle does not make one a marksman, so too the possession of advanced measurement analyzers does not make one an engineer.

Those in possession of tools, but not yet proficient in their use, are usually unaware that almost every word they utter betrays their lack of experience.

Comments that reveal a person's lack of understanding of measurements and/or acoustics include:

- "Tell me where to place the microphone to make a proper acoustic measurement."

- "I want an analyzer that lets me measure the low frequency response of a monitor loudspeaker in a small room."

- "Turn on the array and let's measure its response."

- "We don't need to measure here anymore because one can't hear comb filters."

- Let's measure the RT60 of this control room. I planned for 0.25 secs."

- "We installed tube traps, diffusors, Sonex (you name it) to remove the standing waves."

- "I am going to use my electronic equalizer (which operates in the frequency domain) to correct phenomena in the

time domain (reflections in the room, audience, etc.)."

Bruel and Kjaer put it succinctly when they said, "To measure something properly, you need to know everything about it. If you know everything about it, why are you measuring it?"

Panaceas are worshipped far more often than truths and are recognized by the cry of "but it measured well, how come it sounds badly?"

In this writer's experience each new measurement tool has been greeted by the desire on the part of the user to categorize every device through its use. Fortunately, for the majority of us, gifted individuals

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FET-2000:	400	300	1000
FET-1500:	300	200	600
FET-1000:	190	120	380

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arise to guide us past our own limitations. Dick Heyser was such a giant and his work that undergirded TEF analysis (TEF: Time, Energy, Frequency) employed the multi-faceted nature of the acoustic signal in both its measurement by analyzers and its processing by the human ear/brain system.

Lord Kelvin (1824-1907) put it best when he said, "I often say that when you can measure what you are speaking about, you can express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind. It may be the beginning of knowledge but you have scarcely, in your thought, advanced to the stage of science whatever the matter may be." Measurement is a quest for the truth.

It was Lord Raleigh who first pointed out that in all matters in acoustics the ear was

the final judgment. The ear/brain system can be thought to say about measurements: "I care not how good you be, if you're not good for me."

With all this in mind, let's go back and review the seven common measurement misunderstandings listed above.

"Where Shall I Place the Microphone for the Measurement?"

If, for example, you are measuring a sound system in a church, and assuming you have successfully completed your audio tests (i.e., the electronic tests), you are now ready to look at things in the acoustic media. You should have someone talk the system (no music please!) and you should walk the entire audience area, listening carefully for the best seats and the worst seats. Once you have found them, look around and see if you can detect why they are good or bad. Use your

hands to cup your ears as you listen to all the surfaces in the room. If it's not evident, then try measuring there and see if it will reveal itself to you.

"I Want an Analyzer That Lets Me Measure the Low Frequency Response of a Monitor Loudspeaker in a Small Room"

Probably the most heartfelt requests we hear are those requesting a repeal of the law of physics regarding the measurement of low frequencies in a small room. We often hear it said, "I want to measure the low frequency response of my loudspeaker while it is installed in a small room." What appears at low frequencies on the real time analyzer is predominantly the room response — not the loudspeaker's response.

The correct choice is to:

- Measure out of doors or in an anechoic chamber.



"...SOUNDSPHERE LOUDSPEAKERS ARE THE REASON FOR THE CLARITY OF SOUND?"

Don Hartley/President • Dynamic Sound • Exeter, NH

Comments Mr. Hartley on the Sun Foods store, "The Lowell store has approximately 76,000 square feet and is the largest supermarket in New England. It contains 24 checkout counters....

...This store is owned by Hannaford Brothers and they basically have three or four names that they use for different stores. In 1984, they built a store similar to this, with a 22-foot ceiling and at that time we were just completing a new installation at their warehouse, which comprised of twelve 250-watt amplifiers and approximately 80 Soundspheres. Since the ceiling in their new store was going to be 22-feet high, we strongly recommended Soundsphere #110's and guaranteed equal sound in each and every part of the store. This installation was completed; and last year when another store was planned in Lowell, they called us for an installation similar to Keene....

...The size of the store and the use of Soundspheres have caused many supermarket competitors throughout the United States to evaluate this store, and we have received numerous phone calls about the sound system since it works so efficiently and about its clarity where you have all concrete walls, concrete floors and open girders in the ceiling. We have given all of them the same answer that it is very obvious the Soundspheres are the reason for the clarity of sound!"

We strongly recommended Soundsphere #110's.

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- Measure in the near field pressure zone (i.e., with less than an inch from the cone).

A third non-scientific method, the one most commonly used, is to find a point for the measuring microphone that is least harmed by the modes and tell yourself, "This is the response of my loudspeaker." There are many satisfied users of this technique and they don't appreciate you or me intruding with any awkward facts.

Figure 1 shows the limitation of a real time analyzer, in this case, in a study of comb filters generated by two loudspeakers one foot apart.

Figure 2 illustrates a beautiful example of using the TEF analyzer to measure the low frequency in a room.

"Turn on the array and Let's Measure Its Response"

Very often large arrays are assembled without testing, and hoisted into position. At this point the entire array is turned on and pink noise and/or music is listened to.

Pink noise allows one to admire the steadiness of the reverberant soundfield over the entire audience while not intruding on them with adverse information regarding the ratio of L_D-L_R .

Music is perhaps even more insidious as one strolls around caught up in the melody of their favorite CD. Remember that we have a very accurate measurement of intelligibility of speech, whereas we do not currently have an intelligibility measurement of music.

The proper way to turn on an array is one device at a time: first one, then an adjacent one. For example, a "long throw" horn and then its "short throw" horn. When both have been looked at individually, combine them and look again.

These tests are the times that try men's souls—also the array rigging as you raise and lower to correct oversights in impedance, polarity and synchronization.

Good array design is not impossible, but rare. There is too much mysticism in array design: misaligned devices can, by combination and processors, become aligned arrays. Sometimes we hear the oxymoron, "A point source array," which

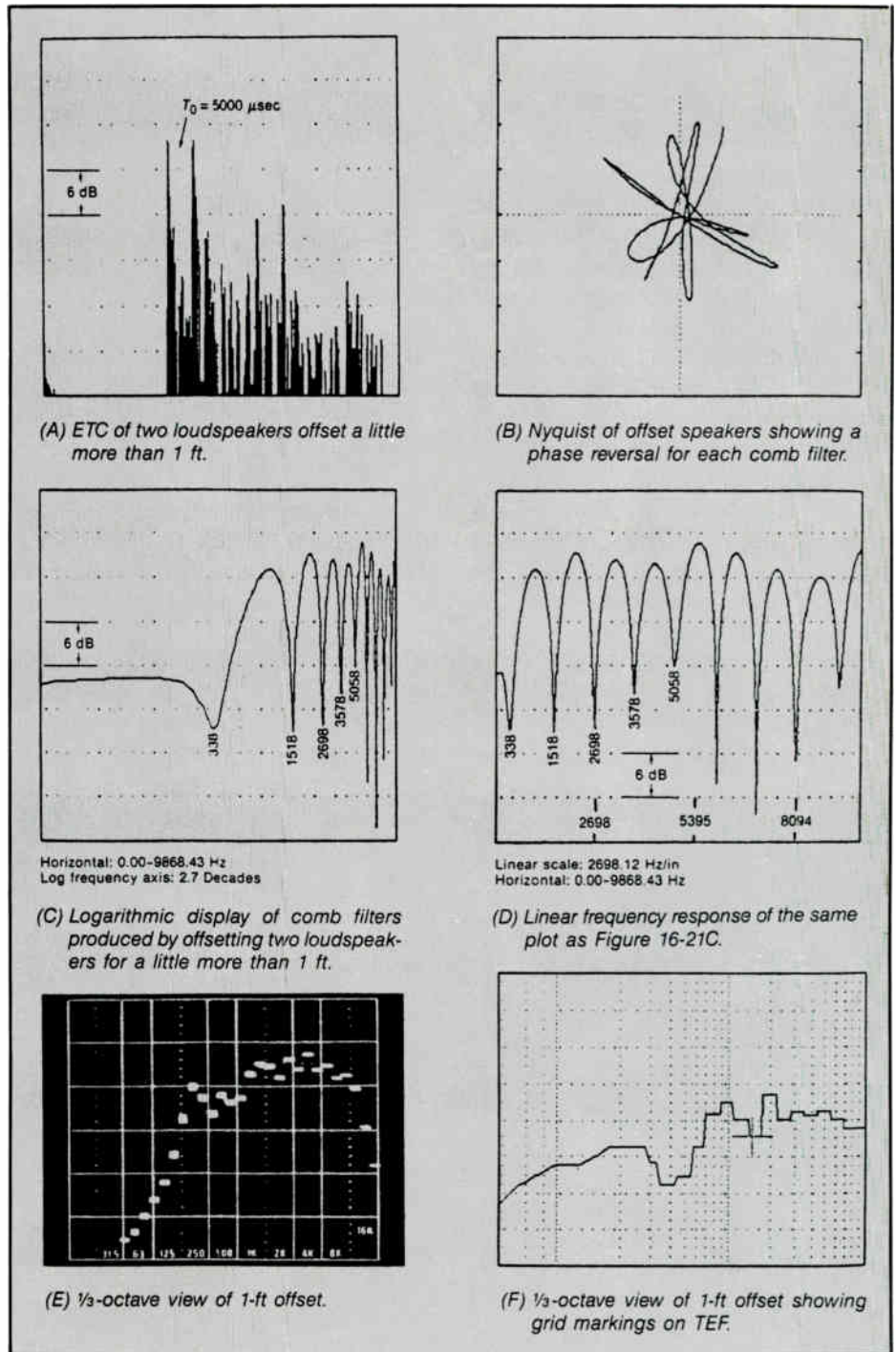


Figure 1. The skirts are too wide on a real time analyzer to show what is really going on. Also a real time analyzer is seeing total sound, which means room and loudspeakers.

COURTESY HOWARD W. SAMS

we would like to have occupy the same place as Eddington's "infinitely small, weightless elephant."

"We Don't Need to Measure Here Anymore Because One Can't Hear Comb Filters"

Without ear calibration, measurements

often confuse the measurer. For example, a pair of missynchronized midrange loudspeakers may be the cause of the bad listening area. It will be detected by the ear as excessive reverberation (a hollow, barrel-like sound). If you take the evidence of your ears, you will probably blame the



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AKG's C568 short shotgun offers you real directivity in a remarkably small and convenient condenser microphone. Only 10" long, the C568's sensitivity, wide frequency response, durable metal housing, and integrated impedance converter/preamp easily meet the demands of live on-air or recording applications. A perfect balance of pressure gradient and interference principles means the C568 can be up to three times as far from a sound source than normal mics and still yield the same ratio of direct to indirect sound. Used close, it reduces indirect sound levels by 8 dB for improved isolation. So whether it's for ENG, film, theatre or church sound reinforcement, or music applications, AKG's C568 means business. And at half the price of the competition. Just stand back and take a listen.



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problem on the room. If you measure and find comb filters, you can try shutting off one of the two devices and listen for the change. If the sound improves, your solution is at hand. You must synchronize the two devices or replace them with a single device.

The comb filters may not be tonally significant, but they are indicative of an

altered polar pattern from the horns which, in this case, is putting undesired energy on side walls, ceiling and floor instead of the audience areas as intended (See Figure 3).

"Let's Measure the RT60 of a Small Room. I Planned for 0.25 secs"

Another sure indicator of "never mind



The McCauley Model 6520 is a two inch compression driver used in systems demanding maximum power and articulation. The Model 6520 features a field servicable titanium diaphragm, a conservative 150 watt RMS power rating, and a frequency response from 500 Hz to 16,000 Hz. These advanced features make it especially useful in upgrading existing speaker systems. When matched to the McCauley Model 472 CD horn, a perfect 90x40 degree coverage pattern with a bandwidth from 1,200 Hz to 13,500 Hz +/- 3dB is obtained. The 6520 is used in the McCauley professional series main speaker arrays and stage monitor systems. Its superior voice reproduction makes it unparalleled in performance in custom projects such as studio reference monitors, club and discoteque systems, commercial/professional sound installations, and concert hall system stacks.

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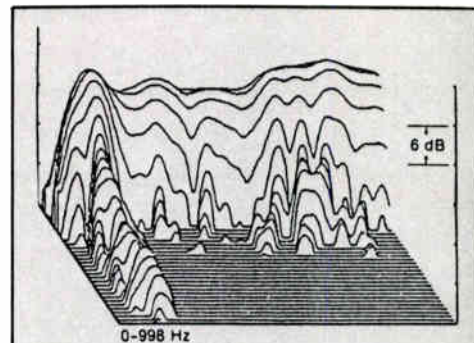


Figure 2a. The pronounced low-frequency mode at 125 Hz causes a boomy muddy sound.

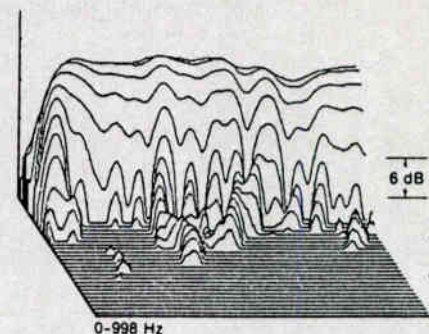


Figure 2b. This measurement was made in the same small room after the installation of a Helmholtz resonator. This is a frequency range where soft, fuzzy materials would be useless.

the dog, watch out for the owner" is the individual who is going to use his sophisticated analyzer to measure RT60 in a room that has no reverberant soundfield level above the ambient noise floor. Many in sound system work have had little, if any, training in acoustics and when they have had it, it tends to be exclusively for large room acoustics. Large room acoustics can be approached statistically. Small room acoustics become a matter of specific encounters with boundaries, not statistical masses of encounters. The Sabine equation and its derivatives do not apply in small acoustically dead spaces.

To quote Ted Schultz, "In a large room, if one has a sound source whose power output is known, one can determine the total amount of absorption in the room by measuring the average pressure throughout the room. This total absorption can then be used to calculate the reverberation time from the Sabine formula. This method fails badly in a small room,

(continued on page 98)

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Orban's Industry standard automatic level control units excel for one simple reason: They offer extraordinarily transparent control action on a wide variety of program material. Whether being used for multi-track recording or on stereo mixes, Orban compressor/limiters can be counted on to maintain transparency and dynamic integrity while efficiently controlling levels and peaks, with few audible artifacts.

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THE NATIONAL SOUND AND COMMUNICATIONS ASSOCIATION

BACKGROUND AND FOREGROUND

BY SUZAN PRINCE

NSCA Expo has been called "the most egalitarian, equitable venue in the business." Now entering its 11th year, the National Sound and Communications Association and the annual Contractors' Conference and Expo started back in '79 when an astute group of sound and electronics system contractors sensed an urgent, unmet need in the industry.

"They strongly believed there was a great merit and need for a trade group wholly separate and removed from what used to be a component of the Electronic Distribution Show," recalls Herb Jaffe, vice president of Atlas/Soundolier, one of NSCA Expo's first exhibitors.

"That's essentially how the NSCA got rolling," Jaffe continues. "And frankly, the founding group was quite fortunate to have attracted a very good board of directors right from the beginning." Manufacturers in the industry lauded the fledgling organization soon after it formed, he adds, and quickly lent their full support.



The Las Vegas Hilton.



Las Vegas at night.

That's true, reports William Little, president of Quam-Nichols, another pioneering exhibitor. "My view of the association is that it's a continuing success story. It started off with about six or eight guys sitting around a table putting together a concept that was hardly universally accepted at the time. And through the years, NSCA has become a staple of our industry."

Significant accomplishments of late include settling the UL and CSA safety standards to which amplifiers are tested. "We've really made tremendous headway in that area," relates Mel Wierenga, 1989 Association president and chief executive of Ascom Inc., Wyoming, MI.

"In less than two years our manufacturers' product safety committee was able to meet successfully with both UL and

CSA to develop and implement vital new techniques and methodologies that are much more representative of real-life situations concerning those technologies," Wierenga explains. That safety concern neatly wrapped, the committee meets again this month at Expo '90 to determine which pressing project it should tackle next.

Little allows that thanks to NSCA's efforts, the annual Expo has burgeoned into "the key meeting place and marketplace in the commercial sound business." Further, he opines, "The Association closely represents the interests of its constituents — the contracting community; and it certainly provides an effective marketplace for manufacturers to show off their wares."

Commenting on the Expo, set for Las



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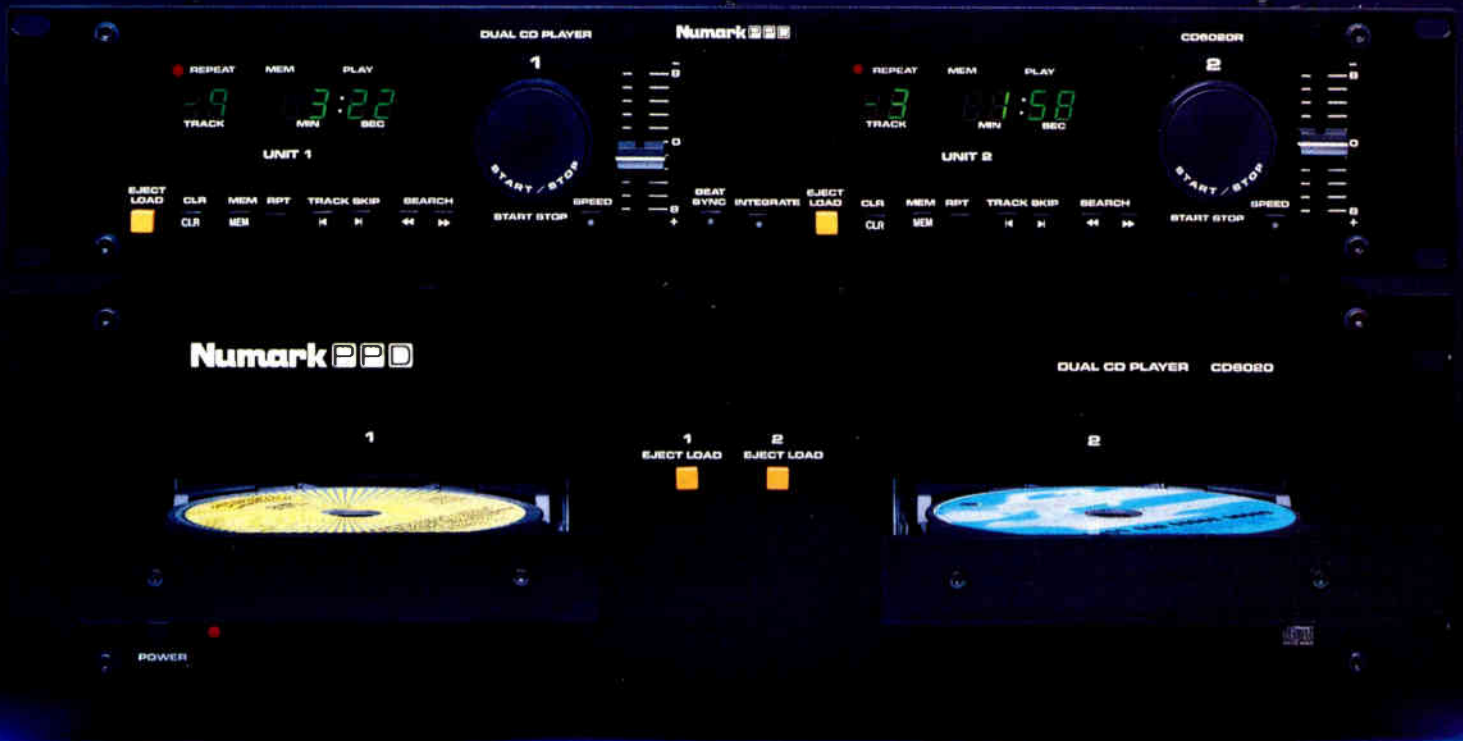
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A professional CD player that does the work of two.

Introducing Numark's Dual-Transport CD Player

Finally, there is one CD player that satisfies the mixing needs of DJs, club owners and professional sound installers... Numark's CD6020. This revolutionary player features two CD transports in a single unit. So now, with a single player system, CDs can be mixed with the same ease as LPs.

The CD6020 consists of two 19" rack-mountable components—a control unit that can be mounted neatly in the mixer console, and a transport module that mounts in an equipment rack. This design ap-

proach enables sound contractors to upgrade existing club installations to CD without touching the turntables.

For hands-free mixing, the CD6020 features Numark's patented Integrate™ feature. Push a button and it ping pongs from one disc to the other, playing programmed selections from each disc automatically, and without interruption. There's also Numark's patented Beat Sync™ feature that automatically mixes from one disc selection to another while matching the beat structure of both discs for perfectly-

matched, beat-synchronized mixes.

The CD6020's control panel features two sliding pitch controls for varying the pitch of each disc $\pm 8\%$. A matching set of LED displays, large start/stop buttons, and a full complement of search, repeat, and memory functions provide total mixing and playback control!

So, if you are looking to upgrade your installations to CD, check out Numark's new CD6020 Dual-Transport CD Player. It's the only CD player you need to do the work of two... for a lot less.

Visit us at NSCA Booth #431

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Vegas this month and themed "Capturing the 90s," Jaffe adds: "It's now at the point where the NSCA is truly the industry event of the year. The majority of the contractors usually send one or more representatives, and in many cases the manufacturers concentrate the introduction of new products to coincide with the show."

In a nutshell, he says, "What draws 1,000 people to the NSCA is the ability to see products that they might not see otherwise; the ability to visit with each other, and the ability to visit with their suppliers."

Little believes NSCA has become "a buying event to the degree that business gets somewhat soft six or four weeks beforehand as contractors wait to see what's new and what special promotions are to be offered during the Expo."

Executive committee members of the Palos Hills, IL-headquartered Association report a 10-percent annual growth rate in total Expo attendance over the past several years. Attendance of both system contractors and exhibitors in 1989 surpassed 4,000.

"I think we'll easily top 5,000 at Expo '90," projects Jay Johnson, of Central California Electronics in Fresno. Johnson is Association vice president and conference program chairman, and is slated for appointment as 1990 Association president.

"There's been some concern about whether we'll do better in Las Vegas than we did in Nashville," he continues. "But this same concern was expressed last year about Nashville, and at the time I felt that with a strong education program we would do very, very well. And we did. This year, I believe our program is stronger than it ever has been."

That contractors rank continuing education among the Association's most valuable membership benefits is evident from the increasingly well-attended classes in audio, management, sales and specialty topics given during Expo as well as year-round. "The program appears to be fulfilling its founding mission," observes Wierenga.

"Over the years it's been our goal to develop a proper framework that enables



NSCA '89 broke all previous attendance records.

this Association to mature and grow. With an ever-broadening curriculum, we're trying to provide members with the necessary resources and opportunities to grow and expand professionally, both in technology and in business management."

Last December, for example, NSCA initiated a Chief Executive Officers Conference which it plans to schedule as an annual fall event. Specifically targeted to owners and chief operating officers, the conference explores business management techniques such as financial planning that contractors can readily apply to their daily and long-range operations, Wierenga explains.

This year's Contractors' Conference and Expo program, meanwhile, has been expanded to include courses that appeal to technicians and those technically oriented, adds Johnson. "We are trying out a new Hands-on Design and Installation Program for Technicians session that emphasizes hands-on system experience for trainees."

In addition to the regular educational program, the Conference offers an expanded listing of pre-show Basic and Advanced Sound Design and Estimating Courses for salespeople. "Besides the obvious financial benefits for contractors on

the exhibit floor and in the educational seminars, the pre-show Basics and Advanced workshops are geared to harness more and better company sales results," attests Tom Chambers, president of Chambers Electronic Communications, Phoenix, AZ.

In one Advanced workshop expected to draw heavy attendance, an industry consultant and two executives of AMX Remote Control Systems Corp. will address "Audio Visual Control Technology in the '90s."

"Specifically, we'll talk about where computer-controlled systems, primarily control panels, are heading in the '90s," elaborates William Anderson, AMX director of sales and marketing. He also cites infrared technology as "a very important related issue" for the decade. "We'll also touch on industry standards such as CEBUS, and the fact that as with any kind of standards, it's very hard to get a particular one adopted." Indeed, the ongoing debate over choosing a singular data communications format — RS232 or RS422 — for computerized remote control applications promises to be a hot topic, and is itself fodder for a separate convention presentation, notes Wierenga.

The outgoing Association president affirms that a special round table session, "Women In Electronic Construction," marks a first. "Each year we see more and more women sitting in the Estimating and Design classes, and attending more

and more seminars."

With increasing numbers of women joining the construction and the electronics construction industries, "We felt the need to develop a program that will help us determine this segment's special educa-

tional and professional requirements, if any, and how we can work to fulfill them."

Although the proportion of female NSCA members is currently estimated at two or three percent, Wierenga believes the figure for the sound industry's total work force is "upwards of 10-percent." The WIC program features a speaker from the National Association of Women in Construction (NAWIC), and will cover how women in the sound industry relate to sales, office operations and management functions.

"The purpose of the session is two-fold," Johnson elaborates. "First, to enlighten and enhance one's knowledge from first line manager/owners, and second, to determine how NSCA may help provide education programs not yet apparent to the Board." Discussion leaders include Star Garter of Ascom Inc.; Debra Serben, a sales executive with Com Tech, and Shirley Palmer, director of office operations for Audio Systems of Florida.

According to Wierenga, who is among NSCA's founders, membership rolls across the board effectively doubled in the early years. A 10-percent to 20-percent membership growth rate has occurred annually over the past five or six years, he notes. "In 1988, the organization experienced a 24-percent membership increase. We followed that with a 26-percent increase in 1989. If you want to call that solicitation, I would have to agree."

Other founding members of the organization include Bud McKinney, now retired from Lloyd F. McKinney Associates, Hayward, CA; Harold George of Indiana Electronics in Granger; and Robert Ancha, Sr., of Ancha Electronics, Palos Hills, IL. Ancha served as the organization's first president.

Quoting the trade group's recently formalized mission statement, that "NSCA is organized for the benefit of its membership by providing services, activities and information in a noncompetitive arena," Wierenga is sanguine about the future. "That statement fairly says it all in terms of where we've been, what we're doing now, and where we're headed over the long haul." ■

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IT'S A LEARNING EXPERIENCE

BY PAMELA MICHAEL

Someone, some sage, (a prehistoric sound contractor, perhaps), once said, "The trouble with experience as a guide is that the final exam often comes first and then the lesson." The National Sound and Communications Association strives to improve that situation by providing a wealth of practical and useful information to this year's Expo '90 attendees in a series of workshops, seminars, lectures and demonstrations being offered April 17-20 in Las Vegas. NSCA has always offered an extensive and varied educational program at their annual conference. This year the program has been expanded, with over thirty sessions being

presented in four separate "tracks": audio, management, sales and specialty. In addition to the regular educational program, both Basic and Advanced Sound Design and Estimating Courses are being offered in special pre-show sessions on April 17 and 18. The choice of subject matter shows the concerns of the NSCA leadership and of its speakers. We talked to some of the presenters about their topics and intended formats, and the state of the market. Here are some highlights.

From the two-day pre-show Basic Sound Design and Estimating Series on Tuesday and Wednesday (Apr 17 and 18):

YAMAHA SOUND REINFORCEMENT HANDBOOK — AN OVERVIEW

Peter Horsman,
Applied Training Engineer,
Yamaha (Tuesday)

Originally a 100-plus page compilation of various owners' manuals intended as a customer support tool, the increasingly indispensable handbook has grown in three years to a 400 page compendium of sound reinforcement essentials (excerpts of which have been reprinted in *Sound & Communications*), recently revised in a 50,000 copy second edition. Peter Horsman, who presents training seminars for Yamaha, will lead a "walking tour" of the book, starting with fundamentals and basic math, on to product, all the way to the building of entire system. Novel new ways to use the Handbook as a promotional tool for your own business will also be discussed.

MICROPHONES — TYPES AND USAGE

Tim Vears,
Shure Brothers, Inc. (Tuesday)
"Everything you ever wanted to know about microphones but were afraid to ask, plus lots of handouts," promises Tim Vears of Shure. He'll provide a basic overview of microphone specifications as they relate to the selection of microphones for specific applications, addressing in depth the areas of most interest to sound contractors: church and choir sound, conferencing, as well as some performance and recording situations. Special attention will be paid to side effects — proximity and interference.

LOUDSPEAKER SELECTION AND USE

Paul Hugo,
National Sales Manager,
Gauss Loudspeaker, (Tuesday)
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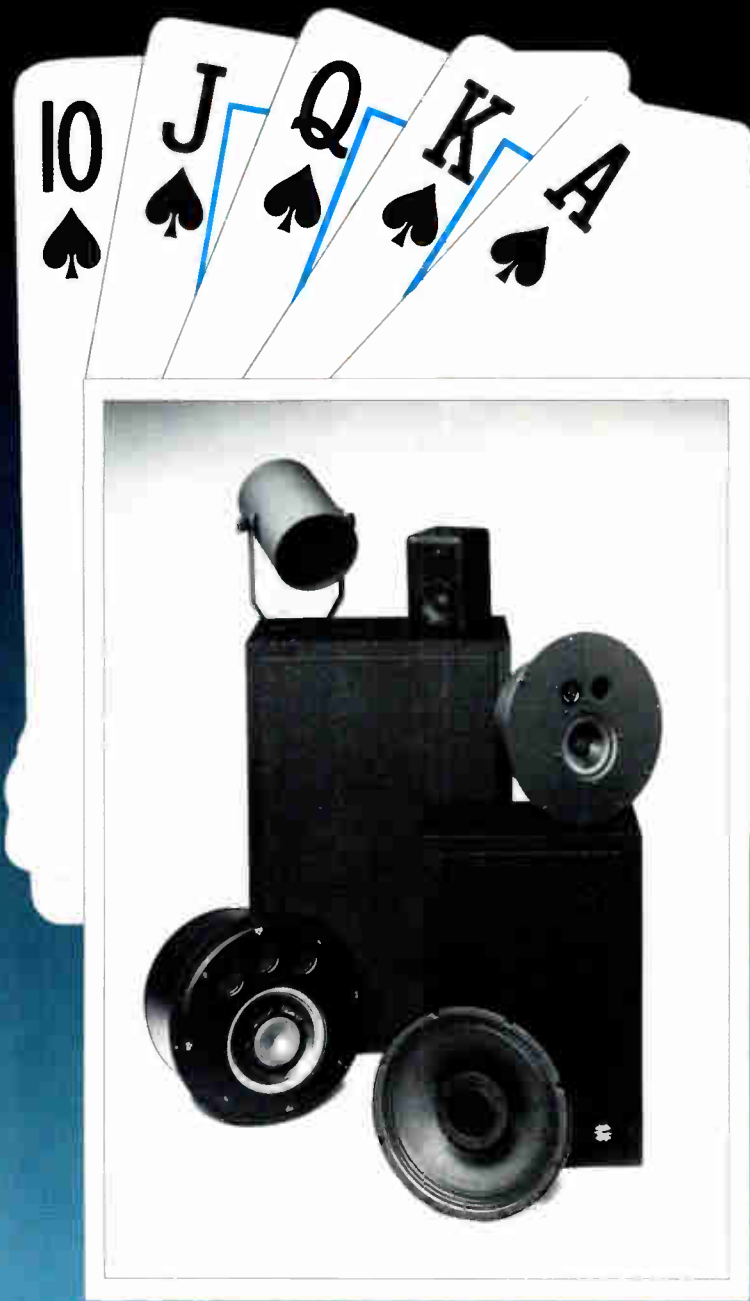
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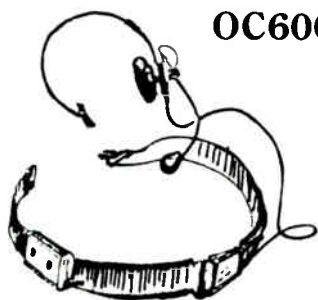
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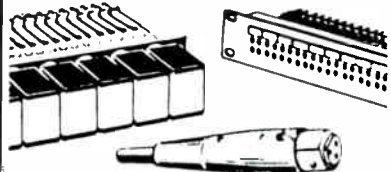
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NSCA EXPO '90

technical as well as economic sense," is the focus of Paul Hugo's informal discussion of appropriate loudspeaker use. Paul will go over cabinet tuning and porting to achieve desired low frequency responses and explore failure modes of speakers that are used inappropriately. "We'll employ a little reverse detective work" he says, "looking over failed designs and following the trail back to the crime."



Paul V. Hugo, National Sales Manager, Gauss.

DESIGN OF SOUND SYSTEMS FOR HOTEL MEETING SPACE

Jeff Loether,

Manager, Audio/Visual Systems Design Architecture and Construction Division, Marriott Corporation (Wednesday)

Jeff Loether, the only Audio/Visual designer we know of employed fulltime by a hotel chain, will examine the spectrum of various sound systems being used to serve hotel meeting and function spaces, from the most basic "background music with powered podium" situation all the way up to showroom systems. He will discuss repair and maintenance, space requirements and the system's utility and potential profitability to the hotel. Five areas of concern will be emphasized:



Jeff Loether, Marriott Corp.

Reliability; Flexibility; Ease of use; Cost; Personnel requirements and skill level. Jeff will also discuss how Marriott hires and qualifies sound contractors.

SOUND MASKING — DESIGN, TUNING & ADJUSTMENT

Joel Lewitz,

Lewitz & Associates (Wednesday)

What are sound masking systems all about, including the room acoustics and work station parameters which influence the degree of speech privacy achieved. Lewitz will address performance requirements such as sound level, uniformity, incoherence and volume control, and also look at selecting components for a sound masking system.

From the two-day pre-show Advanced Sound Design and Estimating Series on Tuesday and Wednesday (April 17 and 18):

MIXING CONSOLE TOPICS

Chris Foreman,

Panasonic Industrial Co.

Assisted by consultant Mel Lambert, former editor of Recording Engineer Producer (Tuesday)

The focus is *DAT, DAT, DAT*, says Chris Foreman. He will cover three areas: where DAT applies to sound contractors; review

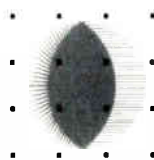
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of basics — history of development, how it works; controversy surrounding DAT and the future of the format.

AUDIO/VISUAL CONTROL

William Anderson,

Director of Sales & Marketing,
AMX Remote Control Systems (Tuesday)

Control systems for the 90's, trends, projections on what the end user will be demanding of the sound contractor in the next decade. The technical/economic/aesthetic aspects of controls will be covered, as well as control panel/user interface will be discussed in depth.

"There are only so many things you can do with a relay," states William Anderson, who promises a two-way, interactive brainstorming session. "I'm very interested in hearing from sound contractors, consultants and dealers on what they think we need to be doing. From a manufacturing

point of view, we very rarely get to the end user. These people are dealing with them every day."

LOUDSPEAKER SELECTION AND USE

John Murray,

Electro-Voice (Tuesday)

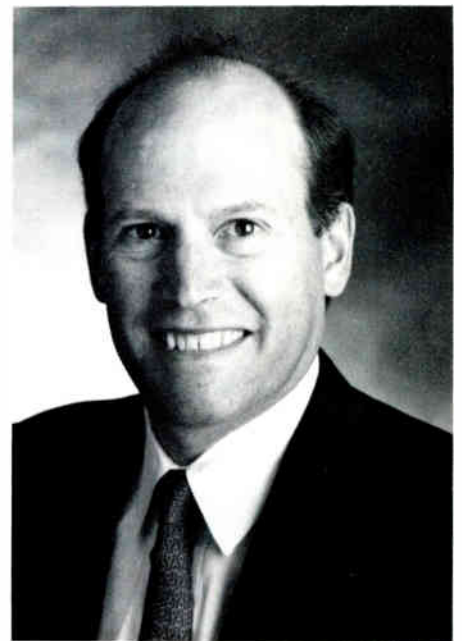
"This is not a numbers crunching session," says E-V's John Murray. "The emphasis will be on how to apply equations and how to interface speakers to a given room." The presentation will cover the five parameters that govern selection of loudspeakers in sound reinforcement systems: level; coverage; bandwidth; NAG-PAG (gain before feedback); Intelligibility.

PROJECT EXECUTION

Joel Lewitz,

Lewitz & Associates (Tuesday)

Final checkout, tuning and adjustment of large systems requires cooperation and communication between the contractor and the designer. Learn what to expect and what is expected of you. This course will examine typical specification requirements for initial and acceptance testing, demonstration and adjustments. A survey of representative consultants' sound system system checkout "check lists" will be included.



Joel A. Lewitz, Lewitz and Associates.

CONSTANT VOLTAGE DISTRIBUTION, UNDERSTANDING GAINS AND LOSSES & EQUALIZATION TECHNIQUES

Christopher "Topper" Sowden,
Joiner-Rose Group (Wednesday)

Topper Sowden will discuss techniques for optimizing system design to best meet client needs and how to prepare systems for consultants. "With time available, the sound contractor can perform self-tests that will both demonstrate the system and avoid delays in completion," Mr. Sowden says.

INDOOR/OUTDOOR SOUNDS

David Marsh,

Vice President, Pelton Marsh

(continued on page 96)



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THE MIRAGE HOTEL: REDEFINING LAS VEGAS SOUND

BY P.J. GOODMAN AND ROBERT PATRICK

In 1987, Stephen Wynn, chairman of the board of the Golden Nugget Inc. in Las Vegas wanted to build one of the largest hotels in the free world. Wynn chose Las Vegas as the location of his hotel, as Las Vegas is the entertainment and gaming capital of the world.

In less than 27 months a mere \$620 million fantasy became reality and the Mirage Hotel opened its doors on November 22, 1989. What occurred in the interim was a model of a fast track design-build construction project.

Acromedia Corporation designed, engineered and installed the major sound and display systems for the Mirage Hotel. The scope and scale of this project is so large that this article can only endeavor to give you an overview of the project, coupled with some of the more interesting aspects which were encountered during its design and construction.

THE MIRAGE FACILITY

The Mirage Hotel has a "Y" shaped 29-story tower with a total of 3,049 rooms, as well as multiple lanai bungalows with private pools. The front entrance of the Mirage is enhanced by a lighted lagoon with waterfalls and grottos. The centerpiece is a gigantic volcano which erupts every few minutes. Simply stated, "The volcano regularly stops traffic on Las Vegas Boulevard." As you enter the Mirage you notice the tropical theme. The casino incorporates the unique concept of placing gaming areas under separate roofs to increase the feeling of intimacy. As you register, you come face-to-face with a 20,000 gallon aquarium, which has sharks, rays and other sea life. The Mirage incorporates two natural habitats, one for marine animals (dolphins) and another for the white tigers used in the Siegfried &



Stephen Wynn's Mirage Hotel is one of the world's largest. It was a model of fast track design-build construction.

Roy Show. As Wynn stated "Everyone will recognize the Mirage as a resort hotel which includes a casino, not a casino which includes a resort hotel."

FAST TRACK DESIGN-BUILD

Fast Track Design-Build projects are the acknowledged way of doing business in the gaming industry due to the potential revenue loss incurred every day the casino is not open to the public. The Mirage was no exception!

Typically of course, sound and display contractors engineer and install systems to a set of plans and specifications that have been developed by a third party such as a consultant, designer, architect or in some cases the owner himself. This process

works well when time permits. Design-build projects, on the other hand, require that Acromedia take on the added responsibility of defining the requirements of each system prior to any fabrication engineering or site construction. This method of contracting allowed Acromedia to create a coherent system design that satisfies the client and more importantly the end user or operator(s) of the system(s) in the most time efficient — and cost-effective — manner!

When a project needs to be completed in a very short period of time, Fast-Track design and scheduling is employed. This technique has various project activities running concurrently. For example, the Showroom sound system design may

MIRAGE

change as the design of other disciplines mature, resulting in conflicting requirements for a particular room space.

A great deal of coordination is needed to ensure that nothing is overlooked and that all of the requirements are met. Once construction begins, the consequences become even more detrimental in that usually more than one trade is affected by any one change. For this reason it is imperative that the fast-track design and construction team have extensive experience in their field of expertise as well as a good working understanding of the other team members.

tems and the Convention Area Sound Systems.

It was apparent from the onset that any one of these systems would be a substantial project onto itself, but when coupled together in a fast-track project the need for setting design priorities and detailing functional requirements was the greatest challenge.

The initial design phases focused on defining the facility requirements, especially those that would affect the structural construction, because the building construction had already commenced.

The process of system design with on-

construction drawings were only 16 working days ahead of the site work.

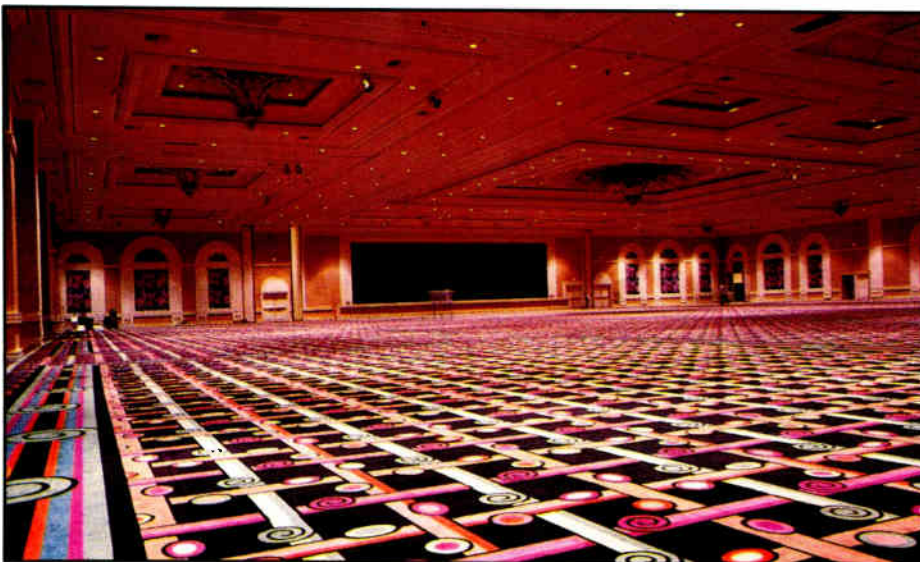
The initial design phase for the electronic systems addressed aspects such as supporting structures for rear projection glass screens, embedded conduit requirements, ceiling loading and air conditioning to cool the large electronic heat loads.

Concurrent with these activities, coordination with other trades such as electrical, stage rigging and architectural finishes refined the design through almost daily revisions. A great deal of effort was spent in assuring the integration of functions and maximizing the flexibility of the various systems.

Once the design had been developed and documented, the critical equipment was selected. The design moved forward to the fabrication engineering phase which was performed in Acromedia's Los Angeles facilities. The most difficult task during this phase was to keep abreast of the changing field conditions and to confirm accurate delivery dates from the vendors and suppliers. At last count, there were over 110 major manufactures used, and in excess of 1,000 purchase orders written by Acromedia for the various electronic systems.

Again, on fast-track projects the design, engineering and fabrication are performed concurrently. The initial release for fabrication started in November 1988 with the Race and Sports Book System. In February 1989, the Music/Page and Convention Center fabrication was started. The Showroom Sound System was delayed until April 1989. The reason that the most complex system was last in the fabrication process was due to the need to give the main attraction of the Theatre Mirage the maximum amount of time to develop their specific show requirements.

In recent times the premier show attraction in Las Vegas has been that provided by illusionists Siegfried & Roy and their cast of tigers and elephants. The hotel, once again, set a modern entertainment record by announcing the signing of the Siegfried & Roy show for a five-year contract costing some \$55 million. Needless to say, the Theatre Mirage showroom was



The 40,000 Sq. Ft. ballroom uses 3-way distributed speakers with subwoofers to achieve concert levels in a distributed ballroom system.

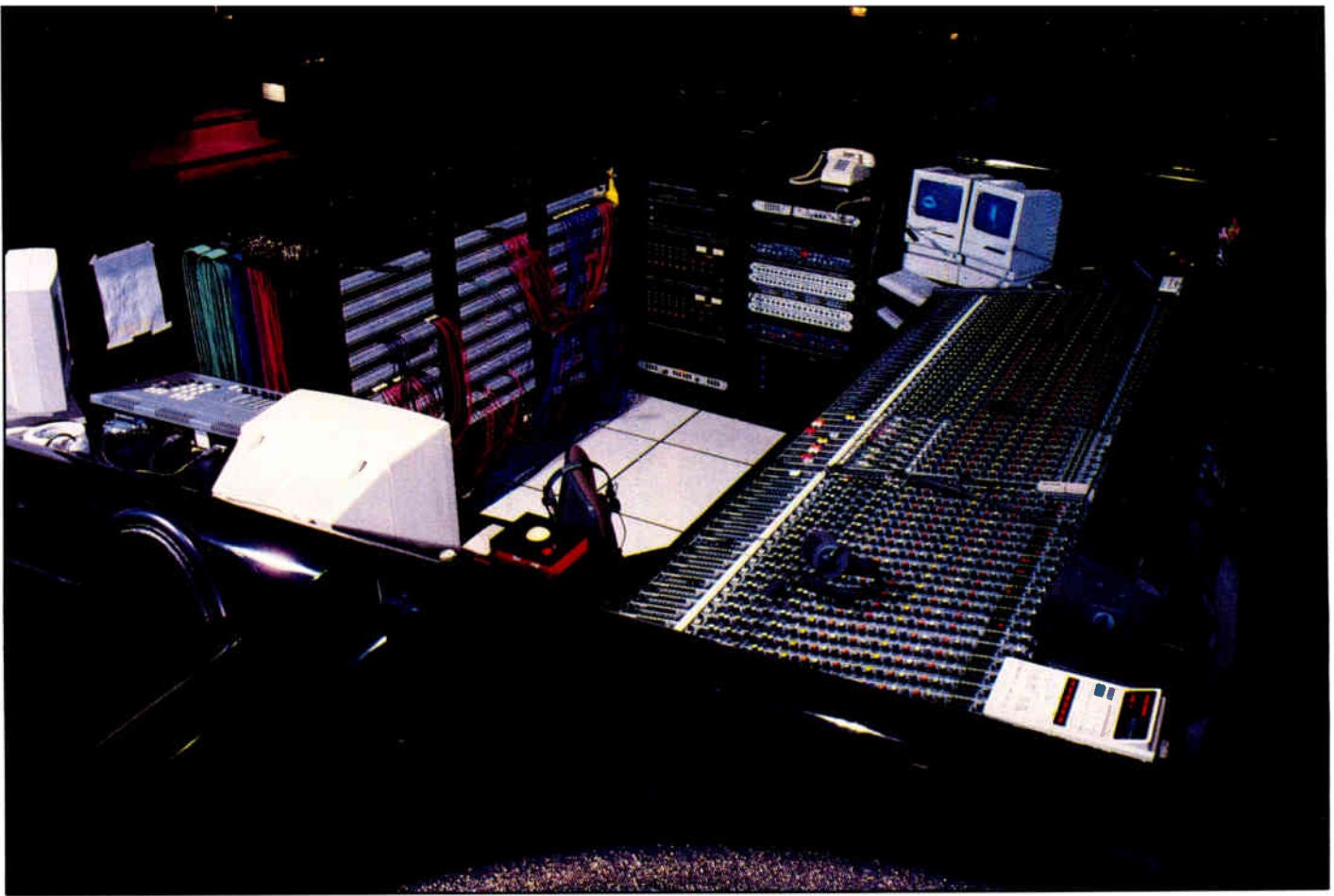
The advantages to this approach is that each of the team members brings his experience and resources to bear on producing a workable system and there is a single point of responsibility on the part of each contractor to achieve that goal.

DESIGN EFFORT

In December 1987, Acromedia was commissioned to develop a design program for all major sound and display systems for the Mirage Hotel.

The systems included the Showroom Sound System; Race and Sports Book; the Music/Page and Video Distribution Sys-

going construction led to some interesting consequences. During the early phases of the design effort there was an overload of design considerations and client approval requirements. Nevertheless, the concrete continued to be poured and the steel was being erected every day. Through very careful construction management we could see where the project was in relation to finished construction drawings versus the actual site construction conditions. Appreciate that up to 1,500 workmen were on site daily. The need for current construction drawings was critical in keeping the workforce on schedule. At one point, the



The Theatre Mirage house mixing position uses a Harrison SM-5 and four computers to operate and control the Siegfried & Roy show.

especially designed and constructed to accommodate their extraordinary production requirements.

In addition, the showroom had to be flexible enough to be easily reconfigured for one week of each month when other superstar entertainers such as Kenny Rogers and Dolly Parton would take the stage.

SHOWROOM SOUND SYSTEM

In the case of the showroom, the original design objectives were defined in broad terms. Emphasis was placed on providing a dual purpose environment for the 1,500 seat showroom. The Theatre Mirage would be used by Siegfried & Roy as a full scale theater production house, and every three to four weeks there would be a headliner act using the showroom as a concert venue with sound reinforcement and extensive stage monitoring facilities.

The primary difference between these two modes of operation is that when the showroom is used as a theater production house, emphasis is placed on production communications, ambience and special effects loudspeakers, automated cues and

signal routing. Whereas in the concert venue mode, emphasis is placed on live reinforcement using microphone distribution, mixing consoles and an extensive on-stage foldback system.

The design goal for the showroom sound system was to accommodate these two modes of operation and to allow for an efficient means to alternate between them. This was accomplished by extensive use of automated switching equipment including both medium level and high level matrixes and integrating the equipment used for both modes of operation.

Siegfried & Roy sound requirements included 24 channel surround sound with over 100 production, cue and effects speaker outlets to provide multiple sound sources. The show was to be fully automated.

The showroom loudspeaker systems were comprised of the main house system, the ambience loudspeakers which served as the surround speaker system, and special effects speakers which could be rigged as required for each show. The JBL Professional Concert Series speakers are used throughout the showroom in conjunc-

tion with the Intersonics subwoofers which we refer to as the "elephant callers" in honor of the Siegfried & Roy show. This approach provided the design team with the necessary diversity in cabinet size and coverage angle to satisfy the myriad of speaker applications in the system. The use of a single speaker series throughout the entire showroom provides a homogenous sonic quality from all sources in any application.

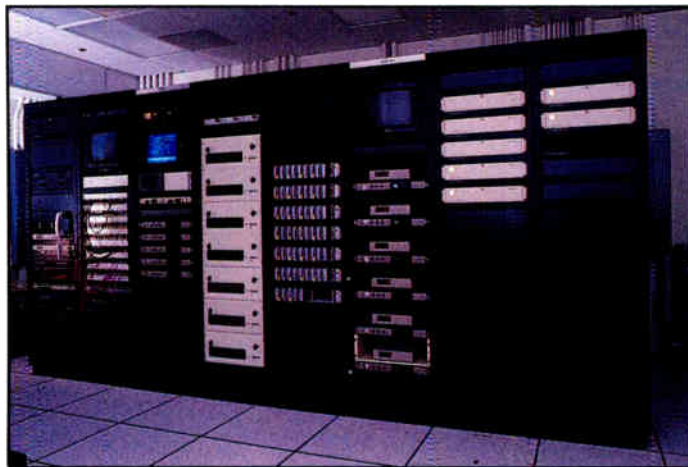
An initial estimate showed that the showroom system would require approximately 35 full size equipment racks, thereby dictating the need for a major equipment room space requiring 216 KVA of power and a massive air conditioning demand.

The showroom sound system equipment that is automated include the equalizers, signal routing, digital delays, signal processors and tape machines. The automation is controlled by four dedicated CPUs (two Mac Plus computers and two Amiga computers). Two Richmond Sound Design systems are provided to facilitate the operator interface and control the automated functions. Automation interfaces

MIRAGE



A portion of the music/page power amplifiers used to power speakers throughout the Mirage facility.



The Race & Sports Book equipment room contains fiber-optic receivers and video switching equipment for the display system.

use MIDI controls, RS-422 and parallel I/O ports. A New England Digital system is used to provide digital quality audio for special effects and musical tracks.

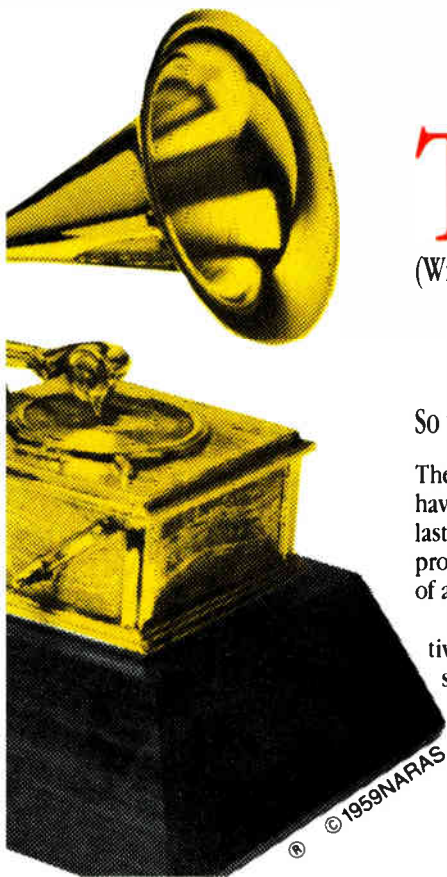
The New England Digital System is a direct to disk eight-track recording system which provides digital recording, process-

ing and editing capabilities using a dedicated Mac II computer for control.

For live performances a microphone distribution system using 90 Jensen four-way microphone split transformers was installed. Permanent microphone cabling interfaces the 12 pair and 52 pair micro-

phone snake systems via on-stage facility panels.

Most of the signal processing equipment is MIDI controlled. It can be operated autonomously or in conjunction with the automated cue software and the New England Digital equipment.



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And they didn't. Because for the second consecutive year, Apogee speakers were selected as the house sound system for this prestigious event. No sliding filters. No floating crossovers. Just clear, natural sound with less electronics and fewer cabinets than many conventional systems.

Apogee processors do have all the functions you

need—frequency division, time domain alignment, full bandwidth protective limiting, precise equalization—in well engineered, finely tuned circuits specifically designed for use with their respective loudspeakers.



Model A-3x3 Single Channel, Permanent Version Processor

Optimized electronics = optimum signal quality. And Apogee systems are easy to install, easy to array, and quick to take on the road (ask about the full complement of rigging hardware).

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A 52-channel Harrison SM-5 mixing console was selected for the house mixing position for its high quality and flexibility in signal routing.

RACE & SPORTS BOOK DISPLAY SYSTEM

In recent years there has been a literal explosion of ways to gamble. Many of us live in states that now use lotteries, but the main area of expansion has been in the area of wagering on professional sporting events. Today, you can place your wager on almost any major sports activity such as thoroughbred horse racing, football, basketball games, boxing, tennis matches — and the list goes on and on.

The heart of this type of gaming is in a facility that is generally referred to as a Race and Sports Book. Typically, in the older style Race and Sports Book facilities, the odds for most sporting events are dis-

played on manual pull-down writer boards.

In the Mirage Hotel, however, the information is displayed using the most current display technology. This includes the use of large-screen data and video projectors along with digitally controlled LED display boards that are interfaced directly with the betting computers.

To provide the patrons with the live action from the various sporting events, multiple satellite receiving systems were installed. Audio and video switching equipment was provided for selection and distribution to the various projectors and large-screen television monitors throughout the Race and Sports Book.

There are literally dozens of orbiting satellites having hundreds of satellite channels available on various bands; therefore, the video information for different sporting events can be received in many different ways. The hotel staff plots out a complete



One of 10 clusters in the showroom using JBL Professional Concert Series components. This cluster is rigged to fly in and out of position for service.

reception program, on a daily basis, of the events which will be displayed in the Race and Sports Book during the course of their operational period. The number of channel changes, antenna orientation changes and satellite changes etc. that occur every day are sometimes mind boggling. It would take a full-time qualified engineering technician just to manually perform all of

all.

Now available in single and dual channel models, Apogee's second generation processors enable you to precisely tune the protection circuits to keep amplifiers from clipping. New rubber conductive front panel



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switches feature a hidden lock to prevent unwanted recalibration.

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the switching and controlling functions.

The design challenge was to consolidate and remotely control and tune the satellite systems. By using a satellite antenna computer control system, a trained race and sports book operator (not an engineering technician) can program all of the information into the computer, which includes a user friendly interface.

In order to simultaneously receive multiple live satellite broadcasts, eight satellite antennas were provided with additional space for up to three future antennas. Each of these antennas are 3.7 meters in diameter and are steerable. Four of these are C-Band; and four are combination C-Band and Ku-Band.

Las Vegas has to be one of the micro-

wave interference capitals of the West and accordingly there are locations within the city where it is all but impossible to receive quality satellite transmissions.

In order to achieve the quality picture that would be required by the hotel, Acromedia engaged the services of a specialist in the measurement of terrestrial interference.

After an extensive survey of the hotel's land area, it was determined that there was only one practical antenna site, and that location was 2,500 feet from the Race and Sports Book.

Consequently, due to the site conditions and some objectionable interference from terrestrial sources, the satellite antennas were recessed below grade. A special

radio frequency barrier was constructed to minimize the terrestrial interference.

The satellite antenna's down converters and receivers are located immediately adjacent to the antenna farm. The video and audio signals are transmitted via fiber-optic cable to the Race and Sports Book equipment racks. All the satellite antennas are steerable, and the receivers can be tuned remotely from a proprietary computer system.

The effort was all worth it as the picture quality is excellent from all satellites.

DISPLAY SYSTEMS

The General Electric Talari Multi Light-Valve video projector produces 16,000 peak lumens of light on a 12-by-16-foot

RM-800 SERIES

The RM-800 intercom employs one of the most popular system concepts. Equally useful for home or office where one central



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to five remote indoor or outdoor locations.

RM-806 MASTER STATION

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IS-801 INDOOR REMOTE STATION

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The OS-805 is a surface mount,

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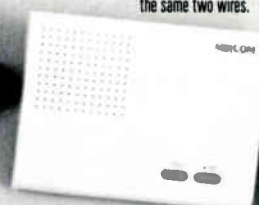
RH-201K HANDSET TO HANDSET KIT

The RH-201K offers "hands-free" communication and an operating distance of over 1 mile using only two wires.



RM-201K HANDSET TO DOOR STATION KIT

Similar to the RM-201K except it is also possible to release an electric door control using the same two wires.



RM-201K MASTER TO REMOTE INTERCOM KIT

The RM-201K requires only two wires for announcing visitors and inter-communication.



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front projection screen. It is used for projecting the feature sporting event within the Race and Sports Book. This video projector was selected because of its high light output and the high contrast it attains in the existing ambient light environments.

Ten Barco Vision 1500 video projectors were installed with custom Stuart Film-screen glass rear screens each producing a 6-by-8-foot image with 1500 average lumens.

In addition to the video displays, the Race and Sports Book uses approximately 66 digitally addressed LED display boards to display the gaming data. The betting computers directly control and update all gaming data displayed.

The audio for the Race and Sports Book

The music/page system used in the Mirage Hotel is not your normal background music and paging system.

areas is divided into separate systems. Each utilizes Altec two-way flush ceiling mounted loudspeakers in tuned enclosures. Each area within the Race and Sports Book uses its own noise sensing microphone to automatically adjust the level to the ambient noise.

In order to distribute and route the audio and video signals throughout the Race and

Sports Book, an audio follow video switch matrix with 60 inputs and 60 outputs is provided with remote controls in 10 locations.

MUSIC/PAGE AND VIDEO DISTRIBUTION SYSTEMS

The music/page system used in the Mirage Hotel is not your normal background music and paging system. In addition to the standard interface from the hotel's PBX for paging announcements, the music and page system is unique in that audio compact disc changers are used as the sources to distribute a custom tailored play list via processor-based switching to the various zones within the hotel. Additionally, a digitally based play-

THE SOUND COMBINATION DESIGN & QUALITY

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MIRAGE

back programming system for special announcements and messages was developed and installed.

The music/page sound system speakers were the wide range B.E.S.T. units so as to provide the full range available from the CD. The system uses Symetrix ambient noise sensing devices to automatically adjust the sound level based on the average

ambient noise level of the associated zone. There are 26 separate areas that are automatically adjusted.

CD SEQUENCER

Historically, most Las Vegas hotels use a commercial background music source or custom music tapes. The Mirage team felt that the quality of the background music

at most other hotels lacked the "quality" and "sparkle" that could be achieved by modern day music reproduction methods.

The Mirage background music system uses compact discs as an audio source. In order to provide multiple areas with different sources, a computer based CD system was supplied by TeleTechnologies. This consisted of nine CD systems for the various areas. Each CD system has a pair of 60-disc CD changers. Since each changer has an 18-second cycle time between random cuts, two changers are required. A total of 18 CD changers is installed to allow for uninterrupted program material.

A central IBM PS2/30 computer



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R-431 Graphic Equalizer (top) R-830 Graphic Equalizer (bottom)

The Mirage background music system uses compact discs as an audio source. In order to provide multiple areas with different sources, a computer based CD system was supplied by TeleTechnologies.

monitors the CD player activity and creates, catalogs and transmits play list information to the CD player systems at specified times. The computer includes a laser printer to facilitate rapid printouts of the database information. This allows the hotel personnel to create and distribute custom play lists for each of the nine major hotel areas.

MARKETING MESSAGE PROGRAMMING SYSTEM

The hotel has a marketing message system which is an effective means to market its resources to the selected patrons by suggesting activities and making courtesy announcements.

Using this system, the hotel's patrons will hear different sequenced messages at predetermined intervals in the various zones.

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MIRAGE

The hotel marketing message system provides for a high performance, low maintenance means for digitally storing and reproducing encoded audio information. This information is automatically timed and distributed to 26 areas and 24 elevators. These areas include the exhibition area and the moving walkway which brings you from Las Vegas Boulevard to the entrance adjacent to the tiger habitat.

The system uses EPROMs to digitally encode or record the messages. The system has the capability of digitally recording and reproducing up to 79.5 minutes of 10 kHz bandwidth of audio messages that can be assigned and switched to any combination of zones.

ELEVATORS WITH THEIR OWN SOUND SYSTEM

The Mirage Hotel has 24 elevators that have background music and page audio routed to each elevator cab. Each of the 24 elevators is provided with a dedicated automated mixer, equalizer and power

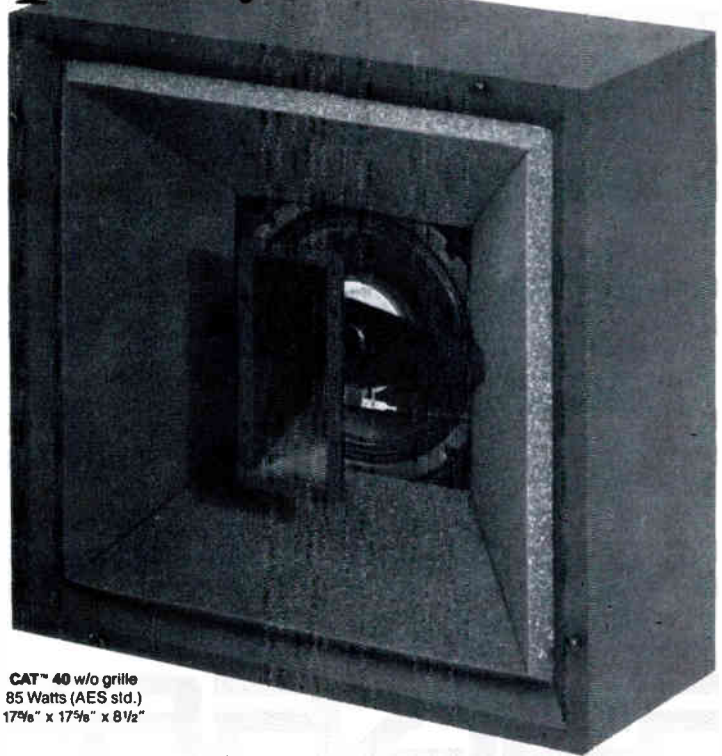
The system uses EPROMs to digitally encode or record the messages. The system has the capability of digitally recording and reproducing up to 79.5 minutes of 10 kHz bandwidth of audio messages.

amplifier. Programmable logic controllers are used to follow the status of the elevators and to crossfade the volume level of the corresponding program based on the elevator position. This provides the capability to individually tailor the music and announcements for each elevator based on the direction of travel and floor location.

TELEVISION DISTRIBUTION SYSTEM

The television distribution system provides for trunk line distribution for audio

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and baseband video between all equipment rack locations and strategic locations, with the music and page distribution system acting as a central hub.

In addition, a common intercom system is also provided to allow intercommunication for property-wide events.

RF distribution is also accommodated by the use of nine RF modulators which allow any baseband video signal to be distributed throughout the Mirage on a CATV basis.

The television origination system directly interfaces with the convention area distribution systems, allowing for greater flexibility.

CONVENTION AREA SOUND SYSTEM

This system provides sound and video

for two major ballrooms (approximately 60,000 square feet) that can be segregated into 14 separate areas using a custom room combining and stage delay matrix. The major criteria for the convention area sound system design is the hotel's ability to quickly adapt to many different applications, events and client requirements.

As the early design meeting progressed, it became apparent that the only practical solution would be to equip the Mirage Hotel with both a permanently installed system and an elaborate portable sound system that could be operated autonomously.

As part of the permanently installed system, over 125 outlet panels were required to interconnect and route signals to the 22 full size equipment racks. The Altec

distributed ceiling loudspeakers included subwoofers in special enclosures to support the hotel's requirements for full range sound in the ballrooms. All ceiling speakers were operated at voice coil impedance using #8 AWG THHN wire and are driven by BGW SPA-3 three-way amplifiers.

PORTABLE SYSTEM

The hotel's portable sound system was built to touring show standards. The system is modular and consists of 27 portable racks of equipment. All equipment is patchable to the permanent system and includes a Yamaha PM-3000 40-input mixing console, processing equipment, ampli-

(continued on page 75)

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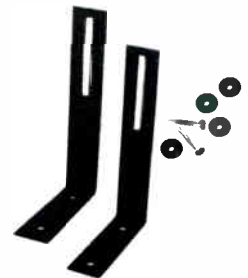
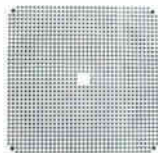
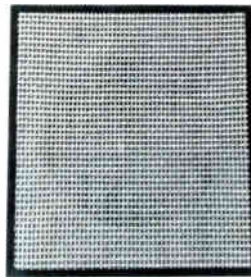


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MR-1
RECEIVER

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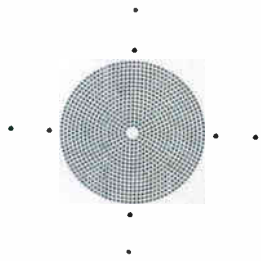
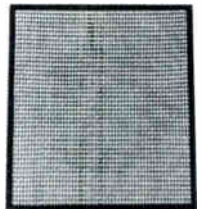
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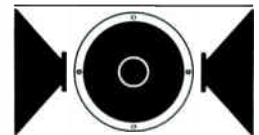
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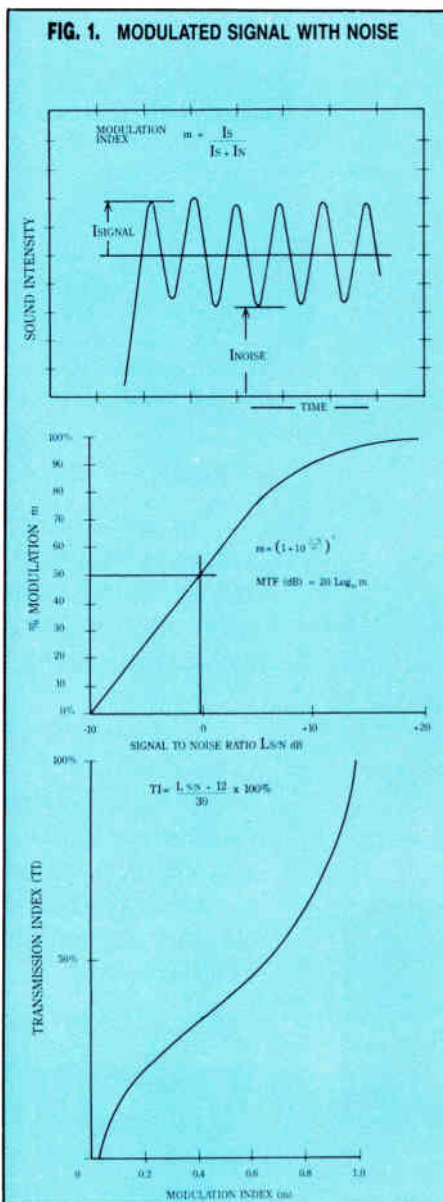
PREREQUISITE TO PERFORMANCE: MTF Test Signals as a Performance Spec

BY ARTHUR M. NOXON

Acoustic Articulation is the ability of an acoustic space to faithfully track signal level changes. That description alone is sufficient to warrant our attention to the subject. What would the world be like if we increased audio signal gain, but did not hear a corresponding sound level rise? What if we cut the signal power and did not experience a drop in sound level? Articulation is such a fundamental concept that it is easily taken for granted. It is currently the best indicator for a communication channel and human perception. That is why we use articulation measurements as the baseline for evaluating sound systems.

The search to define quality audio playback has for many years been keyed to electronic performance specifications. However, the final link in an audio chain is always the acoustic coupler, the interconnect between the speaker and the listener. The proverbial chain is still only as strong as its weakest link, and with today's sophisticated electronics and transducers, the weakest link in the audio chain is undoubtedly the playback room. The question inevitably arises as to how to test the room as a link in the audio chain and what should be the specification.

The long standing test procedure for room acoustics is the RT-60 decay time measurement. In the last few years, a new acoustic test has been introduced into audio. It is the speech intelligibility test and it comes from the world of speech and communication. Intelligibility measurements combine the consequences of



RT-60 with the room's background noise level to predict the integrity that remains of a modulated signal that has been transmitted across a room. This test is applied to the acoustic link of sound systems that are as huge as a dome stadium to as small as a telephone earpiece. Intelligibility testing is now beginning to impact pro sound and hi-end audio, that is why it is the topic of this paper.

Over the last few years B & K (RASTI) and Crown (Tecron) each have produced a procedure to measure speech intelligibility. Their data are converted into a single number, the STI (Speech Transmission Index). This test equipment only monitors the performance of an existing system and is not a piece of diagnostic equipment. The STI is a performance rating number; it does not help the engineer to know what to fix in order to get a better STI. The next generation of test equipment in this arena will naturally be of the diagnostic type.

The concern for intelligibility and how to measure it is not new. It dates back at least to early radio days with the problem of signal-to-noise ratio (SNR) that prevents messages from getting through. The development of the telegraph, telephone and radio, right on into today's deep space communications, forms a continuous chain of contributions to the advancement in the understanding of the perception of signals.

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MTF TEST SIGNALS

requirement in sound systems. Engineers, designers, contractors and architects no longer only work towards smooth-sound level distributions and properly shaped octave band equalization (EQ) contours; now they are being required to meet Speech Transmission Index criteria. Speech intelligibility is a special application of the basic concept of articulation. It is a speech band limited and "weighted" version of articulation.

We encounter something similar when doing sound level measurements. The "A-Weighted" sound level frequency response curve is not a "flat" response curve; it has been modified to include the loss of efficiency of human perception in the lower and very high frequency range. It is the weighted response curve that is integrated over the audio range to achieve the total adjusted sound level in dB,A. This is directly analogous to the STI which is an integration of the articulation frequency response curve which has been weighted for the purpose of speech and communication.

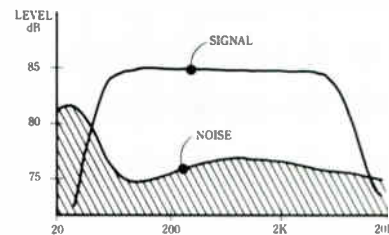
MODULATION TRANSFER FUNCTION

The response curve that forms the basis of articulation measurements is called the MTF, or Modulation Transfer Function, and ranges from zero to 100 percent. Zero percent MTF signifies that a modulated signal is undetectable by a person. Tone bursts, as in a Morse code transmission, would have absolutely no signal modulation at the receiving end. There are two ways this can happen.

To achieve zero signal modulation, the receiver could be a long way from the transmitter. It would receive nothing but background noise, "static" on the transmission channel. The tone sequence may well actually be received but it is not perceived by the listener if the signal is buried more than 10 dB below the background noise floor. The MTF is zero if the external noise is too loud compared to the modulated signal.

Another instance in which MTF drops to zero would occur when transmitting code across a reverb chamber. With a typi-

FIG. 2. PA & CROWD NOISE LEVELS

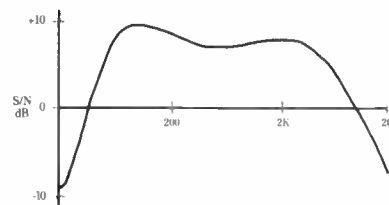


cal RT-60 of 10 seconds (sound level drops 60 dB in 10 seconds), the rapid staccato of a Morse code will be totally obscured by the room's reverberant noise field. Because the tone of the reverberation sounds just like the signal, it masks the signal very easily. The reverberant field type of noise easily masks signal modulation that is 5 dB below the noise floor.

The preferred signal perception is 100 percent MTF. Morse Code could easily have 40 dB of electronic signal modulation, the tone burst signal level relative to the circuit noise floor. People have limits to perceived modulation. Sound over 140 dB is painful and that under 10 dB is inaudible. Maximum perceptible modulation is 130 dB. That is why a 1,000 dB signal-to-noise ratio is imperceptibly different from a 100 dB SNR, assuming the signal strength for both signals was the same.

We might be able to tolerate 130 dB of signal level modulation, but 20 dB has proven to be effective, in full range. A 10 dB modulated SNR has proven clearly heard; this would occur if a 70 dB test tone was placed in a 60 dB background noise level. The result of many studies in perception is that for effective communication, modulated 18 dB SNR is sufficient to be called 100 percent modulation. At the

FIG. 3. SIGNAL TO NOISE RATIO



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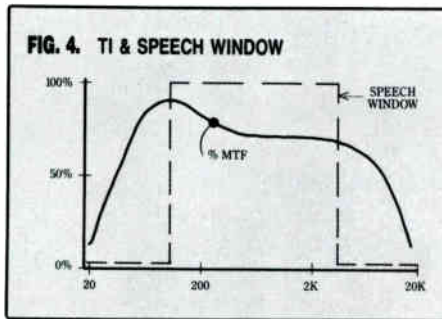
MTF TEST SIGNALS

other end is one-half dB modulation, which is essentially imperceptible. The dynamic range for modulated signals that is significant to human perception is about 18 dB. With these two end points defined, all that remains is to fill in between the intervening points. Much research into human perception has been spent in developing this relationship. (See Figure 1.)

SIGNAL TO NOISE RATIO

By now it should be clear that an articulation test measures both the dynamic and static behavior of sound levels. A third-octave or other RTA device measures static sound level conditions. The sound levels of a facility can be measured first without and later with a signal applied, and the MTF can be evaluated with respect to background noise.

The background noise spectrum can be loaded into "Memory A" of an RTA. Then power up the sound system and measure pink noise levels at the listening position. Load them into "Memory B." The difference between these two curves is the



SNR vs. frequency curve. (See Figure 2.)

The SNR can be converted to MTF by using Figure 1. The resulting TI

(Transmission Index) vs. frequency curve of Figure 4 is a linear, unweighted response curve. For speech intelligibility, the TI is multiplied by the weighting curve for speech. The result shown in Figure 3 is the band-limited STF (Speech Transfer Function) curve. The percent of the area coverage under the STF equals the STI, Speech Transmission Index.

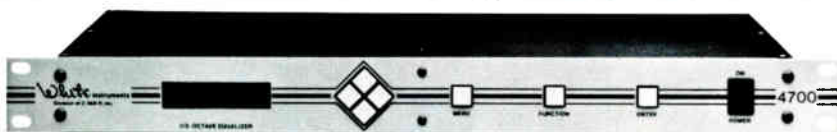
The signal to background noise version of MTF analysis is fairly straightforward. Most of us in audio could today produce the STI by using an RTA, the MTF-S/N chart, the STF weighting curve and a lot of data plotting. This version of MTF has limited application. Conceptually, it measures the quality of communication for an anechoic chamber filled with background noise. The announce system in a noisy, large factory or the PA for a huge, noisy crowd of people might be a reasonable application.

SIGNAL TO RT-60 RATIO

The other aspect of MTF includes reverberation, the more common problem in audio playback. Reverberation is the energy that lingers after a signal has been transmitted. No matter how reverberant a space may be, the residual energy will eventually die away, leaving the ambient background noise as the sound in the room. If an alarm went off every hour in a reverb chamber, a valid signal would be received because the time between signals far exceeds the decay time of the reverb chamber. Conversely, a high-speed Morse code transmitting four bursts per second would be converted to a total blur of noise, completely inaudible signal modulation.

As a consequence of reverberation, the signal modulation rate or bursts per second is related to the MTF. Slow burst rates naturally have good MTF and fast burst rates often have poor MTF. The range of burst rates that matter to people and communication is the range from 2 Hz to 20 Hz and the MTF vs. Reverberation is shown in Figure 4. Burst rates above 20 Hz sound like a low frequency note and therefore are not capable of being a modulate signal.

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MTF TEST SIGNALS

REAL WORLD MTF

The two basic versions of signal-to-noise have been presented. Background noise and reverberation are combined in most real-life situations. If the MTF for these two independent processes can be determined and the combined effect is desired, then we multiply the background noise MTF by the RT-60 MTF. The result gives the combined effect of substantial background noise in a reverberant space.

For example, consider a noisy basketball game in a gymnasium. The crowd noise level could be 85 dB,A. The PA might be set at 90 dB. The RT-60 of the occupied gym might be 2.5 seconds. The SNR of 5 dB gives 75 percent partial MTF due to the PA level and crowd noise. The MTF/RT-60 curve gives a partial MTF of about 50 percent due to the gym reverberance at 2 bursts/sec. The combined effect is a MTF of about 35 percent, pretty bad. Successful announcers instinctively understand this and enunciate slowly to utilize the intelligibility benefits that go with slow modulation rates.

3-DIMENSIONAL MTF DISPLAYS

With MTF, the signal modulation rate is not impacted by the background noise levels but it is strongly affected by the RT-60. Low modulation rates are more audible than fast modulations in a reverberant space. At the lowest modulation rate, the MTF is usually controlled by the background or external noise. MTF for the higher burst rates are controlled by the reverberation of the room.

The full audio frequency ranges from 20 Hz to 20 kHz. Not only does the background noise spectrum vary with frequency, the RT-60 will also vary with frequency. The next step then is to perform the MTF analysis throughout the full frequency range. The MTF frequency response curve is absolutely essential for a detailed analysis or diagnostics of the communication channel.

If both the modulation and tonal frequency aspects of MTF are combined, the result appears as a 3-dimensional print-out, or the MTF waterfall. (Figure 5 il-

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MTF TEST SIGNALS

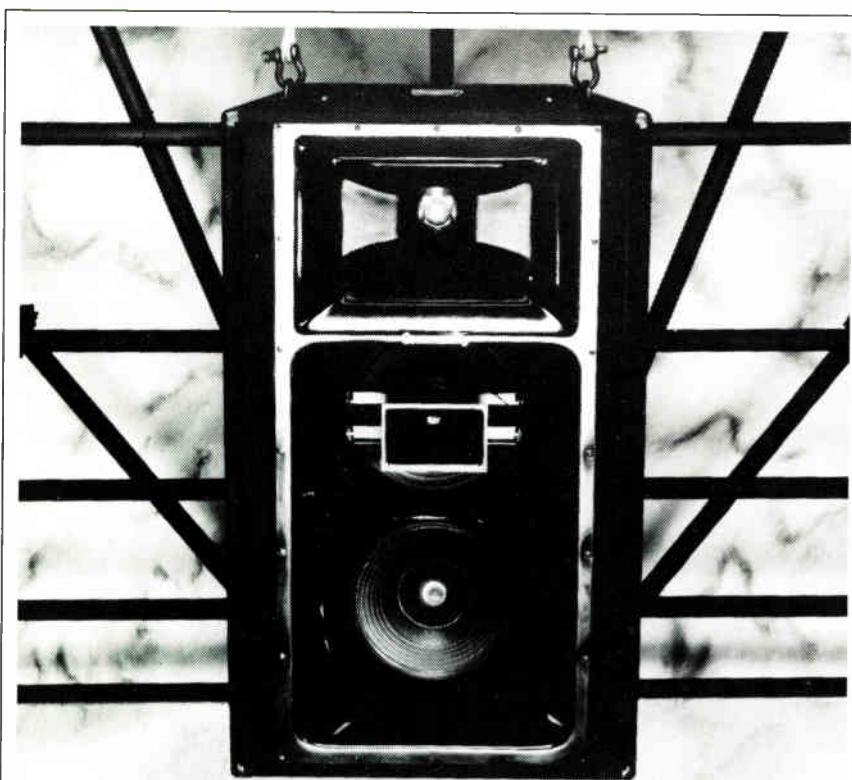
illustrates this display.) The present day's use of MTF analysis is dedicated to speech intelligibility. It is limited to modulation rates between 2 and 8 Hz, and a frequency range between 100 Hz and 4 kHz. This is one-sixth of the total 3-dimensional MTF volume available to human perception. Depending on the ap-

plication, different sections of the MTF volume will be used. For example, a Morse Code transmission would need a narrow range, about one-thirtieth of the total MTF space.

A typical recording studio control room and quality hi fi listening room are required to handle a wide frequency range and be

capable of fast modulation rates. A precision playback room might occupy 50 percent of the full MTF space. Dynamic stability might be required up to a 12 Hz modulation rate for any frequency ranging between 40 Hz and 16 kHz.

A digital sampling studio could have even higher expectations and be required to track well into the first 70 percent of the MTF space. It might have the full frequency bandwidth of 20 Hz to 20 kHz and handle up to a 15 Hz modulation rate. The MTF volume for various categories of performance can only be estimated at this time, as they have yet to be properly defined.



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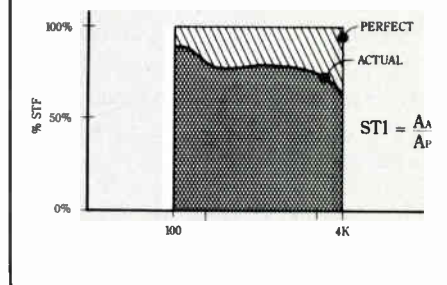
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FIG. 5. SPEECH TRANSFER FUNCTION (STF)



CONCLUSION

The role of MTF analysis in audio is just beginning to make its presence felt. For the last two years it has been making its way into audio by the way of commercial sound systems. An advancement into one specialty area of audio eventually makes its presence felt in all areas of audio. It is safe to expect that in the next decade we will be using another rack mount: the MTF will probably be located just above the RTA and EQ. There can be no doubt that by including human perception of signals as an audio performance indicator, we will produce even better, more accurate and — most importantly — more relevant audio playback systems. ■

Arthur M. Noxon heads up Acoustic Sciences Corporation.

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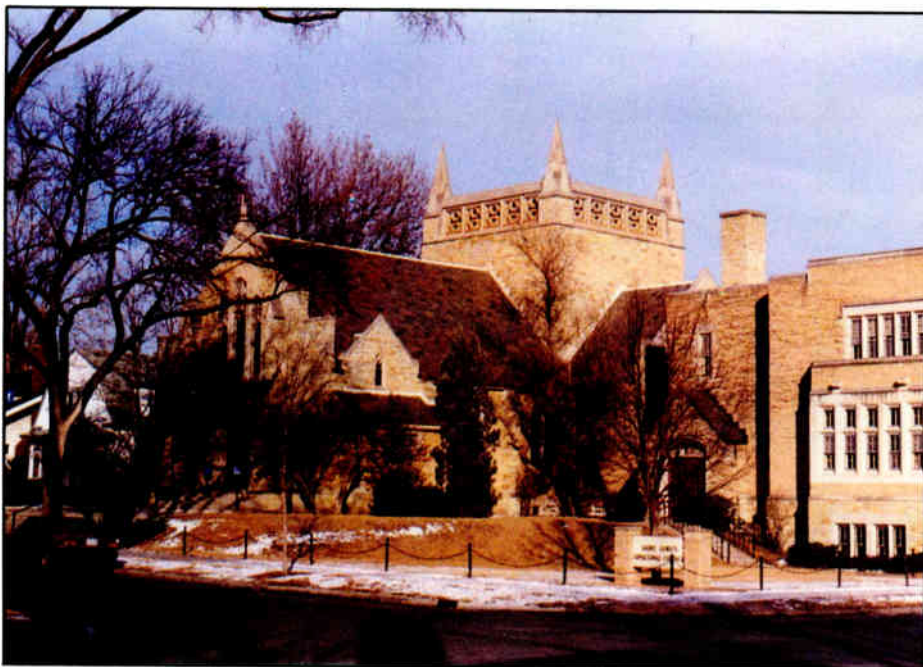
ST. LUKE'S EPISCOPAL: A CHALLENGE IN A CHURCH

BY T.G. McCARTHY

St. Luke's Episcopal Church in Minneapolis, Minnesota invited our company to submit a proposal for a new sound system. Having driven by the building many times, I thought it looked like it would be, more or less, a routine job. However, on inspection, it turned out that there were a number of interesting challenges.

The worship space is cruciform in shape as depicted in Fig. 1. The congregation seating areas can accommodate about 600 people in the nave, transepts and loft. The choir seats about 50 members, split into two groups that face each other. There are two organ chambers, one in the choir area and the other in the attic above the crossing.

Using the test system of choice, the Ivie IE-30A Real Time Analyzer, IE-17A Microprocessor, and IE-20B Random Noise Generator, we measured the reverberation time (T60) at several locations throughout the space. The Ivie is capable of using any of several sources of excitation for reverberation testing: external acoustic impulse (such as is generated by slamming a hymn book against the back of a pew), internally generated pulse fed through a sound system, or external electrical signal fed through a sound system. In this case, we used the existing sound system fed by the IE-20B random noise generator. Ivie can process T60 data in full spectrum, octave, or one-third octave bandwidths. We chose one-third octave bandwidths spaced an octave apart, from 500 Hz to 8 kHz. "She" can integrate any number of reverberation decay samples at each frequency, displaying the results several ways including external oscilloscope or plotter graphing of the decay curve and self-contained, direct, almost immediate readout of reverberation time.



View of outside of St. Luke's.

To compensate for non-linear decay rates (dB vs time) when using the self-contained T60 feature, Ivie lets the operator choose where along the decay curve T60 is calculated. We took 10 samples in each frequency band, and chose to use the reverberation time based on the second 5 dB of decay.

Because the existing sound system was excited with full range "pink" noise during the reverb tests, we could observe amplitude response on the real time analyzer screen at each of the observation points. That gave us a sense of frequency/amplitude coverage as well as reverberation characteristics at many points around the room.

We found the reverberation time in the rear half of the nave to be significantly higher than the "ideal" given in look-up tables for a protestant church of this size (see table 1). Comparing it with T60s

observed at other points throughout the room, we found that the space was really a collection of coupled spaces: the sanctuary, choir transepts, nave front and nave rear are acoustically separate rooms. Each has its own ceiling shape and treatment: There are peaked ceilings, flat ceilings and arched ceilings. There is plaster, wood, cork acoustical tile and even cloth over fiberglass. Walls and floors exhibit a creative variation in treatment too, from soft to medium to hard. These coupled spaces result in a "multiple hump" reverberation decay characteristic, which changes audibly as a listener moves from one location to another in the space.

Ordinarily, we would "plug" varying numbers of people into the room, and see what happens to the reverberation characteristic as the room goes from empty to "typical service" to full. However, in this case we did not feel that we had the

capability to do that and derive useful information. In all likelihood even if we did, it would not significantly change the design of the sound system. We elected to use the nave rear reverberation values as a reference because they are as far from ideal as anywhere in the room and because a significant number of listeners sit in that area. Operating on the theory that if we design a sound system to work in an environment with too long a reverberation then and provide even, direct sound coverage over all ear planes, then we can assured of articulate coverage everywhere; even where the reverberation time is shorter.

Table 1.
Reverberation times, nave rear

Frequency Hz. (1/3 octave center):	500	1K	2K
Measured T60, seconds (room empty):	2.55	2.42	2.38
"Ideal":	1.40	1.36	1.34

Another problem surfaced when, using the Sound Level Meter built into Ivie, we measured ambient noise. The general noise level in the room, caused primarily by traffic on adjoining streets, is borderline acceptable. But it turned out that the building is located directly under a busy flight path to the Minneapolis/St. Paul International Airport. There was some discussion as to whether take-offs were noisier than landings, but there was no doubt that both were very intrusive. The instruments agreed with subjective observations, showing a noise level some 9 dB too high, as is shown in table 2. The noise problem was compounded because, being winter, all the windows were closed. Outdoors, the levels were some 20 dB higher. In summer, with doors and windows open, it was anticipated that the indoor levels would be essentially the same as outside.

Table 2.
Ambient noise

Ambient noise, SPL:	dBA	dBC
Measured:	44	57
"Maximum ideal":	35	(not rated)

So, the reverberation time was too long and the noise level was too high; two shortcomings that would have to be taken into account in the design of the system. Ear planes would have to be carefully blanketed with sound without throwing excessive sound against other surfaces. And there would have to be enough headroom to out-shout the noise when occasion demanded.

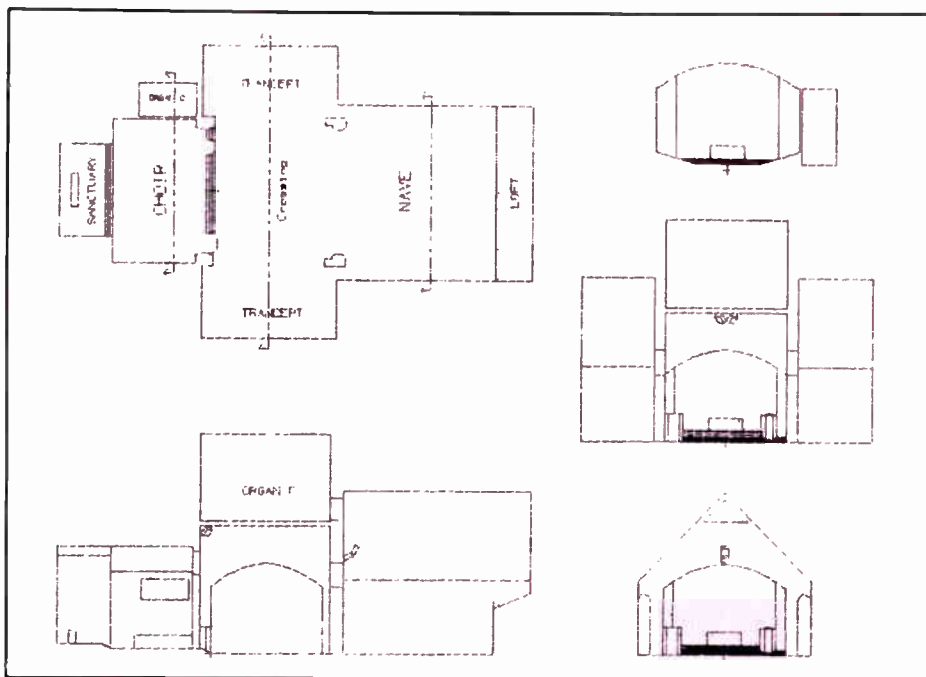
Noise and reverberation aside, the distances involved and the way people are distributed throughout the worship space contributed their own acoustic problems. The church sound committee, headed by

Mr. William Holbrook, had done its homework, and had some specific requirements. In addition to general sound reinforcement, solutions were needed for the following operational shortcomings:

- It is difficult for members of the congregation to hear the spoken word from the sanctuary.
- The choir and the choir organ sound distant and detached from the congregation when heard in the rear of the nave and in the loft.



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These are plan and section drawings of the worship space. The ear plane boundaries are defined by dotted lines. The two arrays are shown in place.

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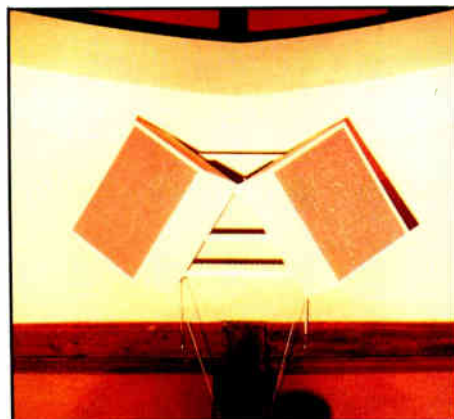
- The crossing organ sounds muffled, particularly in the higher notes.
- Members of the choir have a hard time hearing the spoken word from pulpit and lectern.

Not surprising. It is more than 30 feet from the altar to the nearest member of the congregation. The crossing organ's connection to the worship space is via a "vent" in the east wall of the chamber. There are obstructions between sound sources and listeners (most of the members of the congregation seated in the transepts cannot even see the altar). Other obstructions exist between choir, choir organ and congregation.

In addition to solving the specific problems, the proposed system would include standard features of a church sound reinforcement system: unobtrusiveness of microphones and loudspeakers, capability to record and play cassette tapes, facilities for RF microphones, RF hearing aid system, auxiliary area loudspeakers, musical instrument inputs, and microphone inputs at all the speaking positions.



Rear loudspeaker array.



Front loudspeaker array.

The system was to sound natural, be technically flexible and at the same time be simple to operate.

The existing system, as in many churches, had evolved over a long period of time and was a collection of obsolete hardware and new, with good points and bad. It was connected in a classic all-the-microphones-feed-all-the-loudspeakers-in-the-worship-space-and-in-auxiliary-areas arrangement. Because of its evolutionary growth, with things added on to other things, it was cumbersome and inconvenient to operate. There was some creative applications of equipment and there was some evidence of wishful thinking.

As always, the point of carefully checking the existing system is to get a sense of history; to benefit by those that went before us, both in adopting techniques that work, and in avoiding traps. Another reason is that we want to use as much of the existing equipment as possible in the new system. And, most importantly, we want to be sure we don't miss "the unknown function"; something that the existing system may do that no one is conscious of, but that would be immediately missed if not available.

In listening to the system, our ears and test equipment confirmed what we had been told by members of the sound committee: "The coverage is very uneven. It does not exhibit a 'flat' frequency response characteristic. It doesn't sound natural. It hums and crackles."

With the preliminary survey finished, we had enough information to start designing the new system. Beginning with the listening environment and going upstream, the first task was to decide where to put loudspeakers. Because previous installations in the space told us that loudspeakers distributed along the sides of the room were unsatisfactory, we hoped to use a central array. We began by modeling the room using our loudspeaker array design computer program Umbulus. The program lets us examine any number of potential array locations and combinations of loudspeakers, and it helps determine exact loudspeaker aiming angles. In other words, it lets us determine the best array

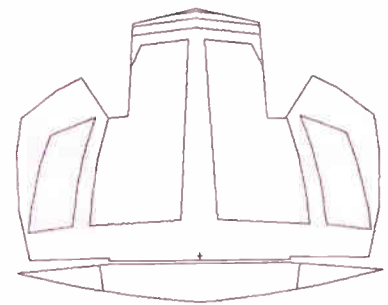


Figure 2: This is an Umbulus map showing the room as seen by the loudspeaker array mounted above the great arch.

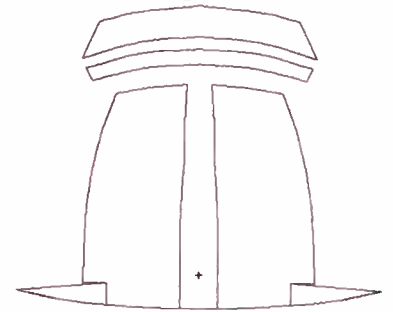
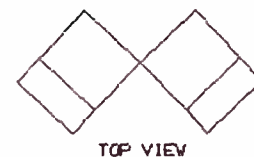


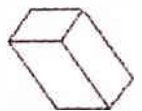
Figure 3: This is what the rear loudspeaker array sees, a clear shot to the areas blocked from the front.



TOP VIEW



FRONT VIEW

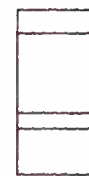


SIDE VIEW

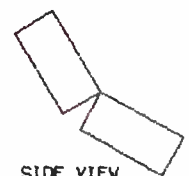
Figure 4: Three views of the front array.



TOP VIEW



FRONT VIEW



SIDE VIEW

Figure 5: Three views of the rear array.

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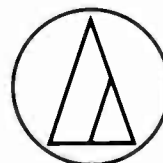
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ST. LUKE'S EPISCOPAL

location and then helps us select and aim the loudspeakers, that will make up the array, for optimum coverage. After that is done, Umbulus even helps us build the array so that it ends up coherent and with the loudspeakers aimed according to the "on-paper" design.

The first choice was to cover the room from a point source array located at the great arch. That could be done, but only if the array was suspended below the arch, which was not esthetically acceptable. Raising the array to clear sight lines through the great arch resulted in a blockage in the acoustic path from loudspeaker to the loft by the nave arch. It shadowed some listeners at the sides of the rear of the nave, too. Umbulus helped determine that even if the rear of the room was not blocked, it would still be difficult to cover from this location because patterns from horns throwing to the rear

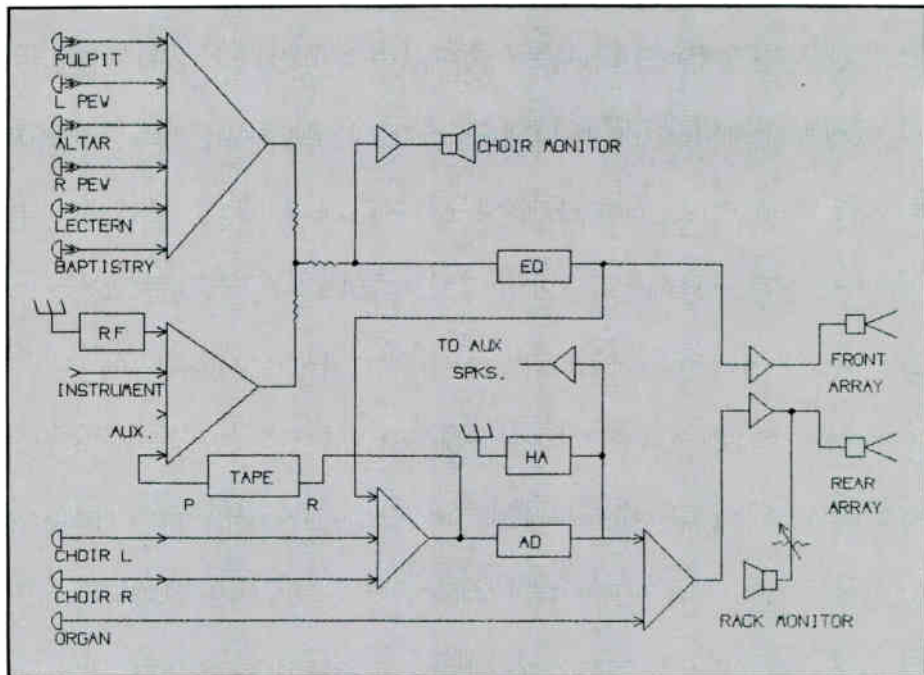


Figure 6: One-line diagram.

would illuminate significant areas of wall above the nave arch. That sound energy would then reflect backwards into the room, contributing only to noise and

reverberation; the detriment of speech intelligibility. The reflections would have been particularly powerful given the operating levels that would be needed for

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ST. LUKE'S EPISCOPAL

the source horns to throw to the back of the room. (See Fig. 2).

The solution to covering the rear of the nave and the loft lay in a second array above the nave arch (see Fig. 3). The two arrays would each "see their own parts of the room." Front array: transepts and nave front. Rear array: nave rear and loft. (The arrays are shown in place in Fig 1b, c, d.) An audio delay, whose delay time was set based on Umbulus generated path length data, would keep both in sync. Surprisingly, in this case, the cost of the split array was not a great deal higher than with a single array. The shorter throws and the fact that we had walking access to both array locations through the crossing organ chamber resulted in economies that tended to balance the addition of the audio delay.

The choir could be covered using ex-congregation loudspeakers. Instinct said place them on both sides of the choir area; but Umbulus said just one side, on the wall next to the choir organ chamber opening would do a superior job of covering both seating areas. By aiming so the far choir area is on axis, the shorter path to the near side is balanced against off-axis pattern attenuation; whereas throwing from both sides toward the center would have caused smearing because of interference and delay. To assure that the choir monitor system was not operated any louder than necessary, we would put a level control at the organ console that is located across the room from the organ chamber opening.

Thus, the room coverage problem was solved: a split array for the congregation and a monitor system for the choir. The next thing was to design the arrays. Using Umbulus, along with what we knew about the reverberation time and ambient noise, we generated the designs shown in Figs. 4 and 5. The arrays are based on JBL loudspeakers because we have isobar data on them and because they have a record of being high quality reliable devices. The two arrays used a total of eight JBL 2118Hs and four 2404H horns.

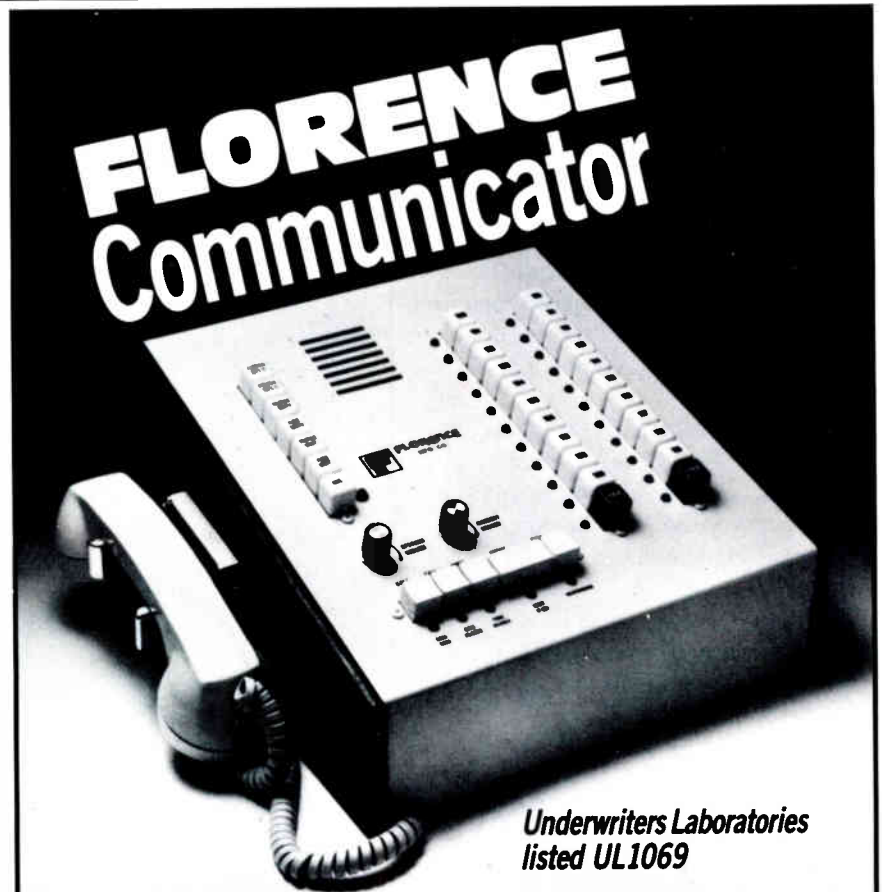
Splitting the array suggested a solution to the problem of being able to hear the choir in the front of the nave but not in back. We could feed choir microphone

signals to just the rear array, letting the distance between loudspeaker and microphones provide enough acoustic gain that we would not have to close mic the choir. We chose small electret omnis, hung about eight feet off the floor above the front pews of the choir seating areas, for this function.

The split array also enabled a solution

to the crossing organ problem. Since it was intended to be an antiphonal organ, we could put a microphone in the organ chamber and feed it to just the rear array, augmenting the sound coming through the vent. That would be a useful application of an existing microphone.

The spoken word microphone took



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some consideration. There were to be a lot of them, scattered all over the place, with only one or two of them in use at a given time. No matter how we figured it, the importance of having as few microphones as possible open at once, and the charge by the committee that the system be "simple to operate" (i.e., "capable of functioning without an operator") necessitated an automatic mixer. Even with the automatic mixer, there would be one non-automatic spoken word microphone: the wireless. We would specify a transmitter that has a silent mute switch, thereby making it possible for a user to turn it off manually without sending an impulse through the sound system.

There were to be a number of reproduction sources too: instrument, tape play and auxiliary. These would not regenerate noise and could be controlled by a standard mixer.

The system is becoming pretty well blocked out (see Fig. 6). A one-third octave equalizer, hearing aid system, auxiliary loudspeaker feed, AC distribution, remote on/off control and a few other goodies and we're all set.

Perhaps I should say here that we always recommend hearing aid systems for churches. As the general population grows older, more of us are experiencing hearing loss (younger members of the congregation may have problems too, induced by recreational listening to high level program material). In addition, we are now regularly addressed by untrained orators (lay people and clergy alike) where we were not in the past. These things help explain why churches approaching 100 years old are now being fitted with sound systems for the first time. Keeping specific hearing problems in mind, it's unrealistic to think that a general area sound reinforcement system can accommodate everyone.

Determining technical values for the elements of the system pretty much fell into place. For example: knowing the sound level that must be achieved at the ears, along with path losses, and array sensitivity determines how much amplifier power is needed; number of microphones

determines mixer size, etc. In general, specific brand names are not too important, as long as the equipment is "professional quality" and reliable. We can be sure that should one manufacturer come up with a truly advanced product, the reverse engineering departments of others will soon announce similar products. As a result, a lot of the audio hardware on the market today is more of a commodity, hav-

ing no clear advantage over a like item from another source. Having said that, I should also say that it's company policy to use the products of the original developers whenever possible.

With the design and logistic details worked out, the proposal was written, submitted and accepted by the church. Order in hand, the installation was almost

(continued on 114)

	
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AN OVERVIEW OF HIGH RESOLUTION INSTRUMENTATION

FOR SOUND SYSTEM SETUP AND PROOF OF PERFORMANCE, PART 2

BY MIKE KLASCO

Last month we printed Part 1 of this article on computer-based testing equipment and how the market is changing. This month we continue with Part 2 where we left off last month. —Editor

DIGITAL FILTER ANALYZERS FROM B&K, SCANTEK AND HEWLETT-PACKARD

A few years ago B&K introduced the 2123 (single channel) and 2133 (dual channel) real time digital filter analyzers. These table top test systems are switchable between octave, 1/3, 1/12, 1/24 octave bands with internal noise and pseudo noise test signals. Their cost was close to \$40K which is why you might not have seen your friends or competitors using these machines. B&K has recently introduced the 2143, a transportable version for acoustical consultants and sound contractors for \$18K, expensive, but B&K does make a nice product. Digital filter analyzers are not to be confused with FFT analyzers, but instead use digital signal processing techniques to create a virtual bank of filters. Perhaps you might remember the Crown RTA-2, an earlier attempt at this approach. The 2143 has its own disk drive which is compatible with MS-DOS 3.5-inch floppies and B&K has a lot of acoustical software for this system (mostly for environmental noise calculations). The system is battery operated, has a liquid crystal display, and weighs 22 lbs. complete.

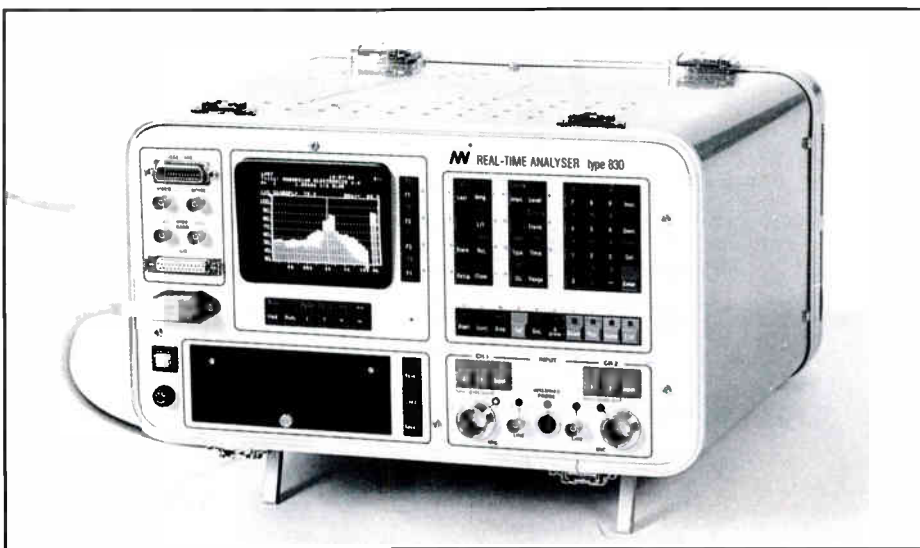
SCANTEK

The Scantek/Norwegian Electronics 830, like the B&K 2142, is a digital filter analyzer. The 830 is transportable, but is larger and heavier than the 2142. Scantek

offers a wide variety of software programs for environmental noise and acoustical analysis that can be used with the built-in MS-DOS compatible disk drive in the model 830 (like automatic determination of absorption coefficients, intelligibility measures, reverberation time, etc.). A fully loaded 830 can run \$35K with the FFT option, dual channel operation, reverberation measurement software, intelligibility measurement software, but cost is quite a bit less without all the goodies. (This summer we plan to field test both the 830 and its software.)

trade-offs). The HP 3588A is a table top instrument that is not specifically intended for acoustic applications although it seems to offer unmatched speed and accuracy in the audio band. Cost is just under \$19K and we will discuss this instrument in the coming months. The 3588A is not likely to find its way into many sound contractors hands, but the application of DSP and FFT to swept signal processing surely has processing speed/frequency resolution implications for future TDS products.

But back to dual channel FFT techniques.



Scantek Real Time Analyzer Type 830.

HEWLETT-PACKARD

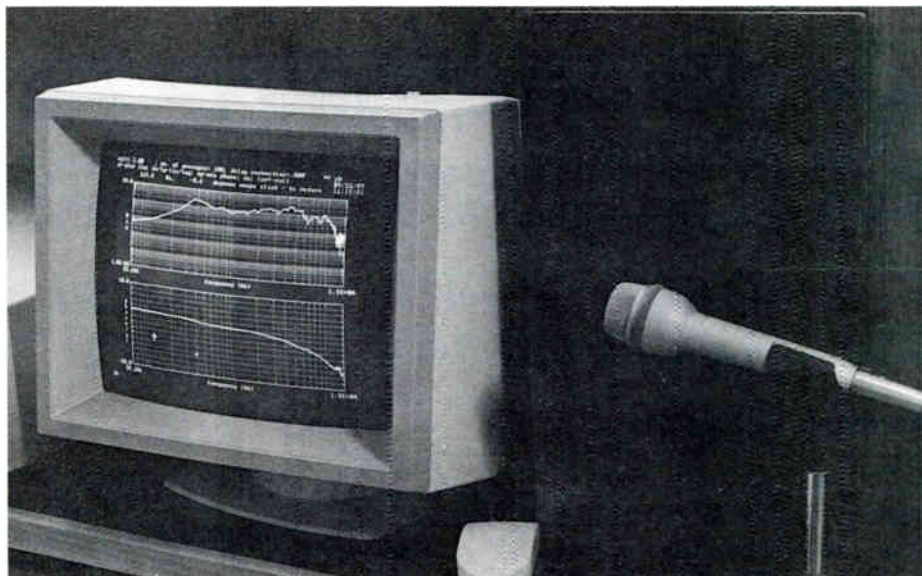
Hewlett-Packard has just introduced an innovative spectrum analyzer that uses a combination of swept signal, digital filters and FFT techniques to achieve both high speed and increased accuracy (speed and accuracy have previously been inherent

SYSid BY ARIEL

Bell Labs developed SYSid (for SYSTEM IdentificatIon), an analysis technique which has been licensed to Ariel. Hardware is a dual channel DSP board that plugs into an IBM compatible XT or AT computer. Hardware/software cost is

TESTING AND INSTRUMENTATION

\$3,000. Compatibility with CGA, EGA, or Hercules monochrome means that most laptops with a full size expansion slot can accommodate the system. SYSid excites a system with either a sinusoidal test signal or a pulse. The analyzer can sample two channels simultaneously, preserving their phase relationship. Transfer function measurements are typically made with a chirp, a wide band signal which (like the TDS-TEF) has low crest factor. Hewlett-Packard also has a chirp spectrum analyzer, along with a microwave band analyzer from Data Technology, and B&K uses a chirp-like signal in some special applications. A chirp greatly increases the amount of energy delivered to the system per unit time enhancing the signal to noise ratio and reducing nonlinearities. The SYSid can also generate a test impulse, as well as sum and averaging techniques. Although the impulse has inherent high



SYSid by Ariel

crest factor limitations resulting in poor s/n measurements, it is necessary to have the impulse response if RASTI or STI intelligibly measurements are to be derived (SYSid software does not yet provide these

measurements). SYSid can measure distortion, frequency response, phase and group delay, impulse response, 1/3 octave bands, modulation noise and noise floor, impedance and more. At the moment, it

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TESTING AND INSTRUMENTATION

does not support measurement of polar plots, reverberation measurements, or intelligibility measurements. For most sound contractors, these are critical omissions, but well within the inherent capabilities of the system. SYSid software has already gone through a couple of revisions and a new software release with greatly expanded capabilities and improved user interface is scheduled soon. At present, it is easier to use than the TEF system, but still is not as user friendly as the MLSSA system. Aside from SYSid, Ariel also has a more conventional dual channel FFT program that runs with the same hardware board. Hyperception, a developer of high power engineering software, offers the Signal Processing workstation software for the Ariel board. This is an incredibly powerful program that provides color spec-

trograms (sort of a color FTC), an arbitrary waveform generator (so you can literally generate any type of test signal you desire) and other intriguing capabilities. (An in-depth review of the SYSid, the dual channel FFT software and the Hyperception Workstation is in progress and coming up in Sound & Communications.)

PSEUDO-RANDOM NOISE FFT ANALYZER

The DRA MLSSA (Maximum Length Sequence-Spectrum Analyzer) is a single channel FFT analyzer data acquisition hardware board/system for XT or AT compatibles with a unique noise generator. Cost for the software and hardware board is \$3,000. MLSSA generates a sequence of pseudo-random noise which it captures

and crosscorrelates with the original sequence. This is a very robust approach, with MLS(SA), TEF, and chirp techniques being roughly equal in their rejection of spurious noise. The MLSSA board will also generate and analyze impulses. Since the MLSSA system "knows" the sequence of the noise-like signal it has sent out, it can crosscorrelate what has come back (to its input) and derive the transfer function, including frequency response, phase, group delay, 3-D plots, RT 60 reverberation, RASTI and STI intelligibility and more. At present the MLSSA cannot plot polar characteristics, although this is not an inherent limitation and probably will be added. There have been papers on measuring distortion using pseudo random noise, and MLSSA supports spot THD

(continued on page 80)

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HIGH TECH SNAKES

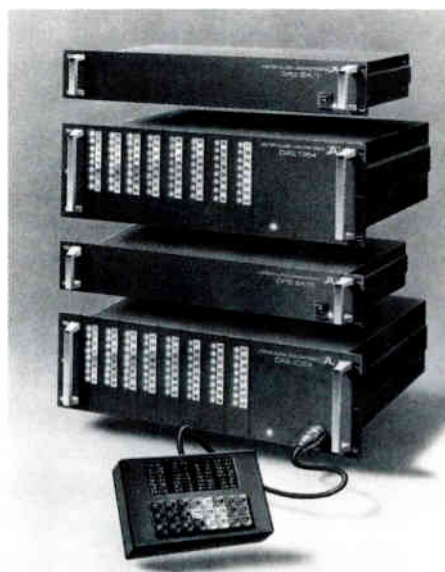
BY MIKE KLASCO

There is a revolution brewing in the space between the stage and mixing console. Both digital processing and fiber optics are coming into the otherwise low-tech field of snakes. Aside from swampy areas, snakes are typically found in permanent installations such as theaters, churches, recording studios, and broadcast stations, as well as temporary setups such as tours and concerts. Variations of snakes such as audio distribution systems can be found in more complex installations such as stadiums, arenas, amusement/theme parks and large broadcast and production/post production facilities.

Most of the *digital snake systems* that are being readied for introduction are based on CD or DAT technology. The digital to analog converters and most of the digital logic "glue" is similar to the circuitry and components of other digital audio products. Even some of the fiber-optic technology is common to the top end CD players that now have direct optical outputs (a number of CD players use optical circuit paths internally, primarily for signal integrity). Specifically, optical isolation is applied to reduce spurious clock and servo system noise leakage from getting into the reconstructed audio output.

These new digital/fiber-optic communication systems claim enhanced EMI/RF noise immunity from power, lighting and broadcast cables and equipment, as well as freedom from ground loops, reduced setup time, and greatly reduced cable size. The question the audio system designer will be asking is, "Is this something I should consider using?" Right now, there is no easy answer. First the positive factors, such as ease of setup and installation. If the cable run is a few hundred feet and you are running two dozen channels, then the bulk, weight, manpower, and even the cable cost is substantial (500 feet of conventional snake might weigh about 1,000

lbs., while fiber-optic would be about 15 lbs!). With any of the digital, or digital/optical systems, 12 channels or more can be sent along a single lightweight cable that could be handled by a single installer. For permanent installations in existing facilities



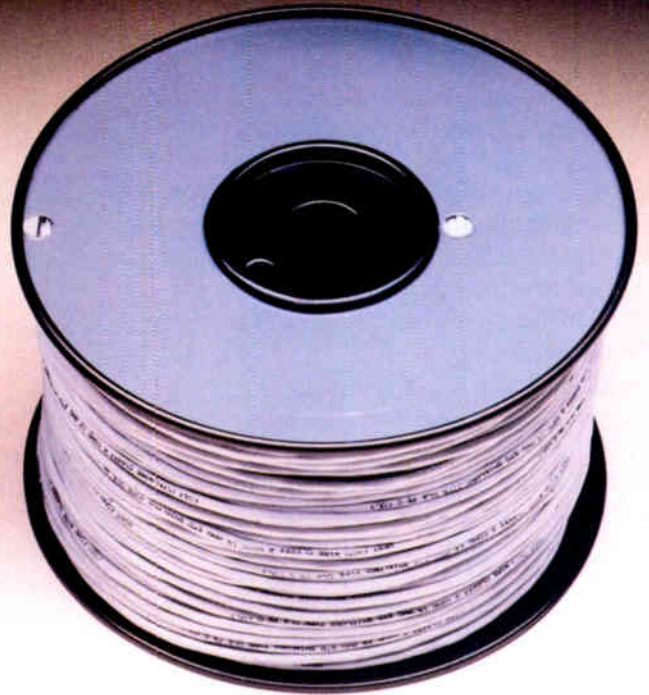
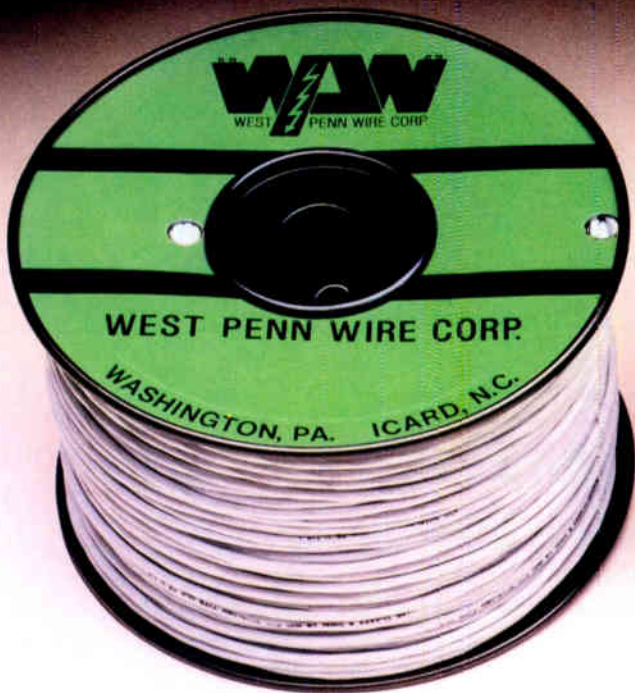
Lester Audio Laboratories' DAS-2064.

that need expanded channel capability, the reduced size versus channel capacity could make many retrofit installations practical and cost effective. At times, conventional cable specifications are compromised in order to fit into existing conduits, while the digital system would free up space for other cabling, with the added benefit of no EMI/RF interference. Routing cable in public walkways in temporary installations also becomes less of a safety problem. The optical isolation further eliminates grounding safety problems as well as endless hours of tracking down ground loops. In general, these digital snakes will make setup and installation simpler, but there are other aspects, such as the far more expensive and complex hardware and procedures for doing splits that are not so attractive.

Another caveat: all these products still have wet paint from the lab. The products briefly described in this article are either hand made prototypes, are in the final pre-production stages, or are early production runs. Do not expect the model you select to remain current (be in production) for long. At this stage of development each company has its own good ideas that are unique and competitors are busy revising their products to incorporate each other's features and suggestions from potential users. Interface standards are also a big question mark, as there are already a half dozen standards in use, and which will be most commonly used for snakes has yet to be determined. Ideally, direct connection of CD players, DAT machines, as well as interconnection between different manufacturers' digital snake encoders and decoders may eventually become possible. Another future possibility is the elimination of the external decoder with the direct connection to a digital mixing board.

Where will these systems show up first? The big pro sound tour rental companies would benefit from the easy setup and freedom from ground loop problems, but that business is very committed to tried-and-true techniques that are robust and well proven. How physically robust are fiber-optic cables, connectors, etc. in temporary installations? What about EMI/RF radiation from the decoders/encoders themselves interfering with other equipment? Permanent installations, such as retrofits where the existing conduit is not large enough for expanded channel capacity, might force some specifiers to be adventurous and go for digital. Another early candidate would be large communications networks spread over large areas which require high quality. One example of this is theme parks, which may want to originate an event at one location and "broadcast" it to another location within the park, or have a park-wide announcement,

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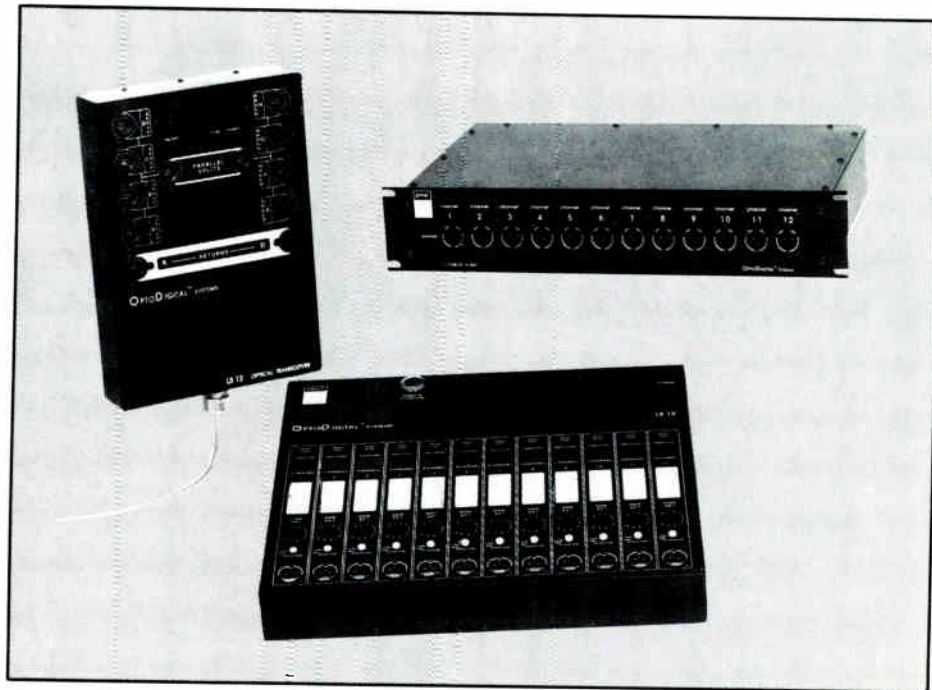
HIGH TECH SNAKES

or put a priority override on program material that is traveling throughout the park (such as music program material) tracking a parade. OptoDigital Designs is presently installing this type of system at Disney and we will take a close look at this project in a future issue.

The snakes in our capsule survey span a wide range, from the simple Audix to the expensive and complex Klotz and Lester systems. The Audix DS-8 is unique in this survey in that it is strictly a one way snake, uses conventional coax cable, and has a price projected to be about \$500. The other systems are all digital with fiber-optic cable. Additionally, they are premium priced and have the capability (either standard or optional) for bidirectional or network operation.

The Audix DS-8 is a digital snake, but uses conventional coax cable to send eight channels of audio. Maximum distance is 1,000 feet between the stage input panel and rack mount output panel. Since Audix's snake uses conventional (low capacitance) coax cable, it can be used to expand existing snakes. The DS-8 uses XLR connectors and accepts unbalanced or balanced mic level inputs. Active balanced circuitry is used. At a projected price of \$500, with .05% distortion and 73 dB signal-to-noise ratio, this would seem to be a breakthrough common usage product for cabarets, schools and churches. The product was first introduced at the Winter NAMM show, but delivery is not expected until the end of the Summer.

Lester Audio Laboratories displayed the DAS-1016, the company's first generation digital snake system, at the New York AES. The product featured "softpatch" in which the operator could delegate which of the 16 inputs would be assigned to the 16 outputs. An LCD display indicated the status of the system. Optelecom's transmitter/receiver was used. (Optelecom manufactures fiber-optic communications products, but its own systems are only for video and voice grade audio, so I am not including a section on them in this survey.) Although the product was ready for production, its introduction was held off until the many revisions and enhancements



OptoDigital Designs' LightSpeed 12.

suggested at the AES could be integrated into the design. The evolved product is the DAS 2000, which is just entering production. More flexible than a conventional snake, it is a multi-point to multi-point sound transmission, distribution, and routing system. Aside from stage to console linkup, applications could also include amusement/theme parks, broadcast stations, and other interlinked systems. Operation can be either in real-time or preprogrammed. Many previously manual processes can be automated by the programmable memory control, reducing setup time and operator errors. The system is modular, with 16 channels per module, up to 64 channels maximum. The DAS 2000 uses 18 bit converters, mic and line levels, 98 dB dynamic range and 48v phantom powering. Up to three miles can be spanned over fiber-optic cable. Delivery is expected by June with pricing somewhere between OptoDigital and Klotz.

Klotz is a West German company that has displayed its product at the New York AES and is in the process of making the product available in the U.S.

The Klotz Oak-Link is a digital data transmission system using fiber-optic cable. Input signals may be digital or analog, and stations may be up to 6,000 feet apart, with the single fiber-optic cable carrying 64 channels of signal. The Oak-

Link station is used at the send and receive locations, as well as patching and routing junctions. The station physically consists of a video monitor and a base unit about the size and form factor of a personal computer. In the case of a stage and mixing console, two stations would be used. In a theme park, multiple stations would be required. Patching, splitting and routing signals are manipulated at the station with the use of a lightpen and a series of dedicated screen displays or with the cursors and numeric keypad. Oak-Link is a 16 bit oversampling system (for regular inputs) as well as interface with AES/EBU and SDIF digital format converters. Both CD (44.1 kHz) and R-DAT (48 kHz) are accommodated. The Oak-Link can be configured and operated under MIDI control. The Oak-Link is both a flexible and high performance system. Its U.S. price will probably be the most expensive of the products included in this survey.

If you ever wondered what the high end audio cable companies would do when fiber optics became commercially viable, here is the answer. Monster Cable's OptoDigital Designs division has introduced its LightSpeed 12 audio signal distribution system for stage/live sound, studio and broadcast applications. A modular building block approach is used with 12-channel A/D encoder and decoder

HIGH TECH SNAKES

units, transceiver head unit, tail unit, and optical digital to analog unit. The audio signal is digitized and multiplexed by the encoder and sent through the (armored) fiber-optic cable to its destination and then converted back to analog form. Configurations can be direct, bus, star, or ring local area network, depending on the application requirements. The system enables up to 96 feeds (8 systems linked) to be sent with 24 returns. Benefits claimed for the system are simple installation, two-way signal transmission, elimination of ground loops and RF noise and better than CD quality sound. The flexibility of the system would make it appealing for complex installations such as theme parks; and one of OptoDigital's first installations is at Disneyland. The LightSpeed 12 System is a 16 bit system with a 48K sample rate (using the R-DAT AES/EBU standard). Signal-to-noise ratio/dynamic range is 94 dB and distortion is less than .01%. The LightSpeed 12 is just going into production now.

The Encoder (12 audio in, 1 digital out) retails for \$3,000. The Decoder (1 digital in, 12 audio out) retails for \$2,000. The OptoLink Transceiver (96 sends, 24 returns, 500 foot fiber-optic cable) is \$4,200. A slave splitter with 48 channel take-off retails for \$1,200.

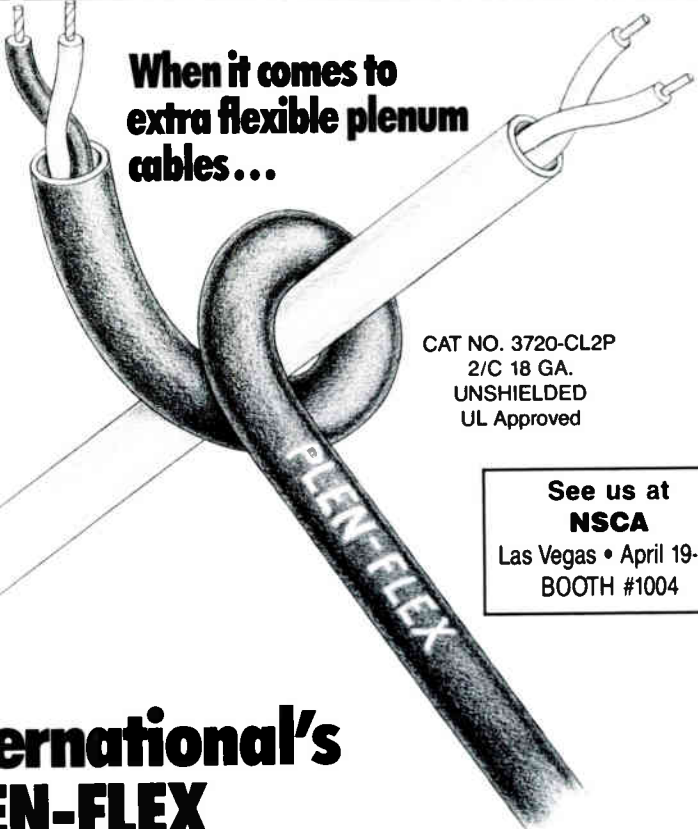
Wadia has focused on high-end recording and production studios using digital tape recorders and on audiophiles as their primary market. Recently the company announced the DigiLink 20 series, a 30 channel mic snake using a 96 kHz clock speed (384 kHz option for golden ears) and provides a range of up to 10,000 feet. Direct interface with all digital standards is supported (as well as its functioning as a standards converter), including AES/EBU, S/P, SDIF-2, JVC DAS and PD DUB-C (hey, where do I put this XLR connector??). This is a premium product for big budget critical jobs such as recording studios, broadcast, film post production, etc. After initial market feedback, the product introduction has been postponed in order to expand it to a 32 channel device. A digital input/output version is expected to be released in three months,

while the audio input/output version is anticipated in about six months. The retail price of the audio input/output DigiLink 20 is targeted at \$10,000.

Other products include 4 channel systems, high performance D to A converters, line drivers and special coax cable. Some of the capabilities of the products

(such as very high current output of the line drivers) might be nice but unnecessary for audiophiles, but of real practical use for the long cable runs in many commercial installations. Wadia is apparently shipping product and has a number of models in production.

The VEAM is a competitively priced

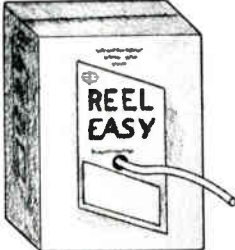


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product with a maximum of 52 channels which can be transferred up to 1,500 feet on a single fiber-optic cable. The VEAM is a modular transportable system intended for road tours. Some of the channels can be setup for bidirectional operation. A two channel intercom, outputs for stage monitors, and direct digital outputs for digital tape recorders are built in. VEAM was a division of Litton Systems, Inc., a substantial conglomerate. Product delivery is still not decided, but the target price is estimated at \$10,000.

The future...Digital snakes are just turning the corner into becoming actual products. Each product has its own unique characteristics in its features, functions and performance. Perhaps over the next year we will see these products begin to share the better ideas as well as more

commonality on interface standards, connectors, and operation. Another opportunity is to take advantage of interface with some of the separate but parallel developments like Crown's IQ 2000 (Macintosh) computer controlled power amplifier system and the sophisticated IED programmable systems, Yamaha's programmable/automated digital mixing consoles (DMP-7), direct connection of DAT recorders, optical output CD players and direct interface with the variations of the AES/EBU, Sony, and JVC standards, and don't forget Ariel's digital output microphone and the European computer-controlled concert systems. How much of this will eventually connect together or even end up in the typical sound contractor's future bill of materials is anybody's guess, and we will keep you posted. ■

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MIRAGE

(continued from page 48)

fier racks and an intercabling system.

The portable system allows the equipment to be easily reconfigured into multiple sound systems. This design allows the hotel to accommodate the widest range of events, from simple presentations to sporting events and headliner acts.

As an example, a few months before the hotel was to open, Stephen Wynn was able to host the Leonard/Duran boxing match. Within a month, a complete boxing arena and spectator seating area was constructed on the exterior parking lot behind the convention center. Immediately, the portable sound system was used to full advantage and within hours after the fight the sound system was reconfigured for a large concert presentation associated with a major convention.

FIELD INSTALLATION

The installation of cable and equipment

was carried out concurrently during the fabrication engineering phase. Over 2.2 million feet of Belden cable was pulled and terminated to the equipment racks. All field cables were individually identified using special long life wire code markers indicating signal level and the unique cable number.

The benefit of an experienced IBEW field crew can not be overstated when it comes to resolving those inevitable problems that occur during the installation of such a large project.

During the final stages of installation, all field documentation was revised to reflect the site conditions and was subsequently incorporated into the project drawings showing the as-built conditions. These drawings were then made part of the project turn-over package.

MIRAGE PROJECT TEAM

We would like to take the opportunity to express our very sincere appreciation to some of the many great people it took to make the Mirage hotel possible. Time and space do not allow us to acknowledge

and thank everyone who worked with us on this project, but we have endeavored to give a tip of the "old hard hat" to those who we worked most closely with.

To the Mirage/Atlantia Design Management Team — Stephen Wynn, Kenneth Wynn, Robert Baldwin, and the many others who created and managed the Mirage Hotel.

To the architects and builders — Marnell Corrao Associates, Anthony Marnell, Glen Kaiser, Irv Bennett, Jon Sparer and the many other people who never doubted that we could build it on schedule.

To the Acromedia Design and Construction Team (who will long remember this one) — George Kindler, Richard Hood, William Scheifer, Andrew Ferreghy — who did a magnificent job of engineering — and to Dale Condit and Robert Myers for their dedication in getting it built and installed.

To our company. To the partners of Acromedia Corporation who had the willingness to risk their company and resources when they undertook to design and construct the Mirage. To Bob Reim for his patient management of a project which would have been impossible without his many years of experience.

Last, but not least, to our wives and families who had the understanding during those extended work days. With these and many other people we helped create the Mirage Hotel. ■

P. J. Goodman is Vice President, Nevada Operations for Acromedia. Robert Patrick is a Project Engineer at the Mirage Hotel.

This Is Not Your Mother's Dynacord!



Most of us were raised on vinyl records, tube amplifiers and cone speakers. Even though compact discs and solid state amps have become the technology of choice, the speaker with its cone and voice coil remain. Now that's not so bad except we know there are certain inherent deficiencies in all speakers, regardless of brand.

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April 1990 75

WHITHER THE NINETIES: THE CONSULTANTS VIEWPOINT, PART 3

This is the third in a series of commentaries by various members of the consulting field regarding our question; whither the nineties? We would like to thank all the consultants who have participated in the survey and would like to encourage any further commentary from the consulting community.

Michael Pigg McKay
PLEXUS/McKAY CORPORATION
Ann Arbor, MI

I am an independent telecommunications consultant focusing primarily on hospitals and academic medical centers, but with a practice that includes work on schools, correctional facilities, and industries. My work is divided fairly evenly among project design and specification, seminar presentations and course development, and new product development. I cover voice, data, video, sound, intercoms, nurse call, paging, radio, and other systems, within the limits of my customers' applications.

I believe that the most revolutionary development in the sound and communications industry in the 1990s will be the impact of widely available ISDN (Integrated Services Digital Network) facilities within buildings, within cities, nationally and internationally. Another very important factor will be the widespread availability of consumer priced, studio quality (in today's terms) digital audio tape (DAT) machines.

By the end of the decade, tens or hundreds of millions of people, worldwide, from teenagers to audio engineers will be able to transmit CD-quality 64,000 bits per second (64 Kbps) digitally coded audio as easily as plugging in a telephone at an available jack. No longer will the low-fi 3000 Hz local phone line at home or at work be an obstacle for music, spoken

word, or other long or short-distance audio communications. No more will original music suffer from multiple generations of copying.

The implications of this will reshape audio program distribution, copyright protection, remote recording and editing, desktop music publishing, the growth of new labels, and other areas of audio as much as or more than cable TV and the VCR re-shaped television in the 80s.

"The most revolutionary development in the 1990s will be the impact of widely available ISDN facilities."

One of the major effects of widespread digital audio transmission capacity and volume-priced audio components is likely to be a growing expectation of excellence in audio by audiences and customers in any number of present-day low-fidelity forums. By the end of the decade, background music, paging, intercoms, many telephone instruments, schools, drive-in theaters, sports bars, and so on will operate at a level of audio quality that will compare with today's systems like Carnegie Hall live compares with AM car radios.

Certain other trends are apparent, though not revolutionary. The near universal use of either personal computers or workstations and of flexible software for audio systems design, even for very modest sized facilities is less a forecast than a follow-through on an existing trend. Continued noise pollution and widespread

emulation of Japanese-style open office plans will encourage the growth of sound masking systems. In the U.S. there will continue to be a widespread shortage of talented people in the field of building systems. The domestic audio systems industry, by focusing on product quality, customer service, and manufacturing techniques will retake maybe a quarter of the domestic and international market share lost during the 70s and 80s, primarily to Japan. Korea, South Asia, Germany, China, and Eastern Europe will be growing sources of components, assemblies, and systems.

As always, the difficulties will be for manufacturers, contractors, engineers, and users to bridge the gap between the inadequate present and the uncertain future. Modular design, rational packaging, flexible raceway and cable distribution, quality power and grounding systems, and adequate provisions for closet and rack space will provide current systems breathing room for the future. These must be coupled with regular and frequent technology and price performance evaluations, careful attention to international design, and an uncompromising attitude on customer service.

Robert J. White
RISARALDA REGIONAL DISTRICT
Pereira,
Risaralda, Colombia

Here in Colombia we do mostly installations in 100 to 300 capacity churches, working with people whose only concept of sound is what comes out of a Sony home stereo.

We have worked with Bogen, TOA, and locally-made stuff of the home-made variety, so as to cooperate with the authorities that want local products. All microphones

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CONSULTANTS

are imported. We have worked with E-V 635-A, RE-11; Shure SM-58; and Uni-sound DM-1011.

We have difficulty getting Belden 8412 or equivalent. Many times substituting an inferior product imported from Taiwan.

I would like to see in the new year a cheap matching transformer equivalent to the Bogen WMT-1 that's UL-listed for a simplex telephone connection, a GOOD rechargeable wireless mic system, perhaps like the NADY 101/201 system, and another year of great ideas from Sound & Communications.

Ed Logsdon

DAVID L. ADAMS ASSOCIATES, INC.
Denver, CO

New equipment will become more and more modular to provide flexibility and easy expansion (e.g. IRP System 41, Rane "Flex Series"). Systems can be built in stages as the owners budget allows.

More features for less money will become "the norm" because of automated manufacturing processes.

Computer control is already here (e.g. Crown P.I.P. modules — IQ System, Rich-

mond Sound Design). What is needed is standardization of the modular equipment. Ideally, this "audio and control signal" bus would allow the designer to integrate various manufacturers modules into one system best suited for the application. Consideration should be given to compatibility with the proposed EIA home control bus as the differences between commercial and consumer equipment narrows.

Kevin C. Miller

DKM RESEARCH INCORPORATED
Catharpin, VA

The biggest change will likely be a steady growth in existing communication facilities such as teleconferencing, fax transmissions, and digital data links. This may be supplemented by any revolutionary improvements in this field as opposed to the anticipated evolutionary upgrades. There will likely be a gradual transition of most major businesses to increased reliance on the above noted communication methods with a comparable reduction in personnel travel, mail and similar package and courier services.

It is likely that arenas, auditoria,

churches, and similar structures will continue to be built and upgraded at a pace comparable to that in the 80's. The sophistication of equipment used in these facilities will increase due, primarily, to the reduced cost of this equipment. Board rooms especially those used for digital and teleconferencing links, will likely increase in number and the sophisticated equipment necessary for these rooms to properly function will become more available at reduced cost. Companies that design and install will likely remain similar to those in past years with some large, some medium and some small.

There will definitely be a continued increase in reliance on computerization of all aspects of business. Because of the increasing complexity of some systems, there will be a continuing and likely increasing need to involve manufacturers in proper application and adjustment of the sophisticated systems. If perfected, the greatest impact in the industry would likely be caused by the transporter system.

Thomas G. Bouliane
AUDIO AND ACOUSTICS
Boston, Massachusetts

I expect that the sound and communications industry, being a small market based in great part on entrepreneurship, will continue to evolve in unexpected ways. None of us can predict our professional future with certainty and any list of predictions will be more greatly influenced by the author's hopes than by any real prescience.

Not to let that get in my way, here's my list:

Overall Market Growth: Geographically quite variable and dependent upon local economic conditions. A point often lost on manufacturers.

General Product Changes: Much the same as in the 80's. Increased system sophistication with a dropping out of aging methods and technologies.

Market Segment Growth and Shrinkage: Driven by forces far outside of our industry — quite unpredictable by us mere technologists.

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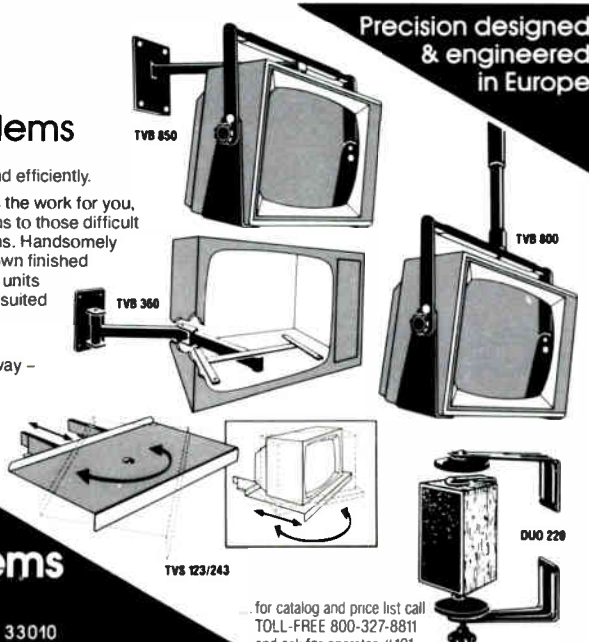
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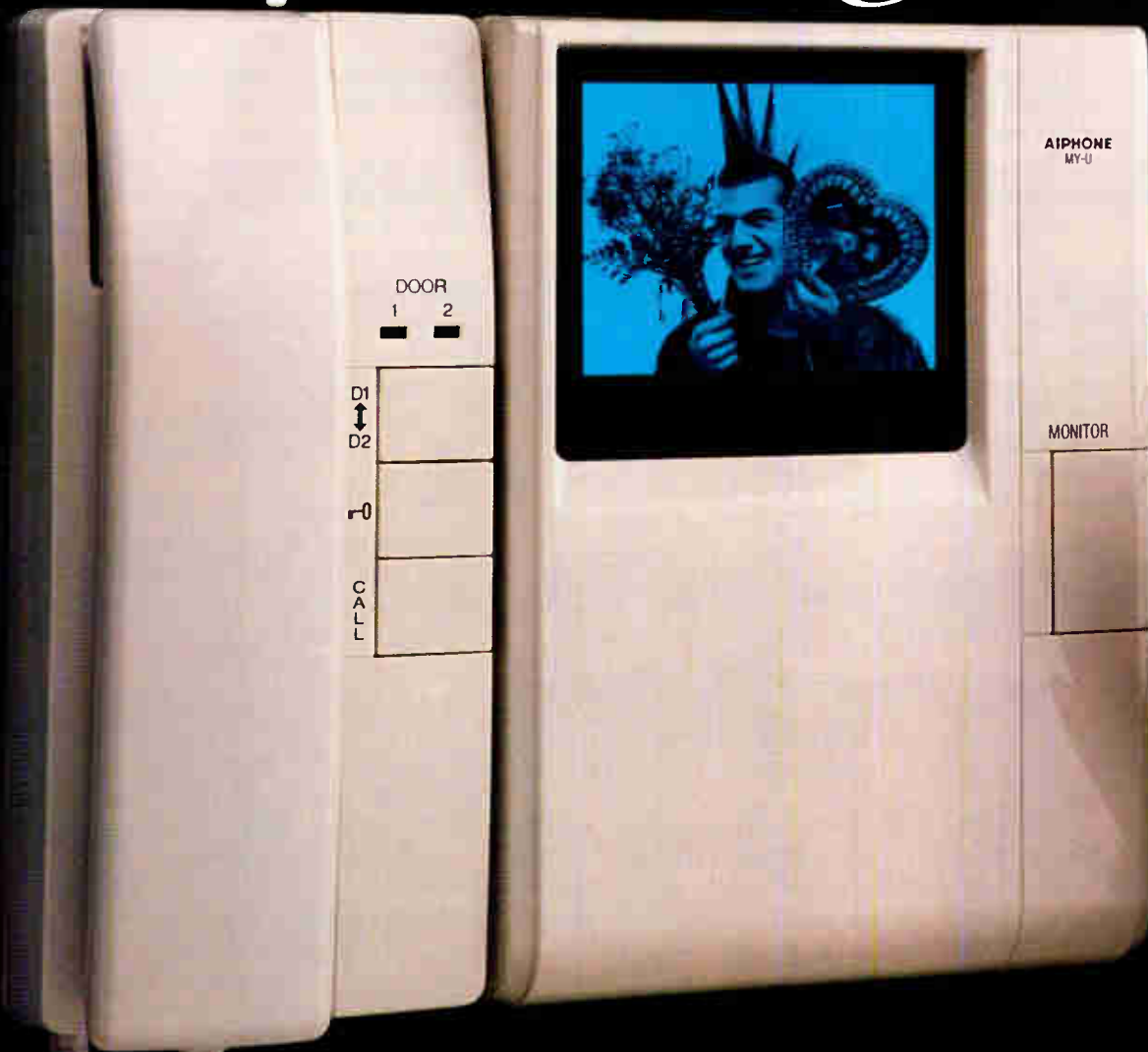


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companies in strong economies will grow, stagnant firms in slow economies will suffer and die. New small companies will be founded by expatriate employees of established firms which do not involve and reward competence and experience. As always.

Manufacturer Consolidation: Good ideas badly administered will continued to be gleefully absorbed by holding companies.

Mega-Consulting Companies: You gotta be kidding! As far as my field is concerned, no one goes into the acoustical consulting business for the money — and that's as it should be. Architectural and

operate as one-manufacturer franchisee on a D/B/A basis. He pointed out that this is the way the rest of the world operates (i.e. Philips and Siemens) and that this method has proven successful in this country for Simplex and Honeywell. That's all true, but I don't buy it. Not to say I won't protect this seer's name in case he wants to buy me out!

New Product Classifications: I've seen great contractor enthusiasm for modular, building-block subsystems. WE all know of TOA's success with their 900-Series. Altec and others have followed suit. Industrial Research's System 41, now that

“Architectural and electro-acoustics are each exceedingly minor fields in the larger scheme and enthusiasts consult because they don't know what better to do with their lives.”

electro-acoustics are each exceedingly minor fields in the larger scheme and enthusiasts consult because they don't know what better to do with their lives. Consulting, when properly done, requires close attention to the client's needs, perceived and otherwise, and overlarge firms cannot bring this intimacy to bear. Some firms will continue to grow, but not to their clients' benefit. Those consultants in these larger firms who sense they are not fulfilling their professional roles will leave to serve clients on their own terms. How nice.

Project Values: The industry will continue to offer products and systems of greater value and will ask its customers to pay for these improvements. And they will.

Contractor/Manufacturer Relationships: One well known manufacturer's marketing manager predicted in 1986 that independent contractorships will be obsoleted within five to ten years. He saw an increase in the Simplex/Honeywell approach whereby the manufacturer designs, manufactures, consults, engineers, sells, and installs his own systems. He felt that successful local contractorships would either be absorbed by the manufacturer or

it's a more complete package, is receiving great attention in the Boston area. I certainly expect more of the same. Also microprocessor control and monitoring of larger systems which are geographically diffuse. IED is charging ahead with both simpler and more comprehensive systems, FSR is getting a good bounce from their ballroom/meeting room control systems, and I suspect Crown will do well with their IQ modules. Looks like a trend to me.

Video and Multimedia: Visual presentation systems attract much different folk than do sound systems. I don't believe sound people will readily make the transition to video/visual systems — the magic just isn't there. But, since sound is perceived as such a minor element of multimedia systems; video/visual people will continue to attempt to be expert in all areas. They'll have only limited success, but their client base, simple souls interested mostly in money, will be insensitive to their loss. The video/visual people will probably win this one.

That's it, that's all you get. I hope that my predictions aren't any more ridiculous than most. ■

(continued from page 69)

distortion checks (with an external oscillator) as well as 2nd and 3rd harmonic distortion analysis. My first impressions with the system were positive and I have lent it to a few other users who have uniformly been impressed with its intuitive approach. While I would not select a system that most likely will have more than five years useful life on the basis of whether it takes only two days to learn or two weeks, a fast learning curve is quite appealing and will likely determine how many people within an organization can operate the system, a significant consideration. (Next month we will begin the first part of a two month review of the MLSSA.)

While many of these instruments are very exciting, most of us will sit in the Ferrari at the auto show, but visit the Honda or Ford dealer when we go shopping for a car. For most sound contractors who need a test system that is comprehensive and has high enough resolution to calibrate electronic crossovers and parametric equalizers, align speakers, set delay lines, yet costs less than \$8,000, right now there are only three choices: The Techron TEF 12, the Ariel SYSid + laptop computer, or the MLSSA + laptop computer. The Techron is the de facto standard and has the most complete capabilities, including polar plots, which the other two systems do not offer yet. A serious consideration is that the Ariel SYSid does not (yet) offer reverberation or RASTI measurement capability. The Ariel is easier to use than the TEF, but not as intuitive as the MLSSA system. The MLSSA does provide reverberation (RT 60) and STI/RASTI measurements, but does not provide swept (continuous) distortion measurements. I have not yet used the MLSSA and Ariel system long enough to make a firm recommendation, and ongoing improvements to all three systems' software can be expected. Furthermore, the functionality of all three instruments can be extended with the use of the new CD test discs from Prosonus and the NAB, or possibly with Audio Control's new and inexpensive function generator. If you are in the market for test gear this year, look forward to our in-depth reviews of the MLSSA and Ariel, with the Scantek and other analyzers to follow. ■

WHAT DO THESE PRESTIGIOUS AND DEMANDING SOUND INSTALLATIONS HAVE IN COMMON?

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GOLDEN NUGGET LA MIRAGE, LAS VEGAS, NV
HOLIDAY INN, VARIOUS LOCATIONS
HOWARD JOHNSON'S, CAMBRIDGE, MA
HYATT REGENCY, NEW ORLEANS, LA
HYATT ORLANDO, ORLANDO, FL
LAS VEGAS HILTON, LAS VEGAS, NV
MARRIOTT HOTEL, VARIOUS LOCATIONS
RADDISON PLAZA, MANHATTAN BEACH, CA
RITZ CARLTON HOTEL, LAGUNA NIGUEL, CA
SHERATON INN, VARIOUS LOCATIONS
WESTIN GALLERIA HOTEL, HOUSTON, TX

OFFICE BUILDINGS

A T & T, MURRAY HILL, NJ
CHEVRON DATA PROC. CTRL., SAN RAMON, CA
CHRYSLER CORPORATION, SOUTHBRURY, CT
HEWLETT PACKARD, FORT COLLINS, CO
LTV TOWER, DALLAS, TX
MOBIL OIL CORPORATION, HOUSTON, TX
SQUIBB, PRINCETON, NJ
STEELCASE, GRAND RAPIDS, MI

NIGHTCLUBS

BAJA BEACH CLUB, CHICAGO, IL
BOBBY MCGEE'S, ARTESIA, CA
HARD ROCK CAFE, NEW YORK, NY
HILTON - SYBIL'S NIGHTCLUB, NEW YORK, NY
LE CLUB, NEW YORK, NY

RETAIL STORES

AMEN WARDY, NEWPORT BEACH, CA
BLOCKBUSTER VIDEO STORES, NATIONWIDE
BON MARCHE, VARIOUS LOCATIONS
GUCCI'S, CHICAGO, IL
HOME CLUB, VARIOUS LOCATIONS
KIDS R US, VARIOUS LOCATIONS
NORDSTROMS, VARIOUS LOCATIONS
RALPH'S GIANT STORES, VARIOUS LOCATIONS
SAFEWAY SUPERMARKETS, VARIOUS LOCATIONS
VON'S MARKETS, LOS ANGELES, CA

CONFERENCE ROOMS

IBM, LOS ANGELES, CA
IBM, SAN JOSE, CA
IBM, ATLANTA, GA
MAZDA U.S.A., BUENA PARK, CA
MERRILL LYNCH, NEW YORK, NY
NASA - LANGLEY AFB, HAMPTON, VA
NBC, NEW YORK, NY
PENTAGON ARMY CONF. ROOM, WASHINGTON D.C.

RETAIL MALLS

BEVERLY CENTER, BEVERLY HILLS, CA
CAPITAL CENTER, WASHINGTON D.C.
CHULA VISTA MALL, CHULA VISTA, CA
FASHION ISLAND SHOPPING CTRL., NEWPORT BEACH, CA
GALLERIA UMBERTO, SEATTLE, WA
SOUTH COAST PLAZA, COSTA MESA, CA

RESTAURANTS

CAFE ROMA, NEW YORK, NY
CALIFORNIA PIZZA KITCHEN, LOS ANGELES, CA
CHILI'S, VARIOUS LOCATIONS
FLAKEY JAKE'S, VARIOUS LOCATIONS
PIZZERIA UNO, BOSTON, MA
RED BULL INN, PITTSBURGH, PA
RED ROBIN, VANCOUVER, WA

INTERNATIONAL

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HOTEL MERIDIEN CONCORDE, PARIS, FRANCE
HYUNDAI CANADA, CANADA
I.R.C.A.M., PARIS, FRANCE
IBM, TORONTO, CANADA
IBM, SAUDI ARABIA
JOCKEY CLUB, HONG KONG
MCDONALD'S OF CANADA, CANADA
MINISTRY OF DEFENSE, ROME, ITALY
PALACE OF THE KING, SAUDI ARABIA
STOCKHOLM CITY THEATER, STOCKHOLM, SWEDEN

SCHOOLS

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LOYOLA COLLEGE LAW SCHOOL, LOS ANGELES, CA
MEMPHIS STATE UNIVERSITY, MEMPHIS, TN
UCLA ROYCE AUDITORIUM, LOS ANGELES, CA
UNIVERSITY OF CALIFORNIA, DAVIS, CA
UNIVERSITY OF HOUSTON, HOUSTON, TX
UNIVERSITY OF RICHMOND, RICHMOND, VA
WASHINGTON STATE UNIV., SPOKANE, WA

CONVENTION CENTERS

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BOISE CONVENTION CENTER, BOISE, ID
OREGON CONVENTION CENTER, PORTLAND, OR
PALM SPRINGS CONV. CTRL., PALM SPRINGS, CA

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KNOTT'S BERRY FARM, BUENA PARK, CA
NBC STUDIOS, NEW YORK, NY
PORT OF MIAMI, MIAMI, FL
S. S. AZURE SEAS, MIAMI, FL
SAN FRANCISCO AIRPORT, SAN FRANCISCO, CA
SEA WORLD, SAN DIEGO, CA
THE WOODLANDS RACE TRACK, KANSAS CITY, MO
THISTLEDOWN RACE WAY, CLEVELAND, OH
WALT DISNEY/PLEASURE ISLAND, LK BUENA VISTA, FL

THEATERS

BUSCH GARDENS, WILLIAMSBURG, VA
GREEK THEATER, LOS ANGELES, CA
HOLLYWOOD BOWL, HOLLYWOOD, CA
PHANTOM OF THE OPERA, LONDON
PHANTOM OF THE OPERA, NEW YORK, NY
PHANTOM OF THE OPERA, LOS ANGELES, CA
RAVINIA MUSIC PAVILLION, CHICAGO, IL
SEA WORLD, SAN DIEGO, CA
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INFOCOMM: An Overview

By David J. Ripp

Infocomm International, held in Anaheim in January, is a show that seems to keep getting bigger and stronger. Even with many changes, in what might be termed the standard audio/visual business, growth is quite prominent, with many new products and technologies being shown. This show in past lives was known as the NAVA Show and then COMMTX, which was very easy to confuse with COMDEX (the big computer show), and has grown in maturity, in strength, and in diversity of products being displayed.

Infocomm is fast becoming the main trade show for a new breed of dealers, who must be more than just the standard audio/visual dealer of yesterday. They must now deal with many audio formats like CD, DAT, and MIDI, as well as the requirements for very high quality audio playback and voice reinforcement systems required for today's conference rooms, boardrooms and presentation systems. On the video frontier, diversity grows as it becomes evident that an alternative to the standard NTSC format, known currently in broadcast TV, is needed. HDTV (High Definition TV) production and playback equipment was shown here as a finished product, proving it can be done and with great advantage over the standard format.

There were also the Hi-Band 8, SP U-MATIC (3/4-inch) format, Interactive Laser Disc Systems, and the Component video formats of M-2 and BETACAM, all competing for the dealers' and customers' attention.

The most aggressive part of the show centered on the degree of computer integration that is now involved in today's audio/video support equipment. Com-

puters are now used as inputs, for display on large screen displays, to control every type of equipment from slide shows to monitor walls, and now, to even program the very sophisticated control systems used in these high end systems. Other uses include aligning and setting up video projectors to display the end results of a presentation system. Computers are filtering down to technicians and service techs in the field who will have to carry a laptop computer to service or set up standard equipment.



Sony PVM4300 43-inch monitor.

HIGHLIGHTS

The amount of audio equipment shown at Infocomm seemed to be up compared to past years, but is still nothing like the NSCA or AES shows. High quality audio is starting to play a larger part in the overall audio/visual picture. Samson Technologies and Apogee speakers were among the first-time exhibitors at this Infocomm.

There were three audio product lines that stood out to us as providing some strong and unusual products for this business.

Anchor Audio, Inc. displayed several versions of wireless and wired portable

sound systems which have very good audio quality and very good portability. Most are battery-powered, or they can be plugged in when the need is there.

"The Whole Gang Is Here" was the slogan of Industry West Electronics of Utah. They were showing a whole array of audio system interface plates and some unusual amplifier and control combinations that fit in a 3-gang switch box. It is a neat line of the extras that can make a system's design and installation go very easy.

In the remote system control arena all the major contenders were presenting new systems with a more integrated approach to control, especially when it comes to controlling all the IR and serial interface requirements for today's equipment.

Within the video products category there were many areas that could be examined.

The new generation of high-band still video equipment has finally achieved the level of quality to make it a viable player in the presentation market, and several companies were exhibiting still video products.



Sharp XV-100 portable LCD projection system.

Large screen presentation monitors were to be seen all over the show floor. Sony showed its 43-inch Trinitron tube with built-in IDTV (improved definition TV), which was awesome, as awesome as

(continued on page 86)

David J. Ripp is Vice President, Sales and Marketing of Allied Telecommunications.

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Walking the Aisles at Infocomm

InfoComm is a mixture of the old and the new, the low tech and high, old friends and new. With over 10,000 people and 300 exhibitors in attendance, the Anaheim Convention Center, while not overflowing, lent a mood of the upbeat to a field that is more and more involved in the wave of the future. The mixture of products and personnel was complex, with many of our consultant friends roaming the aisles looking for new products to spec for boardrooms, along with curriculum heads searching for new lesson plans.

The show, sponsored by the International Communications Industries Association, features what the organization calls "communications technology." And that's what these products are — from slide projectors to data screens; from transparency supplies to the latest in still video and video editing, these products are for communications. Sound products have never been highly visible at this convention; and it's a common remark to focus on the lack of interest the end user of these "audio/visual" products has traditionally exhibited in the audio for their projects. That may be changing, however. Companies such as Apogee, Samson Technologies, Lectrosonics and others were showing their products and collecting leads. Increasingly, we're hearing of the increased interest in the audio quality of presentation rooms.

Sony hit off the show with a morning press conference to introduce its visual database software and a laser videodisc player. The visual database is particularly attractive, according to Sony, to law enforcement agencies and advertising agencies. The software is based on the PCM Inc. package "PC Album," which retrieves still images from a hard disk drive. The new program enables users to catalog motion sequences and still images from an optical disk. It requires only a single screen or monitor for display. The

new CRVdisc player has high speed search and frame memory. Sony also showed, in addition to its 43-inch Trinitron, a new 13 inch MultiScan monitor, a 32-inch monitor,



At Lectrosonics' booth, designer Mike Sims shows off the MAP automatic mixer and LCA16 Logic Controlled Amplifier.

a Video Hi8 recorder/player and desktop editor, among other products.

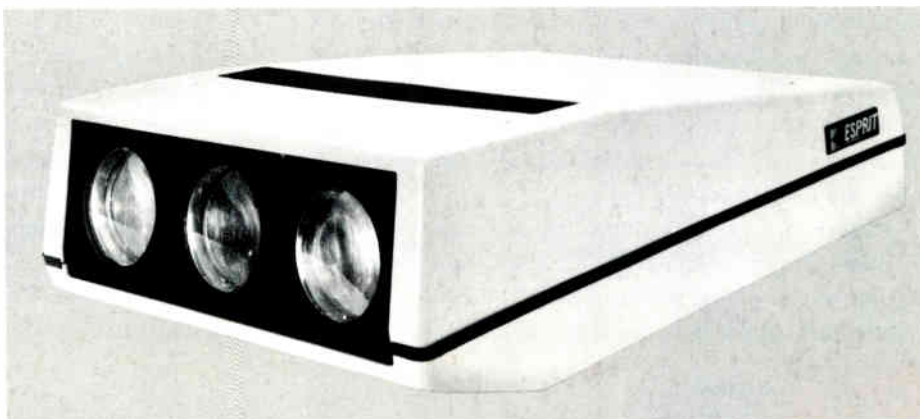
As for audio products, Lectrosonics' LCA 16 Logic Controlled Amplifier powers up to 16 speakers and attenuates any combination of these in response to microphone activity. As the company ex-

plains: "Microphone number 1 is underneath speaker A and near speakers B and C in a conference room. The LC16 can turn off speaker A and lower B and C whenever microphone 1 activates through an automatic mixer. All other speakers in the room remain at normal volume." The company showed its Modular Audio Processing system offering automatic mixing, signal processing and wireless technology in a modular package. I.T.S. showed its line of products, featuring Brahler, for simultaneous translation services, a specialized application requiring specialized product according to the company. Interpreters work 20 minutes on and 20 minutes off — and they'll walk off the job altogether if they have less than what they feel is optimum reception.

360 Systems showed the Model Am-16/B Audio Crosspoint switcher. Features include balanced inputs and outputs, user selectable 16 x 16 mono or 8 x 8 stereo operation, and MIDI interface capability. Audio routing configurations are stored in nonvolatile memory.

Teac and Tascam had booths across the convention hall from each other, with Dave Oren of Teac demonstrating the company's 12-inch videodisc recorder, and Bill Mohrhoff of Tascam showing a variety of boards.

(continued on page 87)



Gretag Image Systems' Esprit.

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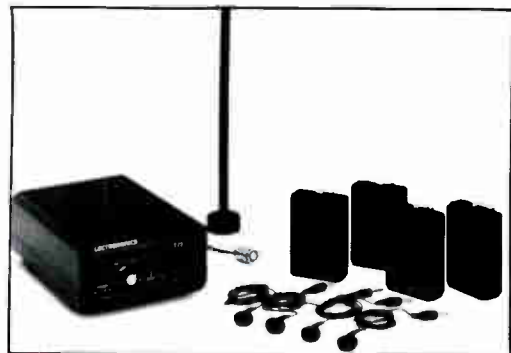
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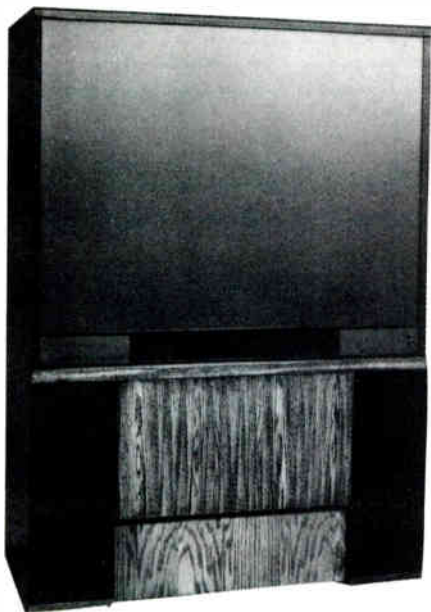
World Radio History

(continued from page 82)

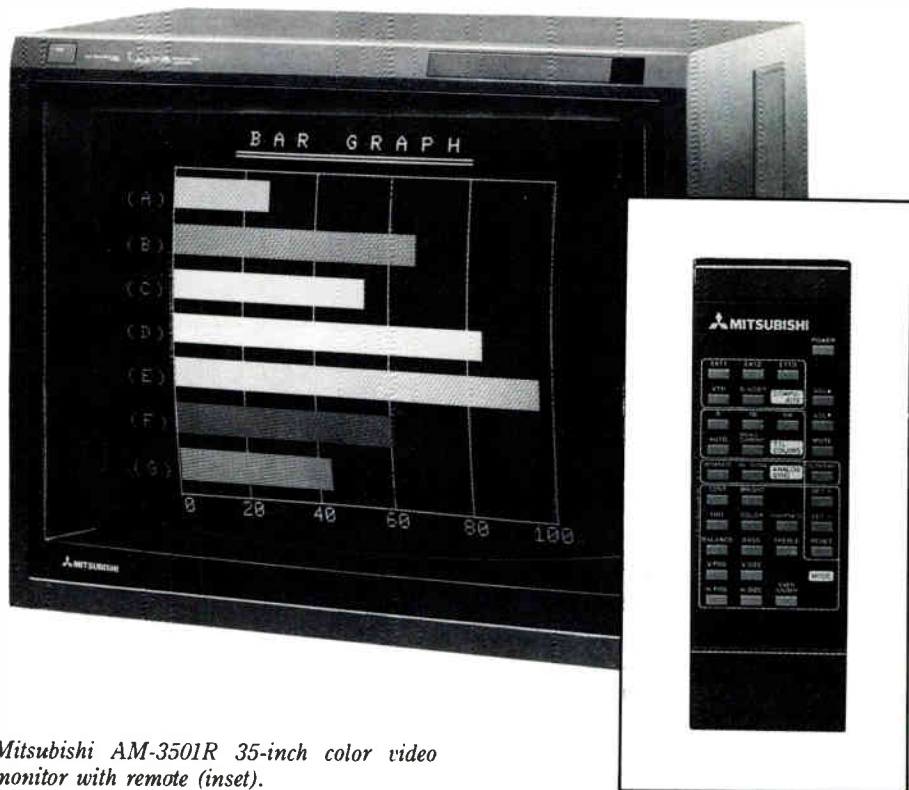
it would be to haul around. (How would you rental folks like to haul this one at almost 440 lbs?) NEC Technologies, Inc. had a full line of good looking Datasmart monitors that not only did video very well, but also scan doubled (IDTV) video and most computers on up to a 30-inch screen. Mitsubishi Electric and Barco, Inc. both presented large size monitors that looked great on both video and data and should take over in the small meeting room environment.

No one could attend Infocomm without being very interested in or at least curious about the Shoot-Out. The Shoot-Out has become quite an event, and offers an excellent way to do a very detailed comparison of all levels, types, and price ranges of projectors. I did hear the comment that the Shoot-Out was the primary reason for coming to the show. The Shoot-Out type of subjective viewing environment could mislead the uninformed viewer, by not understanding what they are looking at on the screen. But that image on the screen, well evaluated, is what really counts in the end result.

The new kids on the block that really seem to be coming on strong, are the LCD



AmPro 60-inch VideoBeam RetroGraphics Console.



Mitsubishi AM-3501R 35-inch color video monitor with remote (inset).

video projectors. Sharp Electronics and Eiki Audio/Video Products both have products that are single lens systems with simple zoom and focus that are very simple to set up and operate and produce a great picture.

Presentation Electronics and nView Corporation have very unusual wireless remote control systems for computers. The Presentation Electronics Silent Partner will work either as a direct keyboard plug-in or as a serial device, and offers a simple programmable remote control system that can perform individual key functions or whole macros. The Toteboard from nView is a complete wireless, small footprint keyboard. The infrared receiver also connects to the keyboard or serial port. This is the answer for those who like to wander with a full keyboard at one's finger tips.

The world of computer interfacing (the splitting and matching of computer signals to the standard RGB/S format that most projectors and monitors need to see), has grown into quite a competitive battle. Extron Electronics has produced a universal interface that, with the correct cable, can connect to almost any computer, but looks

like a Boeing 747 with all the knobs, switches and dip switches that can be flipped and adjusted.

On the other hand, Inline has gone the other direction to make interfacing simple; with very few user controls, it's all automatic. They must be doing something right. Inline was awarded 1990 manufacturer of the year from ICIA. Then there is Covid right in the middle, but it is sure a lot easier now than it was several years ago.

HDTV (High Definition TV) has been making quite a stir in the industry. Is it really going to happen? When will it be available? When will the standards be finalized? These are all questions to which I do not have definitive answers. But, this I do know: everyone who has seen HDTV thinks it is great. The demo of two systems made quite an impression on those who visited during Infocomm.

Those attending this year's Infocomm saw fewer film-based products, in favor of the video formats, which will continue to get stronger. Times are changing, and going to shows like Infocomm is one way to stay abreast of new products and get an overview of the industry. ■

WALKING THE AISLES

(continued from page 84)

Telex was popular with its transport control and cassette duplicators, along with its wireless mics and new aerobics mix. Anchor Audio showed its new Liberty 4500.

Paso's booth showed some popularity for its compact music system. The company also introduced speakers that can be ceiling or wall mounted easily.

The remote control people were out in force. York Controls showed its Masterline Media Control System, with applications in both commercial and residential work. Using LAN technology, the system can automate up to 250,000 functions and is controlled by a system master which controls up to 256 equipment interface modules. Control panel options include electroluminescent graphic control panels, two way wireless remote with feedback and pushbutton panels.

Crestron showed its Vidmux Crosspoint Switcher which accepts both RGBS composite and S-VHS sources. The modular design can be interfaced to MSDOS compatible computers via the RS-232 port.



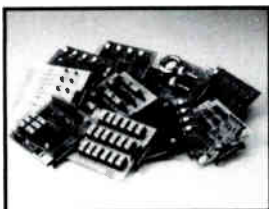
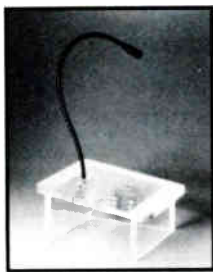
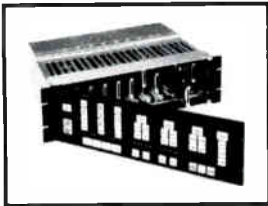
Barcographics 800 computer controlled projector.

ASCII commands are used; and a LAN control connector is included. A rack-mountable enclosure houses the power supply.

AMX's AXCESS Control System assigns a card for every device to be controlled. The cards can be custom-defined and are priced uniformly "so it's easy to spec." says the company. The master control card features the Motorola 68000 16

bit processor and up to 128K of memory. It coordinates up to 255 devices.

Display systems created heavy interest. In addition to the giant Shoot-Out in which screens should be seen ranging from a few thousand dollars to hundreds of thousands, many exhibits were crowded with viewers of new products. Gretag Image Systems introduced the Esprit 1700 and 2000 large screen video/computer graphics display



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systems with simplified remote convergence. The dual function remote permits set up of up to 32 dedicated channels, and RS-232. The light output is 600 lumens.

Barco showed a computer controlled graphics projection system called Barcographics 800, which, through software, provides PC control of all settings for up to 256 projectors. Up to 90 sources can be accessed easily with the addition of the Model RCVDS 800. Setup configurations can be archived on a disk and retrieved later. Barco also exhibited a new MultiData family of monitors with "autolock technology," and presented an HDTV demonstration.

Dukane's exhibit concentrated on the company's audio visual products. Introductions included the MagniView 800 Data Projector, the Model 663 overhead projector, and the MagniView 200C LCD computer data projection panel with new features allowing users to project PC text and graphics in eight shades of simulated color.



Sony AV-C-D7 monochrome camera.

With computerization of displays, more peripheral materials are needed. Covid announced the release of the EZPIX computer video interface to connect data projectors and monitors to a PC and which has no switches, additional cables or adapters. It has a digital frequency centering function and LCD scan frequency readout. Covid was also showing its 123 S-VHS interface.

Sayett Technology was exhibiting after its recent sale by Eastman Kodak to the Sayett management. Among their products were the Datashow HF/MP projection pad and the Smart Remote.

AmPro introduced two large screen projectors providing 1200 lines of resolution. The VideoBeamGraphics are priced at

\$14,900 and \$19,900. They are finished with furniture cabinetry, are available with a curved screen, and are designed to be used in "normal ambient light conditions."

Hitachi Denshi showed its multi-scan system. Cel showed its eight bit 4:2:2 digital effects. Mitsubishi exhibited its video copy processor. And InLine's Scan Mate 6950 was one of the niftier products of the show. Held up to a screen, the Scan-Mate automatically exhibits the horizontal frequency of the screen.

The future of videodiscs was apparent at the Pioneer booth, where various videodisc players were on display, along with a demonstration by ABC News Interactive that showed how videodiscs can be used to optimum advantage using random access and other capabilities. ABC's new Martin Luther King videodisc set is designed for schools, but in its design incorporating full motion video, full text (of speeches, etc.) and computer capabilities which allow a teacher to format and print out customized lesson plans, the program showed the videodisc potential for industrial communications.

New media were common at the show. Panasonic had a large booth showing, among other products an S-VHS digital AV mixer, DAT, a CD changer, and electronic still image equipment (according to the company, a good seller with law enforcement people). Sony also showed still image video equipment, along with vhs recorders. Mitsubishi exhibited video copy processors. Sharp also showed its DAT, along with a Tascam amp and Anchor speakers. The Britannica was there on CD-Rom.

Videonics exhibited its ProEd editing system with built-in "video computer," which controls two editing VCRs and creates titles, graphics and special effects. Luxor showed a new line of TV and computer tables, in both steel and polyethylene. Hamilton Electronics introduced what it is calling a "classroom CD player." The Model 200 has a built in amplifier, so it can interface with other music sources. Gentner was showing a digital hybrid for teleconferencing.

The tape manufacturers were showing a range of sophisticated products. Maxell showed its D-2 format tape along with other products. 3M emphasized its DAT tape along with 4:2:2 digital and S-VHS.

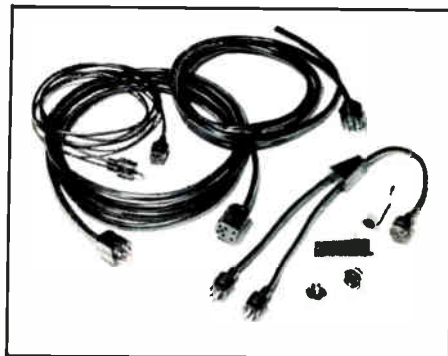


Luxor Mobile furniture model EA-34D

Ampex informed us that the military is buying its digital tape.

Schneider showed its lenses and slide projectors (yes, they still exist). Alpha Audio was doing a good business selling Sonex to schools. RMF introduced a new line of audio visual cables including molded connectors and projector remote control cables.

Infocomm in general proved to be a valid display of communications equipment of a niche unavailable in this kind of focus at other conventions. Since this show is open



RMF Products audio visual cables.

to end users, it's informative to connect with the vision of the business that they are seeing. By the end of the first day, attendance had reached beyond 9,200 — more than the total of last year's show in Dallas (admittedly hampered by an ice storm). One can only conclude that the communications field will continue to grow.

—Judith Morrison

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3D SOUND: A SYMPOSIUM

Crosstalk, a series of televised symposia on subjects of interest to AES attendees, was produced by Testa Communications, publisher of Sound & Communications.

The following is an edited transcript of the second symposium held at the 87th AES Convention in October. The subject was 3D Sound. The moderator was Vincent P. Testa, president of Testa Communications. The participants included: Robert Schulein, General Manager of the HTS division of Shure; William Martens, Vice President of Auris Perceptual Engineering; David Gray, director of the film division of Dolby; Dr. Elizabeth Cohen, principal consultant for Charles Salter and Associates; and Tomlinson Holman, Chief Technical Director of Lucasfilm.

TESTA: Spatial imaging, 3D Sound. Elizabeth, can you define for us, if you will, your idea of 3D Sound.

COHEN: Well it's the accurate and natural reproduction of a spatial image. I think that is my major concern.

TESTA: Is there any set criterion for establishing this spatial image?

COHEN: Yes, you want to be able to have control over direction, distance, depth, imagery, motion of the sound source, the character of the environment, such that it's not necessarily controlled by the reverberant soundfield. We create environments now, pretty much solely by using digital reverb and that adds a timbre, a coloration to the sound source and the listener, thinks, "Hmmm, something's wrong with this picture or aural image."

TESTA: Is there a difference between 3-D imaging as described and surround sound?

GRAY: I would say yes and no. I think that there is a certain element of a 3-D type of sound involved in the Dolby stereo process or Dolby surround process, a matrix and coding type process, whereupon you have a visual image, and you can create a soundfield to go with that image.

You also have the capability of creating something totally different from what the image is showing to you if that's the creative choice that the director or producer wants to make. And you can create depth and illusion courtesy of that. But, I think there are types of sound, necessarily, that could be classified in a 3-D type of vein that do not involve, necessarily, matrix and coding techniques.

COHEN: I think there are two points there. One is to give the artist control over the spatial dimension of sound, and the other is that current surround and development technologies are really derived technologies, and what 3-D sound offers is a chance to take care of, or to use, the binaural capacity of the auditory system as a partner and creation of the illusion.

MARTENS: What we want to do in 3-D audio is create an illusion — a spatial illusion over loudspeakers. And we want to try to recreate some of the experience that a listener might have if he were listening to a sound that was in the room with him. So we want to create natural-like spatial imagery. But the point is, we have do it via creation of auditory illusions or spatial illusions. And so what we're all after in 3-D audio processing is to try to recreate, somehow, the experience of either being there, or being surrounded by a soundfield, or being immersed in a soundfield with sounds all around us. We want to have images of sounds in space, not necessarily sounding like they come from loudspeakers, but sounding like they come from where an artist says they should come from or having music come from where the music producer wants the music to sound for a particular emotive effect. That's the sort of thing we're after.

GRAY: I think we should point out though that there are still two types of situations. A visual image along with a sound field can be radically different from what a sound image can be with no visual

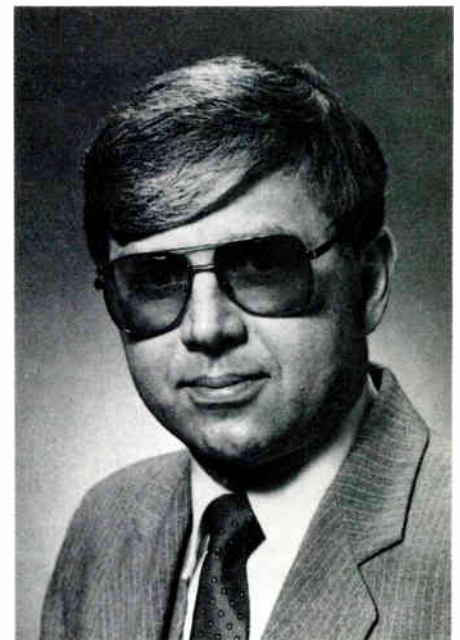
image associated with it.

COHEN: You had that problem with the surrounds in the theaters.

GRAY: I don't mean it's the problem.

COHEN: Or there's the conflict of localization when you see a surround speaker, yet it is supposedly providing you with information.

SCHULEIN: We're really talking about two types of things. One is an end result, a better reality. The sort of thing that David is involved with and that our divi-



Robert B. Schulein, Shure.

sion is involved with really has a lot to do with giving some new tools to the creative person. In other words, effectively you have two more channels to deal with, and given that, the creative options get bigger. And some of the other techniques aren't even asking for more channels — for example, dealing with an existing two-speaker reproduction technology. So, we've got tools on the one hand and then we've got sonic objectives. Elizabeth, you're talking about perhaps the reality of

real spaces, whereas when we get into a picture with sound it's not necessarily reality, it's something that people think is right for that particular picture. It could be backwards for example to make a point for the film.

COHEN: I don't disagree with you at all. And I also think that 3-D sound technologies are certainly viable. One of the reasons they're so convenient is they will work over conventional two-channel speakers.

HOLMAN: I'd like to talk about the idea of there being production on the one hand and reproduction on the other. For film sound, the artist has made a product for you to view and we would like you to view under the conditions that are most like he made it, as possible. After all, you wouldn't go into an art museum and look at paintings under mercury vapor light. You

would look at it under light that was like the light the painter painted it under. Well, this is the same reason we need standards that are currently in very widespread use in film sound, carried across into the home. This empowers the artist to position sound in the 3-D case and all other factors as well such as loudness, localization and spectral balance. All these factors need to be carried into the home.

TESTA: Let me ask you, who would set those standards on the production side so that there would be compatibility on the consumer side?

HOLMAN: Well, standards exist for the theater environment. Very strong ones. I'm involved in carrying those across into the home and doing things like calibrating the sound pressure level. Something very simple. That gives the same impression at home that it did in the dubbing stage. To tell you what is the loudness of this piece of program material. Now, anything else, such as recreating an acoustic space, I think is valid so long as it's about extracting what's in the recording itself and reproducing it spatially correct. But adding a second hall is to my way of thinking a bad thing to do. You're listening to Carnegie Hall through Symphony Hall. This doesn't make sense to me.

COHEN: That's why reverberators as they are right now sound so bad. Because very often it imposes that signal.

SCHULEIN: I think it's important to

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bring up a point here, and that is there's a lot of talk, in particular in the consumer marketplace, about surround sound technologies. I like to use the word recreative versus creative. Tom has been talking about a recreative, where it was produced to be played back one way and then properly recreated, whereas there are many processes that are being talked about that are the creative type. That is, you the listener can now play a part in making it whatever he thinks makes sense. It's a totally different type of thing.

HOLMAN: It's different program material. I think that's fine for say interactive video. You were putting the person in the act. But for media film sound, I think that's a mistake.

TESTA: I think that also applies better to audio-only situations. I think that point is well taken. You believe to remix or to relisten to a concert in the hall that you might *want* to hear it in is totally different.

SCHULEIN: And I think that we have to recognize that the general consumers or end-users are looking to be entertained, and not having to work at being entertained, so these techniques that are designed for encoding and decoding, that are complementary, and designed to work with each other are the solid ones that are going to last in a merge.

GRAY: I think that all these systems have limitations and all the equipment has limitations and use set standards, so that hopefully the limitations become as non-existent as possible courtesy of the *standards*. So if you're going to make a movie-of-the-week or a TV show or whatever the case may be, and your delivering medium is going to be video, you should know well what the dynamic range capabilities of that medium is and what the headroom capabilities are. Very often standards develop in that kind of sense because of the restrictions of the format by which their being delivered.

TESTA: What about sound for video? Where's it going?

SCHULEIN: I think there's an important observation to be made. How's the technology helping all of this? The audio

technologies that are emerging professionally and in the consumer area are very robust in the sense that they maintain very good amplitude and phase integrity between two channels, which means that a lot of the techniques that we're talking about here — be it for two speaker listening or matrix or coding — can be successfully transmitted to the consumer. And we couldn't do some of these things 10 years ago.



Tomlinson Holman, Lucasfilm.

HOLMAN: Something's that's very important for audio accompanying images that isn't so important for pure audio is the fact that sound images locate with picture images on the screen, but as soon as you have sound localization off the screen you're tempted to look at it. And what are you looking at? A loudspeaker. Suddenly the illusion is all broken.

GRAY: My personal opinions of MTS stereo for broadcast use aside, being a two channel system basically left it inherently lacking in capabilities. A 3-D and surround matrix encoding allows a very large amount of software to go with an image with it that is improved from the image of a traditional two channel system. Furthermore, it also gave a wonderful situation in that there was a ton of software available that could play quite well in the home if the proper equipment came out on the market.

COHEN: One thing we haven't talked

about is the live performance aspect of these systems and I think there's a lot of room for creative acts with this type of system — with a 3-D sound system.

HOLMAN: Why not make a space which is acoustically inert and add in any sound that you want? We tried to do this in movie theaters by making them relatively dead and recording everything we want on the sound track. Likewise in live theater the new techniques such as Bill is involved in could even enhance these properties.

MARTENS: There are a variety of technologies that enhance spatial imagery, enhance 3-D auditory imagery in effect and could be used in live situations just as well as they're used in the home. The same principles apply. In fact, what you're after is to be able to place sound in a space that you've designed. And the problems with large space reproduction, of course, are different from the problems of small, home spaces. Yet there's technology coming available that will improve spatial imagery in all these different arenas. In effect the problems are different because of listener position sensitivity of all these different systems. It's a big problem with home systems just as it's a big problem with the live or theater sound, and the real point is you actually have to attack the problem differently with a different technology in each case.

SCHULEIN: I think we should make some things clear. The fewer number of speakers involved with the reproduction makes it more difficult for the thing to be robust. If you want a sound to come from *there*, you put a speaker *there* and it's kind of hard to not hear it come from there. And the sort of thing that Tom was eluding to regarding the home is something we've been involved in, techniques to make this whole thing more robust in the home or for the production environment so that you can move around in reasonable areas and still maintain the spatial integrity of the whole thing.

TESTA: What about price? How far away is this and at what price is it to the consumer or even to the theatergoer?

GRAY: From a surround standpoint,



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they're available in a very large number of products. I think the cheapest decoder on the market right now is about \$200, all the way up to the thousands.

SCHULEIN: Perhaps talk about the compatibility tied in with this which is a key thing to make it acceptable. That matrix type process that David and I have been involved with lends itself to a growing consumer market in the sense that you're not really hurting the single-speaker listener or the two-speaker listener.



William Martens, Auris Perceptual Engineering's Vice President.

TESTA: Do you see a time when we'll have, in the home, real theater, not the matrix type systems, but extracting exactly what the director and producer wanted.

HOLMAN: From encoded software today, it can be done. It is done. From unencoded software no one knows quite yet how to do it. From the bulk of recordings in the catalog, how do we extract spatial character? It's not present in the original recording.

COHEN: When you have a microphone, it's not picking up the reflections of the reverberant field or the early reflections, so it doesn't get the same information that your ears do.

HOLMAN: I'd like to point out that there's one line — a continuum between localization on the one hand and envelop-

ing soundfields on the other. That line is very important and very fine. In work I did at Advent in 1974, I was experimenting with these two kinds of soundfields, that which gives you the sound image and that which gives you the sense of being immersed in a space. And I found even plus-or-minus one dB adjustments of the balance between these two was very critical as to whether you heard a sound image, or if you were swimming in a sea of reverberation. That's a very interesting area. Bill has done more with that.

MARTENS: I'd like to add to that, that current technology allows you to create that sense of envelopment very nicely. There are ways of processing sound to really surround the listener. Regardless of where the listener sits in that space he gets some sense of surround. The area where we need some new technology is in providing clear focused localization of sound sources at any position that we'd like in space, that's equally insensitive to listener position. And that's what's really missing in the field right now. You can't really move a single focus sound image out away from the loudspeaker to the side, above your head.

HOLMAN: I agree completely with Bob on this. My idea is — if you want everybody to hear a sound coming from a place, put a loudspeaker in.

MARTENS: It's certainly not the only way and it also perhaps not as robust as some technologies. For example, if we adopt the standards that we are suggesting for multi-channel reproduction that is transparent, and we can rely on, then an artist or producer can actually place the sound wherever he wants in that space.

SCHULEIN: The thing that the consumer is missing is a sense of controlled spatial reality. We're not use, to this — as consumers in our entertainment. Everything has kind of been flat out front or whatever it might be due to the construct of the room and speakers — fixed and nonmovable. But when you have the ability to do this spatial recreative stuff, it's thrilling. As the scene changes or the music changes, you can be in one space and then another, and that's magic.

GRAY: I think that in the consumer market, the type of equipment that's going out there and the ways that we give them to align it and to calibrate it and to make sure it's right is actually extremely important. I've done thousands of motion pictures at this particular point and hundreds of television shows and the single biggest question from a director or a producer is, "How screwed up is this going to get in the medium I'm going out on?" The more that you can provide the creative community with a guarantee that it will be played back the way they heard it when it was mixed, the better off we're going to be. In film right now, we've come a long way in that situation and theaters are pretty good. I think in the consumer end there have been good starts, but that needs to continue on — because at that point, you will see more programming. Until that moves along and there are more units, etc., producers and directors will say, "Well, I'd rather sort of stay in two channels — it's safer — or I'd rather go in mono because I know what I'm going to get."

"The more you can provide the creative community with a guarantee that it will be played back the way they heard it when it was mixed, the better off we're going to be."

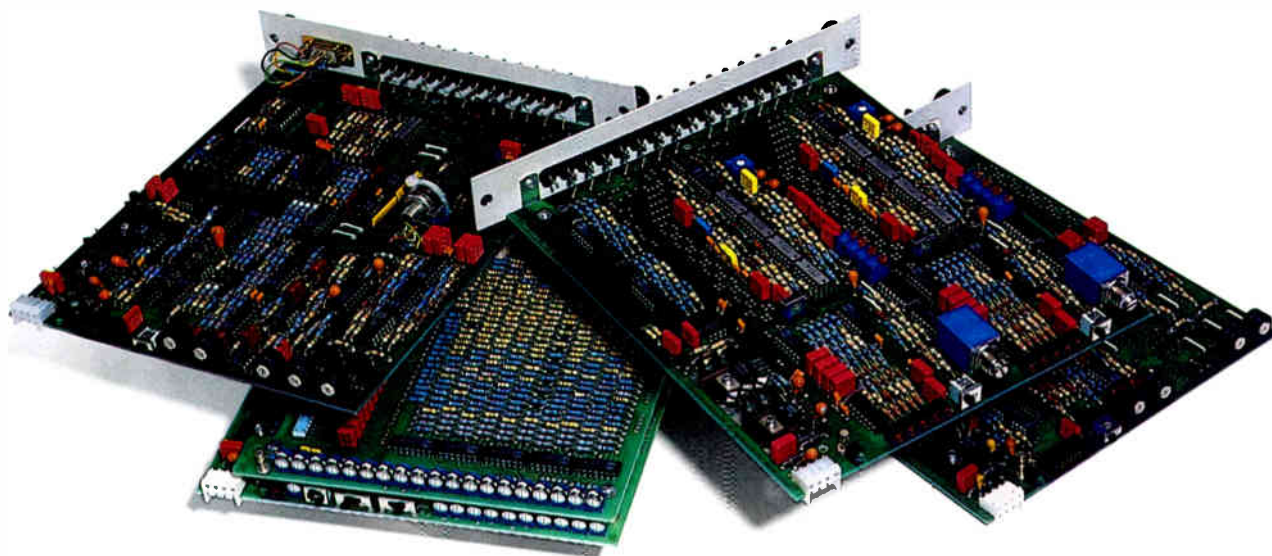
COHEN: I think that it's very important to establish criteria for these sound systems in terms of control over distance and direction, front-to-back imagery, and also something we've neglected to talk about — the acoustics of the actual listening environment itself. The room acoustics.

TESTA: Maybe next year. I'd like to thank all my panelists for being here. This has been Crosstalk at the AES show in New York. ■

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(continued from page 36)

& Kinsella, Inc. (Wednesday)

David Marsh has divided this seminar, quite logically, into two parts: Indoor Sound and Outdoor Sound. He will explain basic sound system gain calculations, how to achieve the needed amount of gain, the inverse square law, room acoustics, how to calculate reverberation times, and other topics, stressing fundamental design principles. Using design examples (both successful and unsuccessful, indoor and outdoor), he will demonstrate streamlined, accurate ways to determine where to position speakers and microphones.



Christopher Sowden, Associate, The Joiner-Rose Group, Inc.

WIRELESS HEADSET PRODUCTS

Jeff Peters,
Pro Audio Sales Manager, Telex Corp.

(Wednesday)

Until quite recently, two-way communications intercom systems have had a reputation for being expensive and user unfriendly. Telex's Gary Fisher sees wireless headsets as new product that can provide sound contractors with high sales and profit potential. The seminar will go into depth on ways to use and promote this fairly new equipment, focusing on the critical issues of: how to work with the customer and this product; new applications; and where to sell it.

From the EXPANDED EDUCATION PROGRAM Thursday & Friday, April 19 and 20:

MUSIC DISCO SYSTEMS

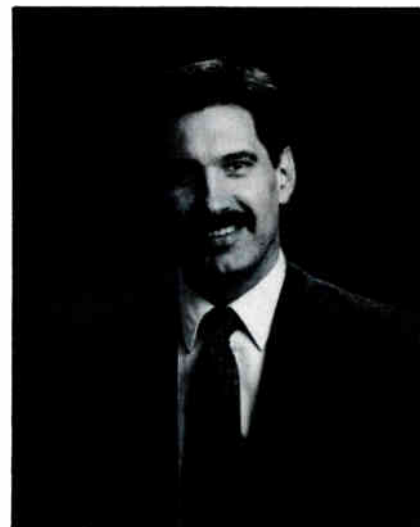
Mike Klasco,
Sound & Communications;
Menlo Scientific (Thursday)

An underground New York after — hours, cabaret phenomenon that boomed into wider entertainment industry use in the 70's, the multiple pre-recorded format/playback mixing console system is now the standard sound system for many nightclubs, discos and ballrooms. Mike Klasco and a panel of experts will examine, in particular, the loudspeaker aspects of sound systems and compare and contrast the benefits and trade-offs of signal processing, one-box systems versus "roll-your-own".

INTERCONNECT...YES OR NO

Barry Glick,
President, Comtex, Inc.
and Harold George,
Indiana Electronics, Inc. (Thursday)

Glick and George will briefly cover the development of interconnect (now seen as an expansion market for sound contractors) and conduct an open forum question and answer session addressing interconnect technical information, installation experiences and pitfalls. Comtex president Barry Glick feels too many sound contractors are giving away business by referring clients to possible competitors rather than doing the installation themselves. He promises, "If you can install an intercom or fire alarm, you can put in an electronic key system. It's all low voltage wiring."



John Murray, Electro-Voice



Ed Young, IED

SOUND MASKING

Mike Klasco,
Sound & Communications;
Menlo Scientific (Friday)

A panel will discuss design and installation of sound masking systems, with emphasis on new tips, techniques, and trends. Particular attention will be paid to an analysis of pre-conditions to sound masking — what are the things you do before you turn on the system; what are the alternatives?

**SELLING WIRE AND CABLE
AS A SOURCE OF INCOME**

Mike Klasco,
Sound & Communications;
Menlo Scientific (Friday)

A panel of experts discusses the economic aspects of specing, selling and installing wire and cable. How do new technology and regulations impact upon the bottom line?

MICROPROCESSOR INTERFACE

Gene Rimkeit,
President, Micro Audio
Bob Rogers,
Senior Project Engineer,
Altec Lansing
and Ed Young,
Vice President of Engineering, IED
(Friday)

This extensive panel discussion will explore the digital control of audio equipment and the increasing capability that microprocessor technology provides to the audio industry. The panelists will offer a brief introduction to how computers and microprocessors work, discuss what kinds of equipment can be controlled by audio, what type of interface is being used, pre-installation configurations, maintenance and installation, cabling and connectors choices, and more. MIDI RS-232 and RS-422, hardware and software development and history are to be covered, as well as recent and future advances in computer control systems, which Gene Rimkeit believes will be the wave of the future — fiber optical connections, a system, literally "wired by light." Software protocols will be addressed by Bob Rogers, who will present the draft of PA-422 (Standard Communication Interface for Sound Reinforcement), just prior to its publication in the AES Journal. Of PA-422, Gene Rimkeit says, "The PA-422 standard will pave the way for computer communications between intelligent audio devices into the next century."

From the special pre-show CAD SOUND SYSTEM DESIGN SEMINAR on Tuesday and Wednesday, April 17 and 18: **ULTIMATE CAD/LISTENING**

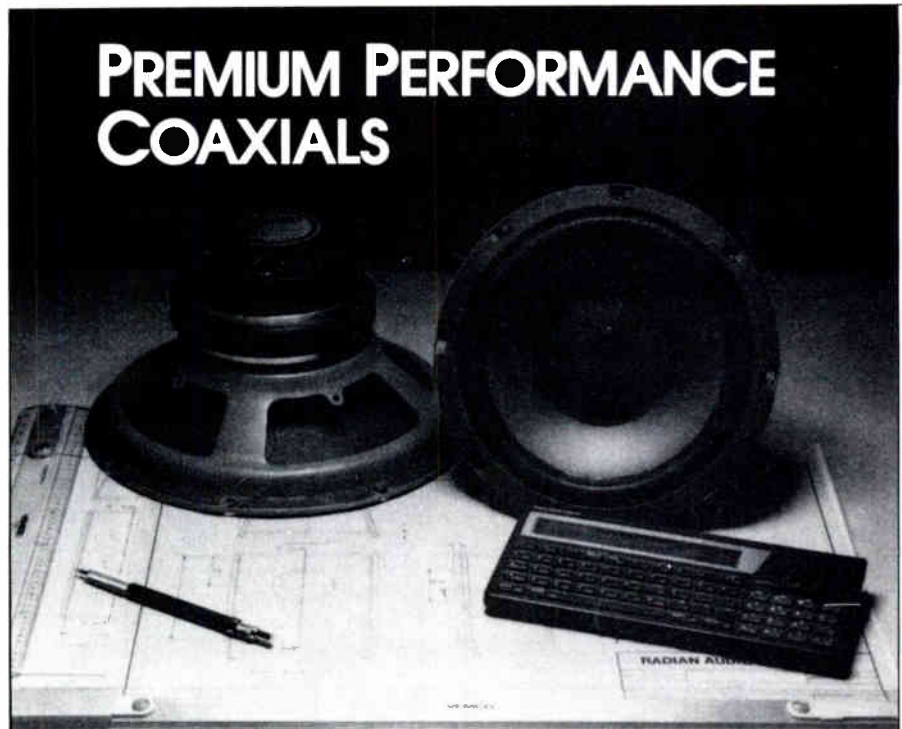
WORKSHOP (Limited advance registration)
Joel Lewitz,

Lewitz & Associates

The goal of this seminar is to provide participants with exposure to various aspects of professional sound system design and installation including: CAD design, fabrication and installation, tuning and checkout, and evaluation of the system by subjective and objective measurement

methods. A number of different CAD design programs and equipment manufacturers will be represented, giving the attendees a broad range of technical and listening experience.

These are highlights of the educational program. *Sound & Communications* will present a comprehensive overview of the NSCA Expo in its June issue. ■



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(continued from page 24)

however, where a large part of the spectrum of interest lies in a frequency range where the resonant modes of the room do not overlap but may be isolated...In this case the microphone, instead of responding to a random soundfield (as is required for the validity of the theory on which these methods depend), will delineate a transfer function of the room...It does not provide a valid measurement of the reverberation time in the room."

The definition of RT60 comes in two parts. Unfortunately, the first part is often overlooked:

- RT60 is the measurement of the decay time of a well-mixed reverberant soundfield well beyond critical distance, D_c .
- RT60 is the time in seconds for the reverberant soundfield to decay 60dB after the sound source is shut off.

See Figure 4 for an illustration of large room (well-mixed reverberant soundfield) and Figure 5 for a small room with room modes.

There is no critical distance in small rooms, no well-mixed soundfield; therefore, no reverberation. There is just a series of early reflected energy.

"We Installed Tube Traps, Diffusers, (you name it) to Remove the Standing Waves."

The hapless soul who is going to control standing waves with devices such as tube traps, diffusers, Sonex, etc, has failed to find out that the primary factor controlling them is room volume. Here, measurement can be useful. This writer has, on many occasions, been shown a new control room wherein the owner proudly proclaims they have eliminated standing waves by the use of one device or another.

When an oscillator is turned on and slowly tuned across the low frequencies we find the usual peaks and dips to be expected in a room that size, sometimes as much as 40dB. We also find loudspeakers out of polarity and other interesting malfunctions whose change in sound was interpreted as an improvement just because it changed. Autosuggestion is easily the most important parameter in any of the branches of audio and acoustics, where objective measurement is depreciated and intuitive subjective judgement is substituted.

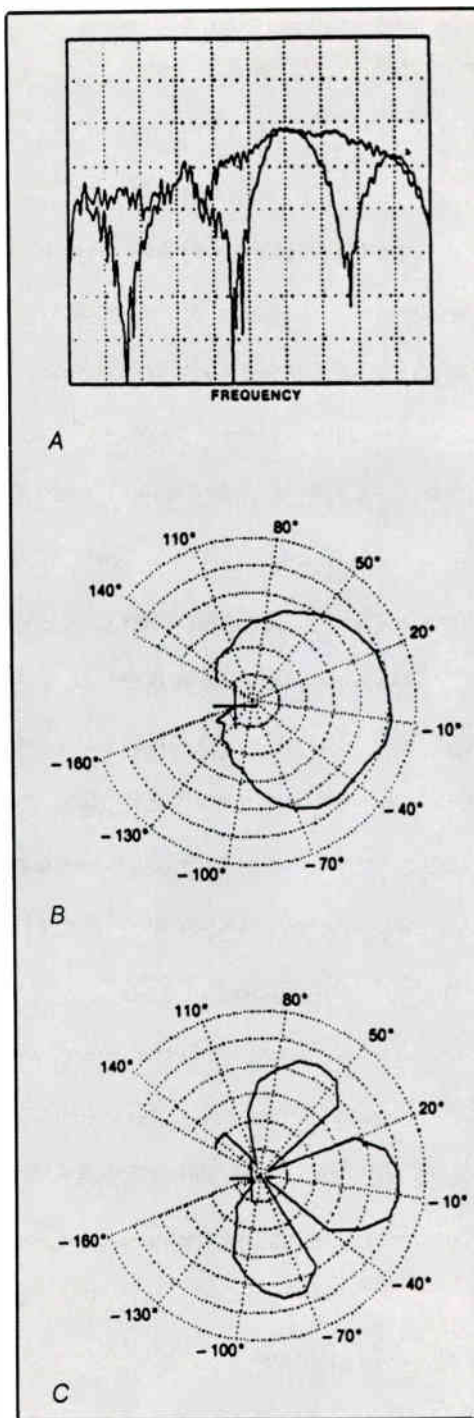


Figure 3. Figure 3a shows the comb filters generated by two identical loudspeakers covering the same area which are out of synchronization by approximately four inches. The upper curve in 3a is made after 285 microseconds of delay was used to bring the two into synchronization. The major problem is shown in Figure 3c. Figure 3b is the polar response of the two loudspeakers in synchronization. Figure 3c is of the same two loudspeakers out of synchronization by approximately four inches. Now high energy is being thrown at the ceiling, walls and floor.

"I Am Going to Use My Electronic Equalizer (Which Operates in the Frequency Domain) to Correct Phenomena in the Time Domain (Reflections in the Room, Audience, etc.)."

What can an equalizer equalize? Some claim to equalize the room. Is this possible? We think not.

When an electronic or passive equalizer is installed in between a mixer and a power amplifier we need to know that all it can equalize is the electrical signal being sent to the loudspeaker.

What comes out of a loudspeaker is called direct sound level, L_D . Early reflections from the floor, walls, and ceiling are called the early reflected level, L_{RE} , and late-in-time, homogeneous mixing sound is called the reverberant sound level, L_R .

When an electronic equalizer is employed it not only alters the L_D at the listener but also the sound power level, L_w , of the loudspeaker. This in turn affects L_{RE} , and L_R but has no effect on L_{AMB} . The question over the years has been "how much can I alter L_D without throwing the baby out with the wash?" Experience has shown that the answer is "not much." Certainly not enough to drop specular L_{RE} having a relatively full frequency response.

What can an audience do to affect L_D from a sound system? The answer, of course, is absolutely nothing. Therefore, it is clear that the audience can only alter L_{RE} , L_R and L_N . Now ask yourself the question, "How can an equalizer adjust L_{RE} , L_R , and L_N ?" The answer is that it cannot.

"I am Going to Install Sonex to Absorb Low Frequencies in my Control Room or Small Listening Room"

Many have a working understanding of absorption, reflection, and transmission of sound but when it comes time to apply their understanding to a "real life" measurement, it is easy to forget about the frequency dependency of each of these parameters.

Absorption is frequently misused, such as attempting to use Sonex for 60 Hz absorption or tube traps to remove standing waves. Knowledge of the four zones in a given acoustic environment is a necessity if proper application of materials and devices is to be achieved:

- The pressure zone
- The modal zone
- The diffusion zone
- The specular reflection zone

The critical frequency is where the wavelength is roughly comparable to the largest dimension of the room. See Figure 6 which shows the four zones.

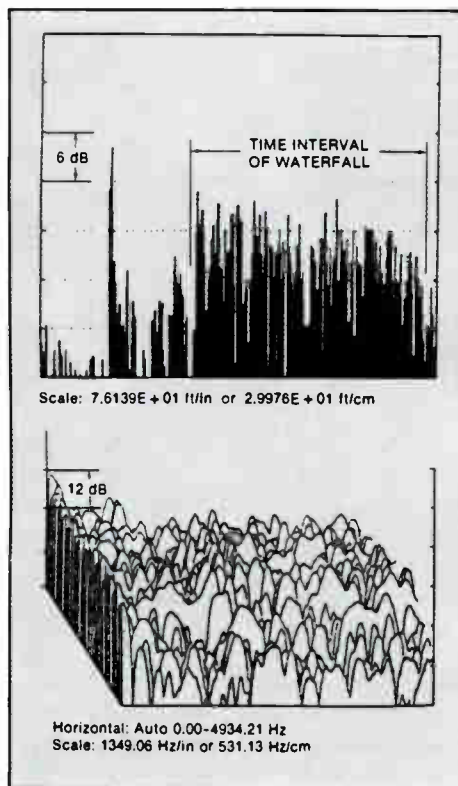


Figure 4. An ETC and a waterfall made in a great concert hall with a "well-mixed reverberant soundfield."

Another frequent misapplication, this one even among professional acousticians, is the use of statistical techniques in small dead rooms where they are totally inappropriate.

Ray tracing is another misunderstood tool. Once the limitation of ray tracing is understood, it is rapidly relegated to its very limited use at specular frequencies only. Then one can begin to understand how wave mechanics allows the formation of high level midrange focused reflections.

Many of us have listened in small rooms to the low frequency resonances that occur when one of the dimensions of the room supports a particular frequency. Figure 2a referred to earlier, shows such a resonance (about 125 Hz). Figure 2b is the same measurement made after the diaphragmatic absorber was constructed.

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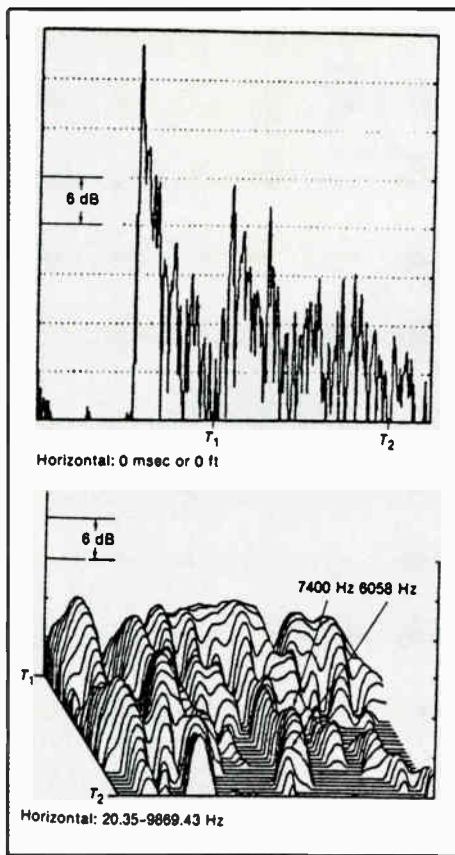


Figure 5. An ETC and a waterfall made in a small room without a reverberant soundfield. The room modes are very obvious.

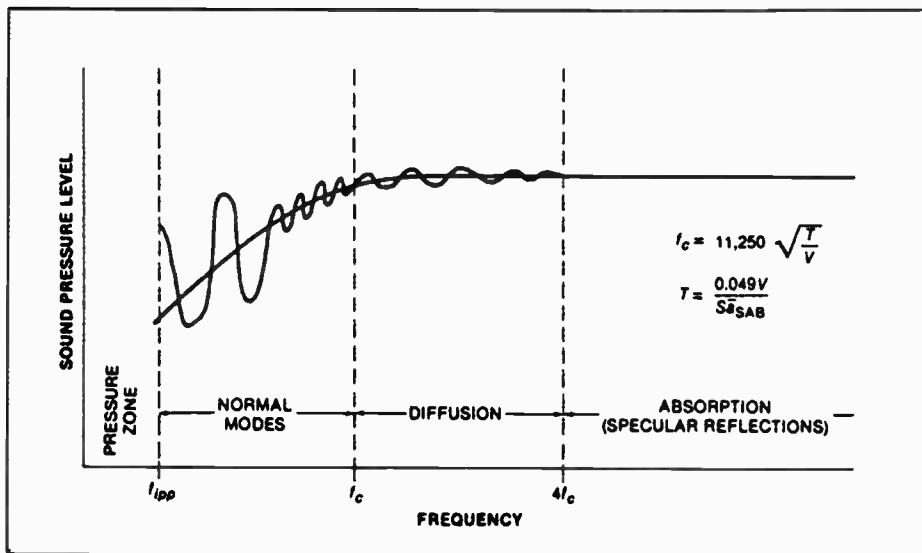


Figure 6. It is very important that one understand the importance of each of the modal zones in a room. The total soundfield is frequency dependent.

COURTESY BBN

SUMMARY

The measurement triad is:

- Intuition and inspired guessing.
- Hard facts won by careful measurement.
- Logical mental processes in a trained mind.

It takes all three to function effectively.

Measurement tools are more sophisticated than ever. That fact does not lessen but rather heightens the capabilities required of their users. For the user who first measures his or her own ability, trains where necessary, and then interfaces with the best of the new equipment they will experience earned success. ■

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News from around the industry

Technical Support; Amps in Arena

Aiphone Technical Support

Aiphone Corp. has consolidated its technical support office and will provide technical service to its distributors from two locations. The regional office in Rochelle Park, New Jersey is responsible for the eastern territory, and the Bellevue, Washington headquarters covers the west. The Atlanta and Chicago regional offices have been closed. John Mosebar, regional sales manager of the Chicago office, has returned to headquarters and assumed the responsibilities of national technical sales manager. The New Jersey office takes on the responsibilities of the Atlanta regional office, under the direction of Fred Koffer, eastern regional manager and Richard Fetterly, eastern technical sales and service director.

Amps for Student Center

QSC Audio Products has announced that QSC power amplifiers were chosen for the Jack Breslin Student Events Center at Michigan State University. The arena uses 70 QSC Model 1200 and 17 QSC Model 1400 amps to provide power to a main speaker cluster and 26 satellite clusters that ring the arena and the concourse areas. The center cluster can trolley from one end of the arena to another as well as perpendicularly to the center. An IED system controls the trolley and automatically attenuates the horns based on location of the cluster, as well as setting the digital delays for the satellite clusters. According to QSC, "in order to achieve the flexibility necessary," 172 QSC AT-1 Octals were used for impedance matching of 50, 70 and 100 volt lines. An additional 171

QSC OT-300 output transformers were used for line matching.

The \$43 million, 263,000 square foot arena seats 15,100 people and is the new home for the Michigan State University Spartans basketball team. The facility has also been designed to accommodate concerts, trade shows, conventions and other functions.

Acoustical consultants on the Center

were Coffeen Fricke and Associates. The sound contractor/installer was Sound Engineering, Inc.

Phonic Ear Meeting

A management buyout plan was discussed at the annual Phonic Ear International Sales Conference. No details were available at press time. Other



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Phonoc Ear personnel at Sales Conference.

items on the sales conference agenda were the establishment of a separate hearing aid company with Phonak, and discussion of the construction of a new technology center during 1991. New product introductions are planned for all markets in which the company is involved, and an increased schedule of R&D investment is planned.

Quartz in Production

The Soundtracs Quartz console is now in production. Originally named Prism, the Quartz console has already been sold in the U.S.A., Italy and the U.K. The 24 bus inline console with computer mute automation of channels and auxiliaries has on-board MIDI muting.

Canada Contractor of the Year

Western Sound Ltd. of Bernaby, British Columbia, has been awarded the 1989 Contractor of the Year by Mark IV Audio Canada, Inc. The announcement was made by Doug MacCallum, general manager of Mark IV Audio Canada. The award recognizes



Costa Lakoumentas, president of Western Sound, presented award by Doug MacCallum, Mark IV Canada. Also pictured are Shawn Inness, Western Sound, and Neil Andison, Mark IV Audio Canada.

outstanding sales growth of Mark IV Audio fixed installation products. Western Sound achieved the highest growth rate in combined Electro-Voice, Altec Lansing and University Sound contractor products in Canada during 1989.

Rep News

QSC Audio Products has named Western Audio Sales of Glendale, California its 1989 Representative of the Year. Western Audio principal Michael Klickstein has been a QSC representative for over 10 years. This is the fourth time he has been awarded QSC Rep of the Year. Klickstein said of the honor, "In order to properly cover a territory as important as southern California, it is imperative that I have an effective organization and staff. Byron, Cari, Greg, Dana and Michelle have done an excellent job for me. As a group, we are very pleased to have been named Rep of the Year for QSC." QSC National sales manager Peter Kalmen said, "Western Audio does a tremendous job. Sales, service and support of their customer base is a pro-

prietary concern of the entire staff."

Celestion's Rep of the Year award was presented to Reflex Marketing of New York, Bob Brennan and John McFadden owners. Peter Wellikoff, president of Celestion, presented the award.

AT THE LAS VEGAS NSCA SHOW... WATCH



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People

ITCA Elects Grove; J.W. Davis Appoints Simonson

Grove in Executive Committee

Henry Grove, III, of Peirce-Phelps Inc., has been elected to the Executive Committee of the International Teleconferencing Association (ITCA). The announcement was made by Jack Landry, The Travelers Insurance Company and President of ITCA.



Henry Grove, III

The International Teleconferencing Association has over 800 members.

Chief Engineer at J.W. Davis

J.W. Davis & Company has appointed Eric Simonson to the position of Chief Engineer, responsible for quality control and product development. Simonson received his B.S. and M.S. degrees from Oklahoma State University where he was teaching assistant in the Electrical engineering Department.



Eric Simonson

Lewellyn at IED

Mark Lewellyn has been appointed to the position of Sales Application Engineer at Innovative Electronic Designs, Inc. Lewellyn was a member of the engineering department at Martin-Marietta Electronic Systems Center, participated with the "Lantirn" project for the U.S. Air Force,



Mark Lewellyn

and also was at United Telephone Company of Florida. He is a member of the Audio Engineering Society and a University of Central Florida graduate.

Senior Project Engineer at R.A. Gray

Ty Durr recently joined R.A. Gray, Inc. as a senior project engineer. In this capacity, Durr will support the company's involvement in major entertainment facility projects. Prior to joining R.A. Gray, Inc., Durr was with the George Thomas Howard Associates theatrical consulting firm.

Durr has a background in audio, video and control system design. His background in engineering design has included electroacoustic and psychoacoustic systems, fire and life safety systems, high security and access control systems, production video systems and intercommunication systems.

Recent projects include Walt Disney World's Pleasure Island nightclub complex, the Showboat Hotel/Casino in Atlantic City and Phoenix's Herberger Theatre Complexes.

JBL Picks VP

Lance Korthals has joined JBL Professional as Vice President of Market Development. Korthals will be responsible for "steering the growth" of professional markets and companies.

Korthals was recently President of Edge Technology Group, Inc. In addition, he has pro audio experience as Director of Marketing and Sales for Lexicon, Inc. and Director of Marketing and Sales for dbx, Inc.



Lance Korthals

Engineer for E-V

Matt Ruhlen has joined Electro-Voice as a project engineer for the loudspeaker group. Ruhlen, a member of the Audio Engineering Society, has served as a project engineer for Rockford-Carbonneau in Grand Rapids, MI and as systems design and project engineer for Audio/Video Engineering in Newport Beach, CA.



Matt Ruhlen

Celestion Gets Sales Manager

Brian Coviello has been appointed National Sales Manager of MI and Pro Audio for Celestion North America. Coviello will be working under the direction of Barry Fox, Sales and Marketing Director. Coviello's responsibilities include overseeing the Pro and MI division operations, new product development, coordination of the rep network and heading up Celestion's growing OEM business.

Coviello's background is in the recording and sound reinforcement industries. He acted as the Manager of Commercial Sound Contracting and was in charge of Sales and Installations for Pro Audio, Recording and Lighting for the Hoffman Music Company, Spokane, WA. He also was a teacher of Audio Engineering for Spokane Falls Community College and a live audio engineer for various performing artists.



Brian Coviello

UPDATE

CALENDAR

Upcoming Events

MAY

ISC WEST (Intl Security Conference): Anaheim, CA. Contact: (312) 299-9311. May 1-3.

Elec. & Elec. Eng. '90: Hanover, West Germany. Contact: (609) 987-1202. May 2-9.

AES 8th Intl Conference on "The Sound of Audio": Washington, D.C. Contact: (212) 661-8528. May 4-6.

Intl Instrument Symposium: Denver, CO. Contact: (919) 549-8411. May 7-10.

Intl Trade Fair & Congress for Entertainment Technology, Equipment, and Management: Berlin, Germany. Contact: (312) 245-5230. May 8-10.

ISE (Ideas in Science & Electronics): Albuquerque, NM. Contact: (506) 262-1023. May 8-10.

MTT-S (Intl Microwave Symposium & Expo): Dallas, TX. Contact: (617) 769-9750. May 8-10.

ELECTRO: Boston, MA. Contact: (213) 772-2965. May 9-11.

Video Expo: Los Angeles, CA. Contact: (914) 328-9093. May 14-18.

Midwest Electronics Expo: St Paul, MN. Contact: (800) 223-7126. May 15-17.

Rep Expo: Brookfield, WI. Contact: (312) 729-0100. May 16-17.

National Fire Protection Conference: San Antonio, TX. Contact: (617) 770-3000. May 20-24.

ICA (Intl Communications Assn): New Orleans, LA. Contact: (800) ICA-INFO. May 20-25.

Fiber-Optic Splicing and Termination Workshop: Sturbridge, MA. Contact: (508) 347-8192. May 21-25.

Semicon/West: San Mateo, CA. Contact: (415) 964-5111. May 22-24.

JUNE

Summer Consumer Electronics Show: Chicago, IL. Contact: (202) 457-8700. June 2-5.

Comdex/Spring: Atlanta, GA. Contact: (617) 449-6600. June 3-6.

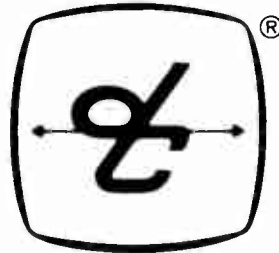
ATE & I East (Auto. Test Equipment & Instrumentation): Boston, MA. Contact: (800) 223-7126. June 5-7.

ISC Central (Intl Security Conference): Chicago, IL. Contact: (312) 299-9311. June 12-14.

NEPCON/East: Boston, MA. Contact: (312) 299-9311. June 12-14.

NAMM (National Assn of Music Merchants): Chicago, IL. Contact: (619) 438-8001. June 15-17.

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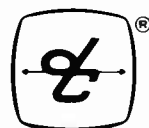
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Products

Numark Intros Amp; Flying Loudspeaker by OAP

American and Japanese Amp

Numark Electronics has announced the debut of the SA3200 power amplifier. A joint design effort combining Numark's U.S. and Japanese engineering staffs, the SA3200 is rated at 510 watts RMS into 4 ohms, and 1.02 kilowatts into 8 ohms (bridged mono mode).

The SA3200 incorporates DC-coupled bipolar technology for a claimed frequency response of 20 Hz to 20 kHz. The high voltage swing characteristics of the SA3200's driver devices account for its slew rating of 50 volts per microsecond and its transient response. This is combined with the unit's wide-band performance for a THD rating of .035 percent and signal-to-noise ratio of 106 dB.

The SA3200 is designed to withstand continuous, high-power output and low impedance loads. It also incorporates current limiting and a fast-tripping circuit breaker power switch.

Circle 295 on Reader Response Card



Flying Loudspeaker

The C-1, by OAP Audio Products, is a full range two-way trapezoid shaped loudspeaker system designed for flying applications. The C-1 incorporates a 12-inch coax and a separate driver/horn for aiming and installation applications. For far field coverage the coax uses a 30 x 60 degree horn. Near field coverage is provided by a swivel mounted 90 x 40 degree defined coverage horn/one-inch compression driver with its own level control. Three-quarter inch void-free birch plywood is used.

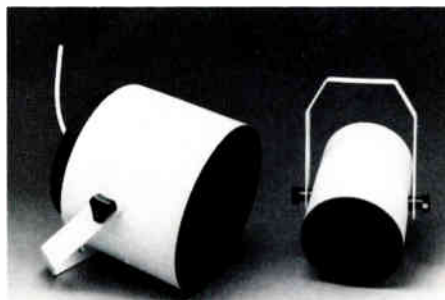
All panels are internally reinforced. Aircraft-type flying hardware is available. A variety of grille colors and textures, and user installable panels are available to match specific decor requirements. The C-1 measures approximately 28 x 20 x 20 and weighs 70 pounds.

Circle 296 on Reader Response Card



Loudspeakers with Track Lighting Styling

Atlas/Soundolier is now offering sound reinforcement loudspeakers in track lighting style, housings. The



Circle 297 on Reader Response Card

9-model DC series for foreground music and paging systems is available with high compliance 4-inch diameter or dual cone and coaxial 8-inch diameter loudspeakers in power ratings from 10 watts to 16 watts. Frequency response extends from 110 Hz to 11 kHz. Impedance of the 1-inch diameter voice coil is 8 ohms, and 70 volt line transformer equipped models include primary taps at 1, 2, 4 and 8 watts.

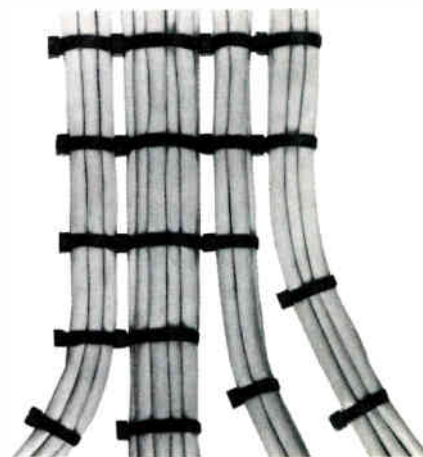
Continuous Length Cable Ties

Strap Loc Continuous Length Cable Ties are designed to reduce the need for many different lengths of cable tie. The product is cut from spool, assembled with lock, and used like any cable tie.

Features include the ability to fasten and bundle large objects, separate and space wires and cables, fasten through panels, and multiple wrapping for tensile strength applications. The stainless steel and nylon locking device features low insertion force, locking, and adjustability.

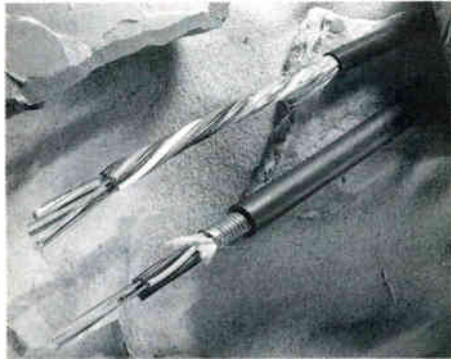
They are now available in the two smaller package sizes of 250 and 500 feet.

Circle 298 on Reader Response Card



Multi Fibers Per Tube

Belden Wire and Cable is now offering multi fibers per tube on its outdoor fiberoptic cable. Adding multi fibers per tube is said to result in higher fiber



counts with smaller cross sections. Applications include utility, campus LAN interconnect, fiberoptic aerial, and long

distance telephone applications.

Belden now offers six fibers per tube as a standard but also manufactures one, two, four, eight and 12 fibers per tube. In addition, different fiber sizes are available within the same cable.

Circle 305 on Reader Response Card

Communications Outlet

The AMP Communications Outlet for open systems interconnection accommodates data and telecommunications equipment. The outlet is "vendor independent," with interfaces that are compatible with IBM Token Ring, DEC-connect, StarLan, Ethernet, ISDN and other networks. It accepts network cable types, including shielded or unshielded twisted pair, coaxial and fiberoptic.

When used with the AMP Com-

munications Outlet patch panel, the outlet allows one-time wiring to user workstations and changes to workstation data and phone systems without rewiring. Each connector accepts up to eight conductors in any combination of signal or drain wires.

Circle 306 on Reader Response Card



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Circle 282 on Reader Response Card



Intercom with Desk Set Option

ADCO Industrial Intercoms has introduced a desk set option. This telephone-style desk set is designed for executive offices or superintendent's headquarters as part of the communications mix.

The desk set provides 2-way communications with other ADCO units located in the plant or the field. ADCO's intercoms are designed for loud noise areas and harsh environmental conditions. The new desk set model is a self-contained station.

Circle 299 on Reader Response Card



Video Lectern System

Buhl Industries has introduced its Video Lectern System. The VLS uses a CCD chip technology video camera and outputs a choice of RGB or NTSC signals to monitors or video projectors.

The sloped stage design offers the feature of having no light or camera head in the presenter's view. The material is viewed simultaneously by the audience and the presenter.

The VLS can be used in environments that are equipped with a monitor or video projector. It will present documents up to 13 inches by 20 inches, opaque or transparent, books, maps, and 3-D objects. By connecting the VLS to an optional recording device, a hard copy or tape can be made of the material presented.

Circle 300 on Reader Response Card

Answering Console

Tone Commander Systems, Inc. has introduced a telephone 5-line, 24-station answering console for Centrex and PBX environments.

The Centracom 524 incorporates features including "Answer" key, "Release" key, 20-character alphanumeric display and queuing with an override function to permit the attendant to select from the queue at any time to handle emergency or other priority calls.

Circle 301 on Reader Response Card



Compact Stage Monitor

Professional Audio Systems has introduced the TOC (Time Offset Correction) Stage Wedge 2. The SW-2 is an ultra-compact stage monitor that has a 15-inch coaxial loudspeaker with a 2-inch throat compression driver. Each SW-2 is complete with its own electronic crossover module that will slide into the S-2 Cardframe Chassis/Power Supply. The S-2 will accept six modules providing six monitor mixes in a three rack space chassis. The SW-2 has 30 x 60 degree high frequency control to 10 kHz and will produce continuous SPL levels of 126 dB at a distance of one meter.

Circle 302 on Reader Response Card



Updated Mixing Console

Ross Systems, a division of IMC, has introduced an updated PC7250 Powered Mixing Console. Each channel of the unit has 3-band EQ, reverb/effect send, monitor send, XLR mic, and quarter-inch line inputs. The output section of the PC7250 incorporates an 8-band graphic equalizer, main level fader, monitor level fader, mix out jack, power amp in jack, effects send and return jacks, and a monitor out jack.

The PC7250 is designed for PA applications, permanent installations and live performance. It delivers 250 watts of power into 4 ohm speaker loads and also includes such features as an active protection circuit which continuously senses the output and uses an LED indicator for protect circuit status.

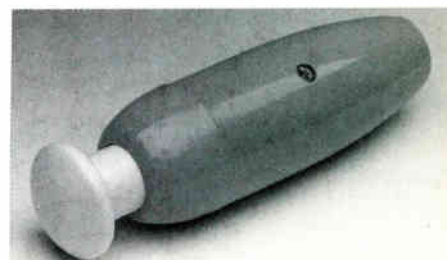
Circle 303 on Reader Response Card



Locking Button

Crest Electronics' Universal Locking Button replaces call buttons with a lock type system. It features a large, mushroom-shaped button and resets with a pull on the white call button. It is also available with a maintained buzzer mechanism where required by state law.

Circle 304 on Reader Response Card

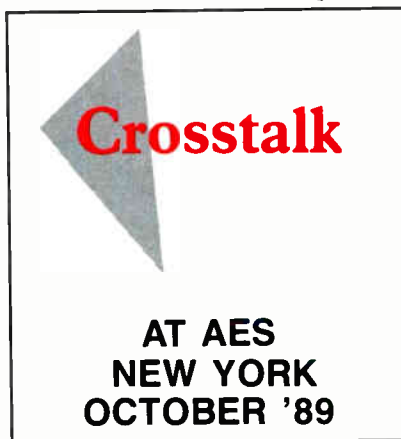


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Italian Company Intros New Equipment

dB Technologies, an Italian sound reinforcement equipment manufacturer and designer, has introduced several new products. The dB Technologies Series 90 hand-held transmitter incorporates FM diversity technology without compander or limiting facilities. Instead, the receiver's two antennas will monitor, react to and compensate for any loss of signal that would result in dropout.

The Series 90 is available in three different formats: hand-held (M 90); instrument (G 90); and lavalier (L 90) lapel-type transmitters, all with a reported operating distance of up to 100 meters.

Circle 307 on Reader Response Card



Cable Tie Mounts

Panduit Corp. has announced metal cable tie mounts used for securing wires and cables in various applications. Made of aluminum, the new mounts feature a solvent activated adhesive backing that provides a claimed pull-off force of 40 lbs. after 24 hours. The static load rating is 10 lbs.

The low profile mounts are designed for use with Panduit miniature, intermediate and standard cable ties, or Pan-Steel stainless steel clamps.

The mounts are claimed to be able to withstand temperatures from -20 degrees Fahrenheit to 180 degrees Fahrenheit. The adhesive remains dry to the touch until activated by the chlorinated, non-flammable solvent.

Circle 308 on Reader Response Card



Connector Kit

A 273-piece connector RS-232 Commercial Connector Kit is now available from Jensen Tools. It can be used to make straight null modem hookups, fabricate patchcord connections between keyboard and TNC for Packet Radio, or for a number of other DB25 patchcord applications.

It includes 16 plug (male) and 6 receptacle (female) 25-pin connectors; 100 stamped and formed pins and sockets; 50 cable ties; one insertion/extraction tool, and a compact Mighty-tuff plastic storage box.

Circle 309 on Reader Response Card

A/V Mics

The Beyer A/V Pack is a set of three microphones designed for A/V Departments. Packaged in a black attache case, the microphones are designed to provide audio for in-house video productions.

The three mics, a lavalier, a hand-held interview mic and a shotgun mic for camera mount and fishpole use, are designed to handle application for recording audio for a video project. The three mics included are: the M58, the MCE86 and either an MCE5 or MCE10.

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World Radio History

(continued from page 66)

anti-climactic. Much of the work was done before going on site: Arrays were built (with the help of Umbulus), painted and tested. The rack was wired and tested. Jack panels were fabricated, wiring lists generated ...ducks generally gotten in a row. On site work progressed steadily, though Chris Eng, who supervised it, found that there were points between which cable access was, apparently, not meant to be. However, problems were solved as they came up and all in all the installation went smoothly. Figures 7 and 8 show the arrays in place. Figure 9 is the equipment rack.

Tuning and gain trimming fell in "right on the lines." Relatively little 1/3 octave equalization was needed. Acoustic gain was as expected. The calculated delay setting resulted in as close to seamless coverage as is practical with two sources operating. Mr. Harvey Gustafson, the church's organist, directed the adjustment of the rear organ level. He declared the balance correct well before the potential gain from loft to rear array was expended. The other features of the system also worked as intended on initial power-up. The system sound clean, clear and natural.

We did a training session with interested members of the sound committee and with the designated system operators, delivered the owners' manuals and wiring diagrams and got the system signed off. We sent the invoice and got the church's check by return mail.

While we did not measure articulation, we did get an informal confirmation that it was good. It came after the system had been in operation for several months, dur-

HARDWARE LIST			
1	Shure AMS 22 microphone	1	Yamaha SCX 90 security cover
2	Shure AMS 24 microphone	1	Yamaha P2150C power amplifier
2	Shure AMS 26 microphone	2	Loudspeaker arrays, using JBL components
1	Shure AMS 28 microphone	1	NSS #833 record panel
3	Sony ECM 55 microphone	1	Sony TCFX433 cassette deck
1	AKG MC50 50' microphone cable	1	NSS TCRM433 rack mount kit
3	AKG MC25 25' microphone cable	1	Furman PL8 power conditioner
1	Shure AMS AMS4000 automatic mixer	1	Soundolier ACS-1 AC power kit
1	Shure M267 mixer	1	UREI 315 direct box
1	Rane SM26 mixer	1	HME System 82 wireless microphone system
1	UREI 539 equalizer	1	Williams PA/FM hearing aid transmitter
1	UREI SC539 security cover	3	Williams PA/FM hearing aid receivers
1	Yamaha SPX 90 audio delay		

TEST EQUIPMENT LIST

Make	Model	Description
Fluke	8060A	True RMS Mltimeter
Ivie	IE-30A	Real Time Analyzer
Ivie	IE-17A	Microprocessor
Ivie	IE-20B	Random Noise Generator
Shure	A15TG	Tone Generator
Taylor	1330	Sling Psychrometer
Thommen	15000	Barometer
Brunton	6620	Pocket transit
Yamaha	MS101	Test loudspeaker/amplifier
B&K	1422	Dual trace oscilloscope

ing a chance meeting with a member of the sound committee. He volunteered that the system was working well. Then during the course of the conversation, he mentioned that they had made one mistake: "We bought too many hearing aid receivers."

Because the sound committee was able

to communicate what it wanted and because, using our test equipment, Umbulus, and historical data, we were able to put numbers on all aspects of the project, problems and solutions were identified early on. As a result the system went in on time and on budget. And it does what it is supposed to do. ■

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BLUE ALERT!

MANUFACTURERS AND MANUFACTURERS' REPS

Companies listed in the current Blue Book Directory will automatically receive update forms in June. If you were NOT listed or have changed location, send your name and address on company letterhead by May 15th to:

BLUE BOOK FORM REQUEST

25 Willowdale Ave., Port Washington, NY 11050

Important! Indicate MFR form or REP form.

Ask Dr. Wokka

Dear Dr. Wokka,

I have noticed over the years that when people talk, their mouths take on different shapes to form different sounds. I'm sure that I'm not the first to observe this, but I have never seen it mentioned in this magazine, for one. Is this some kind of discovery? Moving forward, I must also conclude that the shape, size and aspect ratio of loudspeakers and horn mouths affect the sound coming from them, much as it seems to affect speech. Can you comment on this? I mean, can you give us the real scoop, not the usual medical-profession-syndrome "answers" we get in these so-called "scientific" journals? Let's have something I can relate to, Doc.

Respectfully,
Tony Baggadoni
Atlantic City, NJ

Dear Mr. Baggadoni,

You're treading on thin ice here. Great Men of Audiophical Science are not referred to as "Doc." I do, however, accept your apology in advance. On the other hand, you bring to light a very little-understood and critical question: horn shapes and their mouths.

Your observation is actually being discussed today in upper echelon scientific circles as something to look into, but I must say that it is new ground you are breaking. As for horns and loudspeakers, this effect has been known for years at the Philadelphia Medical College Of Musical Knowledge and, of course, The Church of the Living Sound right on Penn's Landing in Philly. Let's get right to it.

To make an "o" sound, the mouth is formed into a large circle. To make an "oo" the mouth is formed into a very small circle. To make an "ah" sound, the mouth is formed into a vertically short ellipse. To make an "uh" sound,

the mouth is formed into a vertical slot and to make an "ee" sound, a horizontal slot is needed. So there you have the five principle vowel sounds, plain and simple.

How does this relate to horns? A simple matter of scientific genuization will work here. Small circular sources like horn throats will produce an "oo" sound, or in the case of very small throats, a spitting kind of sound like one makes with pursed lips. Then the sound transmits to the mouth. If it's a big circular mouth it ends in an "o," so the entire horn gives a sort of "oo-oh" or often "woo-oh" and even "Woah" sound, depending on how rapidly the horn expands and on how the mouth and throat sizes relate to one another. Now if the mouth is real large, the "o" sound gets lower and lower until it is out of the usable band. Also, if the throat is the right size; three inches approximately; you get a very neutral throat sound and the horn becomes characterless and very musical sounding. This is why we tell all our students to make horns four or five times longer than they have to. If the mouth is more horizontally spread

out, you get more of a "oo-ee" sound, which many prefer for listening to rhythm and blues music. Again, as the mouth gets larger the predominant "ee" sound gets lower and further out of the band of use. If the mouth gets more vertical, the "oo-uh" sound dominates and vocals take on a stupid kind of character. This is something to stay away from, to be perfectly honest.

Now we can begin to appreciate the absolutely horrible sound of "compound" horns like the "Man-o-Ray" or "Turbot" or, worse, the "Pie-Radio" or...well you know...I don't know all these silly names these Hollywood people come up with. Let me tell you about this. One of these horns starts with a small circular throat, goes into a vertical slit and ends up horizontal. The sound is sort of "eww-uh- ee," sort of like the old popular Jewish expression "oy." Interestingly enough, if you listen to someone through the throat, you hear it backwards and get "yo," something very common here in Philadelphia. However, do you want this kind of effect accompanying your music? Hardly. Don't ever use horns that do this. ■

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Company	Page	RS #	Company	Page	RS #	Company	Page	RS #
Adamson Acoustics (416) 420-6279	55	240	Dynacord Electronics (800) 955-ADS-K	75	261	Peavey Electronics (601) 483-5376	27	215
Aiphone (206) 455-0510	79	201	Elenex (716) 534-5280	34	289	Pioneer Laser Entertainment (213) 518-4531	37,38	220
AKG Acoustics (203) 348-2121	23	—	ETA Lighting Systems (216) 425-3388	35	222	Professional Audio Systems - PAS (213) 534-3570	113	229
Allen & Heath (203) 795-3594	99	241	Florence (312) 384-3310	65	257	Quam-Nichols (312) 488-5800	6	226
Apogee Sound (707) 778-8887	42-43	267	Fourjay Industries Inc. (513) 890-6444	3	204	Radian Audio Engineering (714) 961-1213	97	249
ART-Applied Research & Technology (716) 436-2720	8	217	Frazier (800) 643-8747	47	239	Rane Corporation (206) 774-7309	16-17	205
Ashly Audio (716) 544-5191	18	256	FSR Inc. (201) 239-0988	45	260	Riser-Bond (402) 694-5201	66	270
Atlas/Soundolier (314) 349-3110	33	219	Gemco (615) 452-5960	49	230	Samson Technologies (516) 932-3810	5,48	214,258
Audio Intervisual Design (213) 469-4773	14	268	Hacoustic (404) 945-3142	109	282	Sanken/Aid (213) 469-4773	14	268
Audio Systems — AUDSCO (800) 852-6522	52	288	Harman Electronics (818) 895-8734	83	224	Sennheiser (203) 434-9190	57	206
Audio-Technica (216) 686-2600	63	210	IED - Innovative Electronic Design Inc. (502) 267-7436	CIII	221	Sonance (714) 661-7558	77	207
Audio Technologies — ATI (215) 443-0330	91	264	Int'l Electronic Wire & Cable (800) 323-0210	73	259	Sonic Systems/ Soundsphere (203) 356-1136	21,64	252,253
B.E.S.T. (714) 556-BEST	81	213	IRP - Industrial Research Products (312) 640-9553	95	234	Stentofon (816) 231-7200	32	274
BGW Systems (213) 973-8090	11	203	JBL Professional (818) 893-8411	CIV	223	Stewart Electronics (916) 635-3011	31	233
Cal-Switch (800) CAL-SWCH	34	293	Jeron (800) 621-1903	103	276	Syn-Aud-Con (812) 995-8212	68	281
David Clark (508) 756-6216	107	262	Lectrosonics Inc. (800) 821-1121	85	227	Techron (219) 294-8300	68,69	285,286
Columbia Scientific Industries (512) 258-5191	109	283	MacPherson Loudspeakers (517) 321-0700	36	275	TEI (800) 327-8811	78	287
Community Light & Sound (215) 876-3400	56	251	McCauley Sound (206) 848-0363	24	263	TekTone Sound & Signal (407) 844-2383	53	208
Components Specialties (800) 645-5516	74	266	Menlo Scientific (415) 528-1277	100	269	Telecall (800) 752-2860	13	209
Crown International (800) 535-6289	60-61	228	Microframe (800) 635-3811	114,115	291,292	TOA Electronics (800) 843-4753	15	212
J.W. Davis (800) 527-5705	30	254	Mircom Communication & Security (416) 665-4301	44	265	TSI (800) 628-2084	87	250
dbx (415) 351-3500	93	225	Orban (415) 957-1067	28	232	University Sound (818) 362-9516	51	231
DIS-Brahler (301) 622-9100	69	284	Pacific Transformers (800) 325-0501	52	290	Vega (616) 695-6831	CII	211
DOD Electronics (801) 268-8400	46	255				West Penn Wire (800) 245-4964	71	218
						White Instruments (512) 892-0752	54	277

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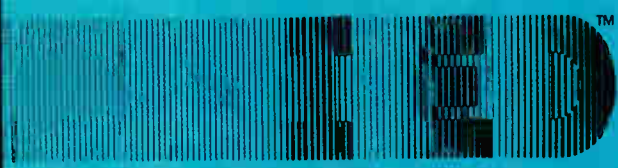
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