

SOUND & COMMUNICATIONS

Volume 36 Number 5

May 16, 1990

RESIDENTIAL INSTALLATION

On the side of a cliff above the Hudson River, a \$1,000,000-plus home with a multi-room media system, security system, and automatic water control demanded that the audio-video installer, the architect, the security and the coordinator all work together. **16**



IN THIS ISSUE

INTERCOMS

Where are the prospects? Legal changes make prisons prime targets. And fast-food finances prime the drive-through market. **26**

SOFTWARE REVIEW

The computer comes to the bidding process. The Anaheim Bid program helps assess whether a job will put you in a mansion or the poorhouse — and whether you'll get the job in the first place. **34**

MLSSA REVIEWED

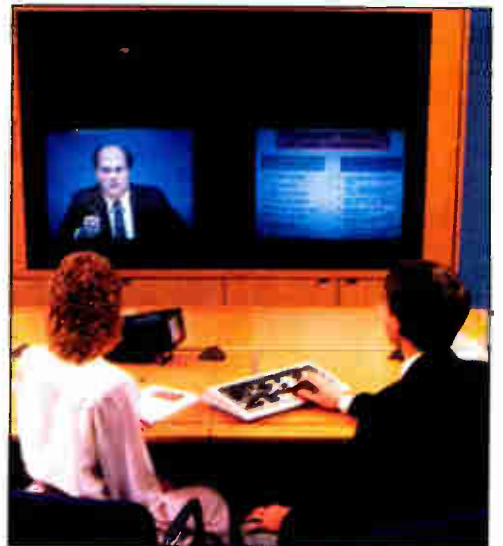
DRA's MLSSA offers predictive analysis in a test system that has unique advantages. **64**

TESTING

Investigative methods of considering boundary surface acoustical effects in rooms. **12**

VIDEOCONFERENCING

Videoconferencing is a growing solution to a multiplicity of problems related to both communications and economics. The base of systems has doubled in the past year. New equipment and new standards make the process more feasible. An overview of the market. **38**



A VALLEY



ey Wine Train has been getting a lot of attention from tourists. But the train's intercom system required early thought and wiring to make it discreet, useful and conforming to code. **34**

ELECTRONIC RANGEFINDERS

The tape measure may be the tool of the past. Electronic rangefinders are taking over. At low cost and feature-packed, they're the newest time savers and come in a surprising number of models. **44**

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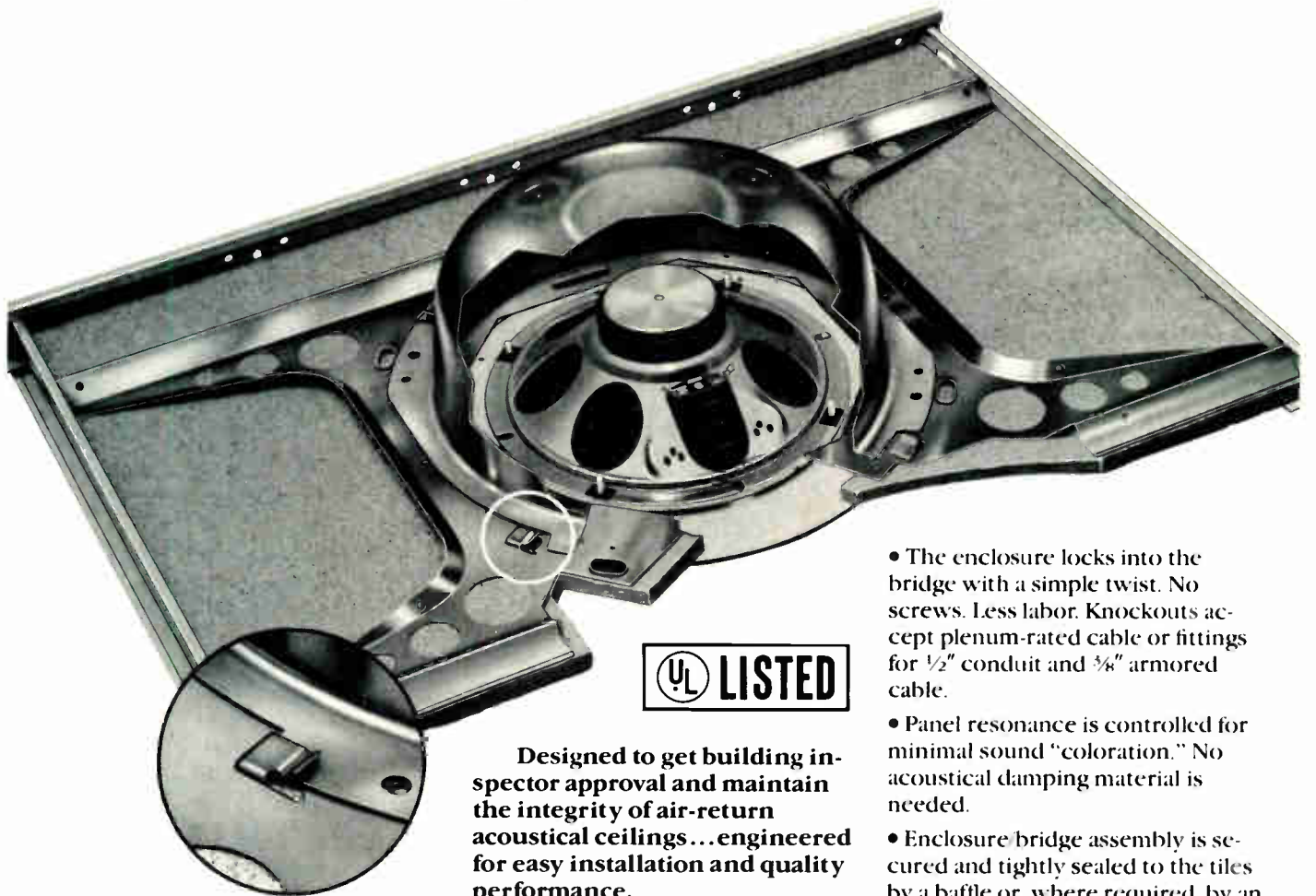
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LETTER FROM THE EDITOR

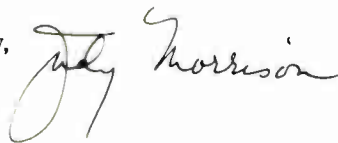
There's a birthday being bandied about our office that you might not be aware of. This May 1990 issue of Sound & Communications marks the magazine's 35th anniversary. That's right — thirty-five years. This publication started with this business, and continues to grow and expand its horizons along with the sound and communications industry. From early issues like FM radio and PBX systems, we've moved into teleconferencing, fiber-optic transmission, and computerized testing and predictions. The mission remains the same as it was in the early years — to keep in touch: with the readers, the industry, and with related industries.

When Testa Communications purchased Sound & Communications from its founder, Jerry Brookman, the reasoning

was that this magazine fit into the markets we were in already and allowed the company a viable outlet for information that we were collecting and needed a forum for. We also saw the seriousness and knowledge of the readership as a positive audience for the direction we thought the magazine should move in. We think we were right. Sound & Communications is a forum for this industry and tries to stay on the cutting edge of technology while maintaining a balance of marketing and installation information. The outside world apparently recognizes this. During the last fifteen minutes, as I write this, I have received three phone calls — one from an engineering college offering information on a software program we have reviewed; one from an audiologists' group requesting a copy of an article we've run on hearing; and one from a market research firm requesting information on the sound contracting business. We're happy to comply, because the business of a magazine goes beyond the magazine's business into the field it covers to service that field. And we invite, always, the comments and concerns of our readers for inclusion in these pages.

Through the last thirty-five years there has been a wealth of changes in the business. But some things have remained the same. We're told that the first advertisement in Sound & Communications was one for Atlas Sound and was placed by Herb Jaffe. We're pleased to say that Atlas (now Atlas/Soundolier) is still an advertiser. And we hope to continue the relationship with our readers and our advertisers through the next thirty-five years.

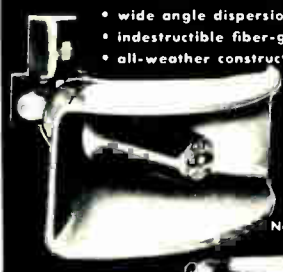
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SOUND & COMMUNICATIONS

Publisher/Editorial Director
Vincent P. Testa

Editor-in-Chief
Judith Morrison

Technical Editor
Mike Klasco

Assistant Editor
Steve Jacobs

Contributors

**Robert Angus, Richard J. Gula,
Dr. Kathleen J. Hansell, T.G. McCarthy,
Steven J. Orfield, Suzan Prince, Gary Rouse**

Technical Council

Dr. Mort Altschuler

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

C. Leroy James

Rees Associates, Inc.

Richard N. Jamieson

Jamieson and Associates, Inc.

Russell Johnson

Artec Consultants, Inc.

Richard Negus

Purcell Noppe Associates, Inc.

William Parry

Maryland Sound Industries, Inc.

Daniel Queen

Daniel Queen Associates

Jon Sank

Cross Country Consultants

William R. Thornton

Phd, PE

Art Director

Germaine Egan Cassidy

Assistant Art Director

Steven E. Ingram

Artist

Joyce Dolce

Production Manager

Joanne Commisso

Typography

Leo Ancona

Helen Schmitz

Circulation Director

Robert Evans

Classified Ad Manager

David Saraf

Traffic Coordinator

Ron Perone

Advertising Assistant

Lisa Levy

Advertising Director

Nancy Davis

Editorial and Sales Office

Sound & Communications

25 Willowdale Avenue

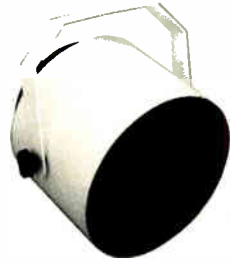
Port Washington, New York 11050

(516) 767-2500

FAX: (516) 767-9335



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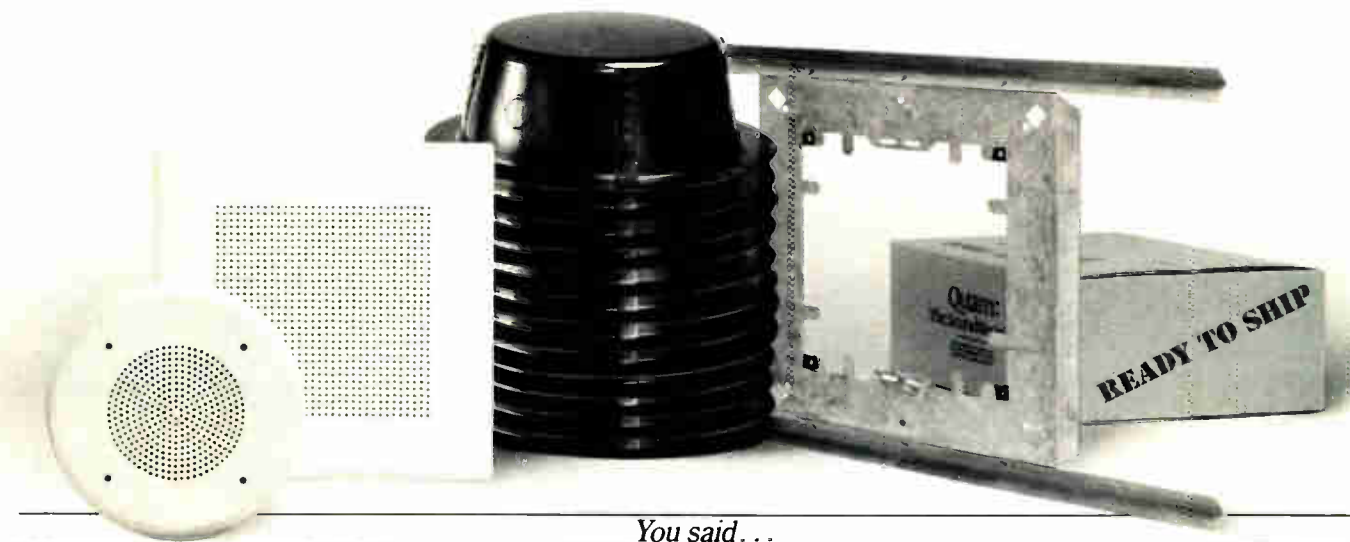
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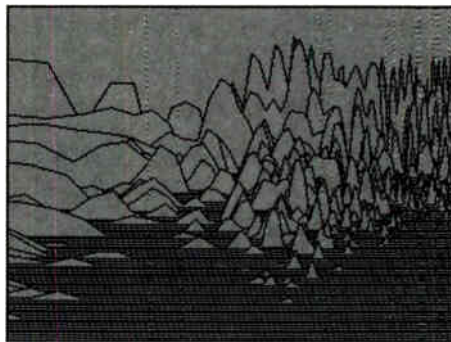
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SOUND
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The intelligent answer to multi-mic mixing is automatic. It's TOA.

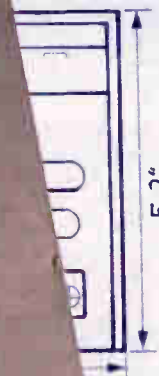
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Eight ports make upgrades and changes quite literally, a snap! And with 37 plug-in modules from TOA's legendary 900 Series — mic, line, aux, BBE Sonic Maximizer, I/O and bridging — system design and upgrade options are limitless.



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Mic's gate on instantly, silently. No pops, no dropped syllables, and no feedback. System response and clarity are breathtaking. Front-panel threshold controls allow attenuation of inactive inputs from 0 (always on) to -40db.

The AX-1000 is the flagship in a revolutionary line of highly engineered audio products changing the way people talk, think and feel about sound. It's an important reason you'll find TOA the automatic choice wherever people are serious about sound.

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NEWSLETTER

RENKUS-HEINZ IN EUROPE

Rumors are rife that Renkus-Heinz is about to cut a deal with N.V. Philips of the Netherlands to supply pro loudspeaker systems wherever Philips has national organizations. This would presumably open up to Renkus-Heinz some of the major new European facilities on tap, such as Euro-Disney and the Neuremberg Stadium.

IVIE BUY-BACK

Ivie, which was acquired by Mark IV Audio as part of the Cetec package, is in the process of being bought back by Ivie management personnel. Finalization of the deal is expected by the end of May. Details of the financial arrangement were unavailable at press time, although it is presumed that Mark IV helped out with the financing.

SOUND & COMMUNICATIONS HOSTS SOFTWARE MEETING

At a meeting in Las Vegas, representatives of all the major sound system software designers met for the first time to discuss their need to keep in touch regarding the possibilities of standardization and interfacing with established software programs such as AutoCad and VDP. The meeting was called and hosted by Sound & Communications magazine, which will keep its readers posted on further developments.

DYNACORD THROUGH ALTEC LANSING

Mark IV Audio's recent acquisition of a majority interest in Dynacord was elaborated, as it became known that Dynacord products would be distributed through Altec Lansing.

CERTIFICATION PLANNED

The National Sound and Communications Association is planning enhancements to its sessions of educational programs at next year's NSCA Expo. A program of certification is being planned for sound contractors.

NEWSBITES

Shure Brothers celebrated its 65th birthday on April 25...Jeff Pallin, formerly with University, is now with TOA... Mike Malizola, previously with Kurzweil, and with Yamaha before that, has moved to Bose.

NSCA-TV NEWS AT EXPO '90

The NSCA Expo was once again serviced by NSCA-TV News, the news and information television program provided free of charge to NSCA attendees in their hotel rooms and on monitors on the exhibit floor. This year, the program was also viewed on an Imtech videowall. NSCA-TV News is produced by Testa Communications, publisher of Sound & Communications.

NEW TEF VERSION

The Techron division of Crown has introduced the Tef 20 System, the newest addition to its line of sound analyzers.

CONSULTING FIRM FORMED

Joel Lewitz, who was a founder and principal of Paoletti/Lewitz Associates, has opened his own consulting firm in the San Francisco area.

PESA AMERICA FORMED

Pesa, the Madrid-based video products company which purchased 3M video products division in January, has opened Pesa America to manufacture and distribute the former 3M line along with Pesa products such as video monitors.

NEWSLETTER

STUDER PURCHASED

The Studer Group has been acquired by SAEG Refundis, a subsidiary of Motor Columbus, the Zurich-based company with annual sales of 1.3 billion dollars.. The acquisition includes all Studer divisions and was negotiated directly with Dr. Willi Studer. Tor Nordahl remains president of Studer Revox America, and the deal reportedly gives the Studer Group a platform to remain independent and aggressively pursue its interests in digital recording and editing systems.

NEVE BUYS ORION

Neve has acquired Orion consoles, in addition to the Canadian distribution rights to Wheatstone products. The Orion Series consoles are now marketed as the Neve Orion Series and include disk-based memory features and modular style construction. Neve itself is a division of Siemens.

NHK TAPE FORMAT EXPECTED ON MARKET

The half-inch composite digital video format developed by NHK has been shown in prototype form by both Panasonic and JVC. An engineer from NHK expects product to be on the market by year-end. SMPTE standardization and nomenclature had not been standardized by press time.

DAT TIME CODE

Time code standardization for DAT is close to final, with Sony showing prototype DAT product incorporating the expected time code standard.

SPENCER TO SONY

Courtney Spencer has been appointed vice president, sales and marketing, of the Sony Professional Audio Division. Spencer replaces Osamu Tamura, who has returned to Japan. Previously, Spencer was Vice President, Sales at the WaveFrame Corporation, and Vice President and general manager of Martin Audio Video Corporation.

COMMAX AT BUSHFIELD'S

J. Bushfield's Inc., with Hiko Shinoda, president, has signed an exclusive agreement with Jung Ang Electronics Co. to nationally market Commax intercoms and related products. J. Bushfield's has formed a new division, Commax Intercom Systems. The company already markets the Telecall line.

EIA, LITTLE SUPPORT HOUSE BILL

Bill Little, president of Quam-Nichols and chairman of the Electronic Industries Association, and Peter McCloskey, EIA president, met with Representative Dan Rostenkowski, chairman of the House Ways and Means Committee, in support of Rostenkowski's proposal to eliminate the federal budget deficit. Little stated, "The federal budget deficit exacerbates most of the concerns that face our industry. These concerns . . . have become serious impediments to our competitiveness."

DOLBY AC-2

Wegner Communications has become the first OEM licensee of Dolby Laboratories' Dolby AC-2 digital audio coding process. Wegner, which manufactures satellite and cable communications systems, will incorporate the process in its decoders. Dolby AC-2 is an adaptive transform coding process for professional quality audio transmission and storage at greatly reduced data rates. The AC-2 process was announced last fall, and is incorporated in Dolby encoders and decoders operating at 128 kbits/sec, one-sixth the data rate of conventional 16-bit PCM.

THE SINGLE BOX SOLUTION:

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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.

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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.

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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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Reflection and Boundary Surface Effects

By Steven J. Orfield

If the AES convention and current literature in the field are any indication, there has been a growing recent interest in the characterization of the psychoacoustic benefits of rooms, loudspeakers, processors, etc. Underlying most of this interest is the well-documented view that most architectural acoustics and audio problems are, to some significant degree, a function of room acoustics. Some of the current issues suggesting this are the interest in binaural recording and reproduction, the increasingly frequent introduction of digital audio components that are designed to simulate specific environments (*i.e.*, symphony halls, etc.) and the ongoing interest and experimentation into the validity of “listening tests” and intelligibility metrics.

As the experienced acoustic and audio practitioner know well, the problem of system design in a “good room” is a limited and predictable problem: alternatively, system design in a “bad room” often has a fixed quality limit. Unfortunately, many rooms are “bad rooms” not only due to problems such as excess reverberation (liveness) but increasingly due to very limited reverberation spectra characteristics of “dead rooms.”

This article is a brief introduction to the issue of reflection and of the four alternative methods of considering boundary surface acoustical effects in rooms:

- Geometric reflection
- Diffuse reflection
- Absorption
- Diffraction

ROOM ACOUSTICS

The acoustical performance of rooms has no absolute quality continuum; there

is no such thing as the ideal room. Generally, rooms must perform a set of acoustical tasks, and those tasks may be both difficult and contradictory. A good example of a potential acoustical performance criteria is the paradigm of the auditorium with a fixed stage. This room often must provide live speech reinforcement, amplified speech reinforcement, live music reinforcement, amplified music reinforcement, reinforcement for movies, teleconferencing reinforcement, and reinforcement for the hearing impaired.

“The alternative and riskier strategy is to assume the more difficult room acoustics tasks to be the highest priorities.”

Depending on the priorities assigned to these tasks, the architect, the acoustical consultant and the audio consultant may decide to employ one of a variety of approaches or to employ a combination of more than one approach. Potential acoustical design approaches include: a fixed acoustical environment; a physically adjustable acoustical environment; an electronically adjustable acoustical environment; and an electronically adjustable audio system capable of simulating alternative acoustical environments and effects.

The most conservative solution to this type of “multiple use” facility is to provide very limited room performance (via the use of large amounts of sound-

absorbing materials) and to simulate room results via the audio system design and adjustment. This solution is often quite predictable in that it precludes excess reverberation and echoes, it allows for a modest cost loudspeaker system (low Q), and intelligibility is usually quite good. Unfortunately, all of these victories come at the loss of perception of the room or its benefits. Live speech and music will generally sound very poor, and the acoustical “felling” of being in a large room will be lost. Also, fabric-covered fiberglass acoustical panels are quite expensive (generally in the \$7 to \$10 per-square-foot range), and thus this approach will significantly increase the architectural budget.

The alternative and riskier strategy is to assume the more difficult room acoustics tasks to be the highest priorities. Under this scenario, the auditorium would be designed for high quality live music and speech, and the sound reinforcement system would be higher in quality (and more expensive) to deal with the greater reverberation times and therefore the higher potential for a “muddy” room. This approach requires three necessities that the first does not — that is, sophisticated acoustical and audio analysis, in addition to architectural-acoustical cooperation in room shape and finish decisions.

In the majority of cases, the room is designed without acoustical analysis or participation, and thus, this second and higher quality approach is often precluded.

While the first approach (a “dead” room) requires a low-tech application of acoustical absorbers and little analysis of room boundaries, the second approach requires specific analysis of room surfaces with regard to reflection, absorption, dif-

fusion, and diffraction.

This analysis of room boundaries and surfaces is generally based on a set of concerns related to the room size and use. In the case of our auditorium example (and assuming need for live speech and music reinforcement) the general intent of this analysis is to insure these results occur: reverberation time should be suitable for the room size and use; echoes should be avoided; early reflections should be supported; early reflections from the side walls should be supported; diffuse reflections may be a useful component of the total area of reflective surface use; and background noise levels should be controlled based on the needed noise criteria for the space use.

With these purposes in mind, there are some general approaches to each of these problems, in terms of surface placement and treatment.

REVERBERATION

There are a number of classic recommendations on reverberation times for different types of rooms. One example of a table of this sort for auditorium use (speech standards) is noted in figure 1.

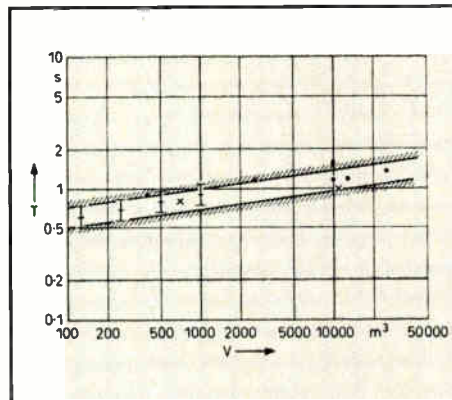


Figure 1. Cremer & Muller — Principles and Applications of Room Acoustics.

The required reverberation time target is typically achieved by use of a three-axis reverberation equation (e.g., Fitzroy Reverberation Equation) into which is input the octave band absorption ratings of each surface material. As the different surfaces are considered, the other performance requirements noted above often determine the exact placement of absorption and reflection.

ECHOES

Echoes are produced when a sound reflection falls within a certain range of delay times, as compared to the direct sound from the source. Reflections shorter than echoes fall within what some refer to as the "fusion zone" and are perceived, as described by the work of Helmut Haas (the Haas Effect) as noted in figure 2.

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



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

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

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

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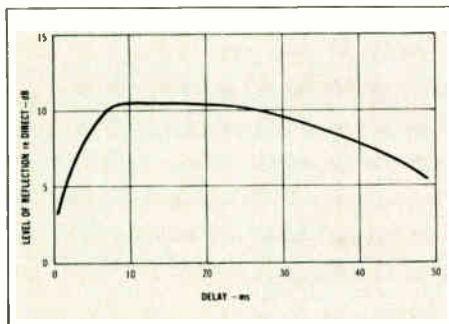


Figure 2. Glen Ballou, Editor — Handbook for Sound Engineers

Beyond this range, typically between 50 and 100 ms, specular reflections of speech not accompanied by closely spaced reverberation are generally perceived as echoes. This is shown in Figure 3.

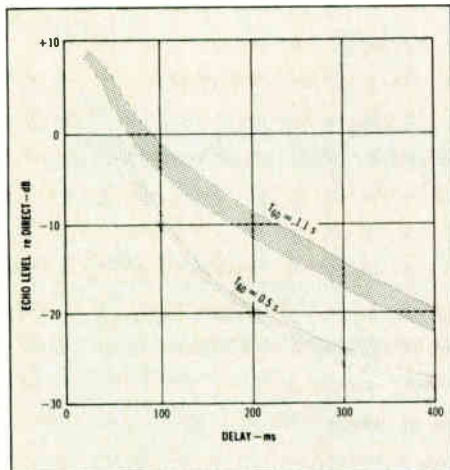


Figure 3. Glen Ballou, Editor — Handbook for Sound Engineers.

Echoes can be dealt with via many methods of reduction. The first is to insure that the basic room shape does not provide reflections within this defined range. If potential echoes are present, the surfaces can be dealt with by changing their angle (*i.e.*, slanting), changing their reflection from specular (imaging) to diffuse or by applying absorption. Echoes can also be dealt with by shifting the frequency of the reflection via the use of various reflector and absorber types. (Echoes can also be “cancelled electronically via the use of loudspeakers and time delay systems.)

EARLY REFLECTIONS

Leo Beranek, in his classic work, “Music Acoustics and Architecture,” popularized the concept of performance rooms and their “initial time delay gap.” By this he was referring to the time between the arrival of the direct sound and the first reflections. He was insistent that this period be relatively short, as he detailed in his book. (See Figure 4.)

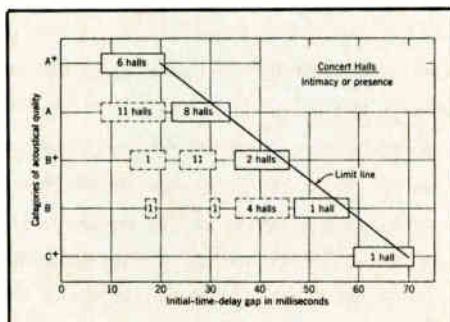


Figure 4. Leo Beranek — Music, Acoustics, and Architecture.

Beranek’s tours and psychoacoustic experimentation demonstrated very clearly that music halls were perceived as better in quality by statistically significant numbers of listeners when this ITD period was within this noted range. Similar concepts have emerged regarding rooms for speech: long initial delay times tend to clearly degrade intelligibility. Most recently, the acoustical community has referred to the “early decay time” (the first 5 to 10 dB of reverberation decay) in appraising the intelligibility benefit of a room.

EARLY SIDE REFLECTIONS

In the same psychoacoustic arena, research has clearly indicated that listener preference (in music performance) is related to what is referred to as “lateralization” or the “lateral fraction.” These descriptions refer to the fraction of sound arriving at the listener from the side versus the front of the room (source and forward reflections versus side reflections) John Bradley of the National Research Council/Canada has been working with this and other metric ratios related to listener preference and has authored a

number of articles and a calculational software program using these concepts.

DIFFUSE REFLECTIONS

Acoustics consultants have long realized that reflections could be controlled by “fractionalizing” or changing the reflections from specular to diffuse. In the design of performance halls, this use of diffusion has long been a method of both blending sound and of reducing the potential for echoes. More recently, the noted physicist, M.R. Schroeder, has developed a new theory of diffusion based on maximum length sequences, and out of this theory has come the quadratic residue diffuser or QRD. This concept will, over the near term, allow for the calculation of the reflection spectra of nominally different angles of desired reflection, thereby allowing the construction of relatively small scale diffuse reflectors that reflect sound in one plane only via the construction of adjacent, varying size linear “wells” made of acoustically reflective material.

These are now quite commonly used to control rear wall reflection in control rooms of recording studios. (Figure 5.)

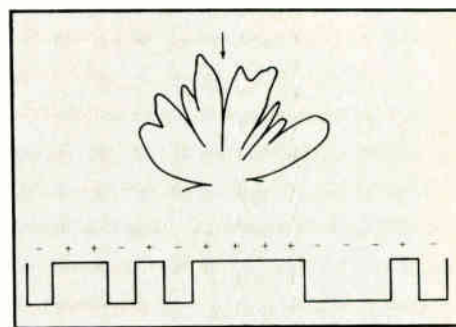


Figure 5. Glen Ballou, Editor — Handbook for Sound Engineers.

BACKGROUND NOISE LEVEL

Finally, one of the most preventable failures in room acoustics is the “noisy” room. This room either exhibits an HVAC system that does not meet a reasonable noise criteria value or exhibits transmission of environmental noise from outside the room. The first problem simply requires a formal HVAC acoustic analysis. The second problem requires that the

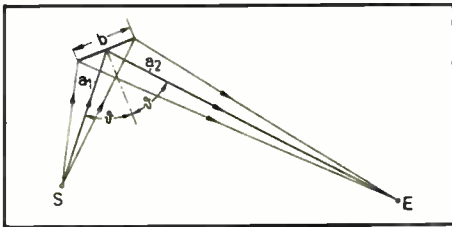


Figure 6. Cremer & Muller — *Principals and Applications of Room Acoustics* page 108.

boundary surfaces also function as transmission barriers to whatever level of exterior noise spectrum can be predicted or expected. All too often, room designers forget that a significant part of the room boundary reflectors also serve as transmission barriers to outside noise.

REFLECTION AND ABSORPTION PRODUCTS

In addition to the custom uses of surface materials specifically designed and calculated for acoustical applications, there are a broad variety of standard materials available for use in reflection control in rooms. These materials fall generally into three categories: geometric reflectors, diffuse reflectors, and absorbers.

Among the more standard materials for geometric or specular reflection are hanging fiberglass reflectors, metal and wood panels and Plexiglas reflectors. (Figure 6.)

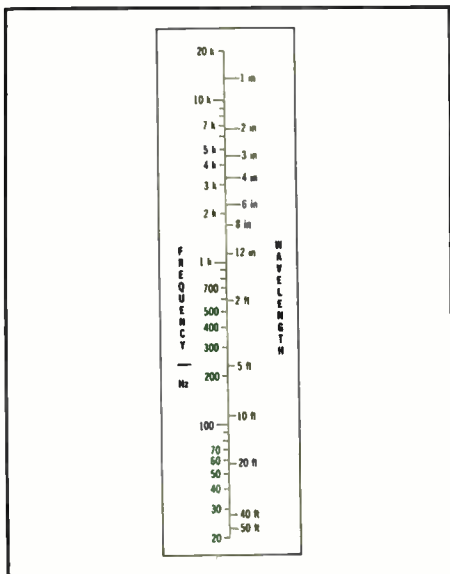


Figure 7. Glen Ballou, Editor — *Handbook for Sound Engineers*, page 8.

Reflectors can also be designed in concave or convex configurations in order to focus or disperse sound geometrically.

With regard to diffuse reflectors, the diffusion performance of the reflector is generally limited by the size of the surface detail in relationship to the wavelength of sound of interest. Wavelength is derived by the equation: Wavelength =

1130/frequency.

The number 1130 is a constant for the speed of sound in air for typical conditions indoors. Typical wavelengths in the audible spectrum range from less than an inch to more than 50 feet. (Figure 7.)

A simple view of reflectors, when considering the reflector size, is that it should *(continued on page 62)*

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AUDIO, VIDEO AND SECURITY IN A NEW YORK HOME

BY RICHARD J. GRULA

Since the market crash of 1987, new home construction has been sluggish throughout the country. But one still-growing segment of the market is customer homes in the \$1 million-plus range. Though the actual number of these residences is small, almost all incorporate extensive audio/video and security systems as built-in features. Ready to spend \$400 or more per square foot, these owners want — and expect — full customized state-of-the-art A/V and security installations. As a result, the high-end home market now provides a growing portion of revenue for sound and communications specialists.

An example of this trend is a home in Westchester, New York. Perched on the side of a cliff high above the Hudson River, the house is an ultra-modern three-story structure with dual outdoor decks, art deco design flourishes and walls of windows facing east on every floor, providing spectacular views of the river. Designed by architect Jay Measley, the house is more than 3,000 square feet and cost over \$2 million. It includes an audio/visual system by Audio Command of Rockville Centre, New York, and a multi-function security system created by DL Security of Ardsley, New York. Dan Siff, a business partner of the owner, served as coordinator for the project and selected the contractors.

General system requirements were straightforward — the owners wanted an A/V installation located in a downstairs media room with control and listening capabilities extended throughout the house. The security system had to be convenient and user-friendly because, as architect Jay Measley put it, the owners 'didn't want to fiddle with a lot of gadgets every time they did something.'



The Media Room contains a multitude of equipment by Yamaha and Sonance.

Since private home designs are typically more sensitive to the intrusion of A/V and security systems than commercial facilities, architect Measley recommends trade specialists be extremely flexible when presenting details of their systems. Options on everything from component placement to brands are crucial.

'Don't come in with one system,' cautions Measley. 'If any specialist is perceived as a rep for a product, I'm almost less interested. It's like an insurance agent — if an agent represents only one company, you're not sure you're seeing a broad range of what's available. If a security or audio specialist can come in and offer different systems based on the same or different requirements, I'm much more receptive to that individual. It's flexibility and knowing you're getting the best

if you're spending that kind of money.'

In contrast to many gotta-be-finished-by-last-week installations, the project was extremely well planned. Measley actually began designing the structure five years ago. Coordinator Dan Siff brought in the security and A/V specialists at the end of the construction drawings phase so recommendations on component placement and wiring needs could be considered before construction. A year and a half before installing components, the security and A/V contractors were able to lay wires in predrilled holes while the house was just a bare steel shell. Benefits were obvious — careful, unhurried installation produced neat, clean, exact work. And since each trade had plenty of time, there was none of the typical fighting between unions and specialists over who gets to do what and when.

SECURITY

For security needs, Rob Aliva of DL Security, Inc. designed and installed a



The security keypad.

\$20,000-plus system that included everything from fire and burglary alarms to motion-triggered lights in the driveway to a special radio telemetry monitoring system for water pumps that serve the house.

Controlling the fire and burglary systems are four Moose Products model Z1100-E keypads located in the master bedroom, at the front door, near the garage entry and on the lower level near the media room. These keypads communicate with various sensors — motion detectors, door contact switches and smoke/fire/gas alarms — and provide the owner with complete status reports of each sensor.

Rather than each sensor having its own circuit, they are zoned in groups — all doors' switches on each level, motion detectors on each level and then individual smoke/fire alarms in the media room, laundry room, kitchen, second floor, boiler room circuit, boiler room natural gas sensor and sprinkler system. Aliva wired the fire signalling system so that when an alarm sounds, it rings in all rooms. The



Angled control panel in bedroom contains Yamaha RX-1100 receiver, KXW 900 cassette deck and Echo Star 3000 IRD Satellite tuner.

user then walks to a keypad, presses a button and all alarms stop except the one which triggered the system.

The indoor motion detectors (Arrowhead Enterprises model DL-250) use dual technology ultrasonic and infrared combined sensing. The battery-less smoke detectors (ESL model 440-CST) have heat sensors for back-up. And the driveway motion detector (which automatically turns on outdoor lights when

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RESIDENTIAL INSTALLATION

people or vehicles are detected) is a dual-technology Napco model D100 modified DL Security for outdoor use.

"We took out the circuit boards and sprayed them with two or three coats of a special epoxy resin designed for that purpose," says Aliva of the modified Napco units. "Before we put the cover back on we put on a gasket seal with silicon. They should hold up a good number of years."

The driveway motion detector uses a combination of microwave and infrared sensing that looks for body heat and motion via a Doppler shift. ("Sort of like radar," says Aliva.) Both sensors have to simultaneously agree there is an intruder before the sensor triggers. This eliminates false alarms because of swaying trees or small animals.

The telephone system doubles as a full-

function intercom with every phone in the house capable of calling any other phone (there is no master/slave scenario). The phones can also be used to answer the front and side doors. When someone presses a doorbell, the phones give off a unique ring and indicate, by way of an LCD display, which doorbell was rung. Owners can then pick up the phone and answer the door without leaving the room they're in.

Because of the house's steel frame, special Belden Brand model 8723 computer grade shielded cable was used throughout the security system. All wires run to a locked junction box in the downstairs laundry room and any cable not concealed within the walls is sealed in metal piping to prevent tampering. Every system within the junction box has backup battery power in case of blackouts.

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World Radio History

"We took out the circuit boards and sprayed them with two or three coats of a special epoxy resin designed for that purpose."

Since the house is located on a cliff, and the nearest county water line runs along a road several hundred feet below, a special water pump system is used. Water is pumped up the cliff from the county pump house to a holding tank which is shared by three houses. If the houses pull too much water, there is the risk the holding tank water level will drop below the minimum amount needed to maintain the vacuum pressure, causing many problems for all involved.

To prevent this scenario, Aliva designed a special system that monitors the holding tank water level and notifies the road-level pump house when to pump water. It also tells the house when it should stop draw-

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World Radio History

WHAT'S NEW IN HOME AUTOMATION

BY ROBERT ANGUS

When Mike Zazanis drives up to the door of his new home in Annapolis, Md. at night, lights come on automatically in the driveway and garage. In the entryway, soft music plays and the living room is heated or cooled to just the right degree of comfort. Elsewhere in the house, lights turn on or off automatically as his wife Lu moves from room to room.

That's home automation, an industry that's grown from practically nothing in 1987 to \$330 million by the end of this year. And that's without the benefit of home automation standardized systems like the National Association of Home Builder's Smart House and EIA CEG's CEBus, both expected to become reality by the end of 1990. Once the standards have been set, manufacturers of everything from air conditioners to TV receivers are expected to begin marketing products designed to talk to each other electronically.

In fact, although perhaps as many as 1000 high-end audio shops, security system installers, satellite and rooftop TV antenna specialists and others may describe themselves as custom installers, there probably are no more than 100 full-time specialists, according to Indianapolis Tom Doherty.

"It's growing so fast that there's a very real question who's going to sell the equipment and do the work," says Harry Bloom, general manager of Bose Corporation's residential sound group. Because custom installation involves so many talents and cuts across so many lines, it's beyond the experience of many traditional retailers, those who are content to sell the product but lack the personnel or time to design and install it.

Enter the custom installation specialist,

once a one-man band operating out of his home but more likely these days to be a team of experts, each specializing in part of a total system. While some professional audio and video retailers have assembled such teams or created custom departments within their shops, the typical custom specialist operates from an office rather than a storefront, without equipment displays and demonstration facilities.

"Home Automation is
an industry that's grown
from practically nothing
in 1987 to
\$330 million by
the end of this year."

For most of the rest of the year, CEBus and Smart House will be concepts, rather than finished products — although some manufacturers already are beginning to mark "CEBus-compatible" and "CEBus-ready" on their products. An important distinction separates the two concepts: Smart House installations require the services of a licensed electrician because the wiring harness includes AC power lines. Also included in a ribbon 1½ inches wide are coaxial cables to handle video signals and twisted pairs or telephone wire, to carry intercom and telephone, home security, audio and other signals.

CEBus, by contrast, is entirely a low-voltage system, which means that any experienced sound installer can put it into a new or existing building. So far, there is no "official" CEBus wiring harness com-

parable to Smart House's; but custom installers like Hometron of Cabin John, MD., recommend that clients today install two runs of coaxial cable (RG 6 or RG 59) and four twisted pairs as new homes are being built. When the appropriate wall sockets become available next year, it'll be a simple matter to connect them to existing wiring. Then, with outlets throughout the house, a buyer or homeowner can expand his system at his own rate by adding CEBus TV receivers, microwave ovens, specialized telephones, home computers or home automation controllers. "The important thing is to get the wiring in while the walls are open," says Hometron's Sean Walsh. "It's easier and cheaper then, and it makes for a much neater job."

Walsh operates from a suite of offices that looks more like those of a doctor or lawyer or successful architect than a typical consumer electronics retail showroom. Instead of shelves full of equipment, his office is lined with shelves filled with presentation binders containing color photographs and specifications — for various of his installations, for the audio and video components he's likely to use, for specialized products like the Unity Systems Home Manager, a comprehensive automation system controlled by a CRT touchscreen. In addition to his sales force, systems engineers and in-house architectural consultant, Walsh works with specialists in audio, video and other specialties, who maintain their own offices nearby.

One of the reasons custom installation has become so popular with high-end audio specialists, home builders, security system contractors and others is the profitability not only in the labor but also in the sale of materials. A typical installation,

including audio, video and related electronics, starts at \$10,000 and can run to more than \$100,000, with the average well above \$50,000.

"These things are not price-sensitive," says Dave Bielecki, whose Barkhamsted, CT company, ASRA Inc., accounts for many of the installations in deluxe homes in his area. "What I'm selling is my expertise and consumer satisfaction. It's my job to know what will work in a particular room or situation, and to know what's best in terms of equipment. I'm not in competition with the local Sound Playground when it comes to price on a projection TV unit or the components for a built-in sound system, which means that I can get full markup on the products I select." Indeed, until recently, Bielecki was forced to buy many of the products he installs at retail because he wasn't generating enough volume with any one manufacturer to qualify as a dealer, a situation which now has changed.

Bielecki, Doherty, Walsh and other old hands agree that one of the biggest pitfalls facing newcomers to the field is the temptation to bid low on jobs. "People who are in audio or video retail, TV antenna installers, security system companies look at what we're doing and the prices we charge and figure they can make a fortune while still charging less," Bielecki said recently. "They don't realize the time that has to go into doing the job right. The result is that they end up spending a lot more time than they can afford on an underbid job, or using second-rate components in order to stay in the business. You can't do that very often before you're out of business. In the meantime, you may have cost a contractor who knows what he's doing the job."

Walsh reports that while there has been a dramatic slowdown in new home starts overall and nationwide, the custom installation market has never been better. "When it comes to homes in the \$1 million and up class, they're selling as fast as the builders can complete them," he reports,

"Because custom installation involves so many talents and cuts across so many lines, it's beyond the experience of many traditional retailers."

"particularly in high-income areas around Washington, D.C. and New York." In order to improve their saleability, builders are in the market for striking features, like a home theater or comprehensive home automation. "And because of their locations, most come fully equipped with the best home security systems." In the past few years, a number of firms like Mitsubishi, NEC, Bose, Sonance and X-10, familiar companies at the Consumer Electronics Show, are turning up a few weeks later at the National Homebuilders' Show.

Beginning in 1991, manufacturers of a wide variety of consumer electronics products plan to introduce microwave ovens, air conditioners, TV sets, personal computers, music systems, even electric blankets that will interface with CEBus to form an ever-expandable, programmable home electronics system. In the meantime, a number of manufacturers offer something less than comprehensive packages, ranging from the pioneering X-10 infrared controller system to a Radio Shack universal remote controller. The X-10 system consists of a number of controllers, remotes and wall modules which can be expanded continually, using the AC wires of a home to turn lights off and on, remote-control various electrical appliances, and so on. Now more than 10 years old, it forms part of the technology of much more modern systems, including CEBus, Mitsubishi's and others.

Mitsubishi's House of the Future actual-

ly contains a number of ordinary consumer electronics products interconnected by X-10, a telephone keypad and other means. The home security part of the package, for example, displays a picture of a caller at the front door in an inset on the TV screen. The homeowner can talk to the visitor through the TV set, and can open the front door simply by pressing a button on the TV remote control. If there's no one at home, a video printer produces a hard copy print showing the visitor and the time of day. A call from a telephone anywhere in the world can turn the lawn sprinkler on or off or start dinner. And so on.

Bang & Olufsen's Beolink signal distribution system is limited to controlling audio and video signals from various points in the home, and to channeling sound and vision from a source in one room to reproducers in others. But the most impressive off-the-shelf item available today probably is the Unity System Home Manager, the one Mike Zazanis uses to manage comfort, lighting and energy costs at his home in Annapolis. It divides not only the house, but some of the larger rooms in it, into zones with their own temperature, humidity and lighting control. It can turn appliances as well as lights on and off automatically or with the aid of an infrared X-10-type controller. The home security system not only warns of open or unlocked windows and doors, but contacts the fire or police department in case of an emergency. It has the potential of alerting paramedics in the case of an elderly person in the house alone who stops moving for a long period of time.

Custom installation of audio-video equipment, home automation, intercom and sophisticated telephone service, security, climate control and home office equipment is a fast-growing, highly profitable field that welcomes newcomers — provided they take the time to learn the business and are willing to take the time to do a job right.

EXPECTATION IN THE MARKET

By SUZAN PRINCE

New prison builds, luxury housing and selected drive-through segments represent prime earnings opportunities in 1990 for suppliers and contractors involved in sophisticated, microprocessor-controlled intercom systems.

On the high-tech front, the melding of access control and communications continues, and the industry expects to develop and place more integrated one- and two-way audio/video-based units in a variety of applications.

Major manufacturers are moving rapidly to capitalize on a recent Federal edict forcing many municipalities to end or at least alleviate jail crowding. "The government is actually fining regional authorities until they get facilities built to eliminate, or substantially alleviate the overcrowding situation," observes Al Burns, TOA Electronics intercom division director.

That in mind, Burns says, "The correctional facilities market for advanced intercom systems has really jumped into the forefront." Besides new construction, "Some areas are doing 'quick fixes' just to gain some beds and help ease the problem."

For the next eight to 10 years, both new and existing correctional installations will be "a prime market," he says, adding, "Sales are going to go right off the charts." TOA cites industry revenue projections of more than \$100 million annually through the decade.

Substantiating the rosy forecast is the knowledge that these facilities' systems need to be larger and more complex than, say, a typical office install. They also require implementation of expensive microprocessor technology, as TOA demonstrated during last month's NSCA, when it showed the first production model of its newest full-featured institutional system.

"The market is going toward integrated turnkey systems that encompass CCTV, intercom, fire alarm, and even in some cases clock systems," Burns continues, observing that while his company expects a marriage between audio and video sources to strengthen, "More and more often it's becoming a trilogy — among security access controls [such as card readers], CCTV and audio products."

As a result, dealer/installers "have begun to get themselves allied with others who may carry product lines they don't have in order to put together complete packages for their customers. Or the very large dealers — the Simplexes, the JWTs, the Honeywells, etc. — are putting together systems as a total package for electrical contractors."

"For the next
eight to 10 years,
both new and existing
correctional installations
will be
'a prime market.'"

Elenex product manager Dave Arseneau also is eyeing the prison market's long-term viability. "It's a very big opportunity that we're pursuing very aggressively." A few clients have even contacted the firm directly, the manager reports. "I'm selling three systems to a prison as we speak."

Arseneau advises that completing a job in this niche often entails custom work. "For one thing, the buildings operate on special frequencies, and for another, they usually require items like a VOX operation instead of a push-to-talk button."

Similarly, Ring Communications says it expects to introduce systems for the correctional marketplace by late spring or

early summer. "Our competitors have products in that industry, and we should have something ready shortly," notes Craig Krsanac, VP sales and marketing.

Krsanac envisions office elevators as another potential bright spot in the industry, albeit a much smaller one. "Right now the elevator market is still in its infancy, representing for us maybe five or 10 percent. But it's growing because of increasing concern about emergency communications in elevators and throughout larger buildings — between floors, supply rooms, custodial rooms, elevator motor rooms."

Fostering new business in New York City is a law effective early next year requiring two-way elevator communications systems in all buildings above a certain height, Krsanac relates. But Ring also anticipates strong nationwide demand.

"Obviously, the need exists in every major city that has tall buildings with elevators," the VP says, "and we're aiming some of our product strategies toward that need." Ring says it has sold out the first production run of a new system geared to the market.

The system includes closed circuit television for monitoring loading docks. "It puts virtually everything at the office security command post's fingertips for communicating, observing and hearing what's happening throughout the perimeter of the building," Krsanac explains.

Mircom Inc. meantime has incorporated security features into its latest residential offerings. According to Dave Ito, marketing manager, movement of security/intercom combo units for homes and apartments is "slow, but we feel it's an up and coming area."

At NSCA the company displayed a recently introduced apartment intercom with security capabilities that better

The video security system for those who live in more than one room.



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serves the needs of its professional customers, Ito says. "We have a lot of sound pros who also work with security products, and until now they've resorted to buying other suppliers' security devices to combine with our intercom systems."

Model ANS-2585, with microprocessor controlled security panel, precludes the need to pursue such alternatives, he adds. "It's one neat little package for retailers; they're very happy with it," as are Mircom installers. "Now they don't have to run separate wires. Everything is integrated into one system."

The combo unit fits in a dual-gain electrical box, and thus requires no special back box. "Contractors love it because it's industry-standard," Ito says, "and common wiring means minimal installation expense." Architects of multi-unit, multi-level dwellings also herald the device, he claims, "because there's one less item for

them to put on the wall in each apartment."

Toronto-based Mircom is pushing further into video-based residential communications this year with two product lines it has started exclusively distributing throughout the U.S. and Canada.

"The market is going toward integrated turnkey systems that encompass CCTV, intercom, fire alarm, and even in some cases clock systems."

One line includes a coax system that displays telephone numbers on a monitor in each apartment to allow for identification and verification of outside callers. Also on that system, "We can tie in eight or 10

remote camera units to enable underground parking lot CCTV surveillance via apartment video intercoms," a big growth area in the residential sector, Ito affirms.

Sales of single-family home video intercoms — "very slow" in past years — should pick up a bit in 1990, the manager predicts. Mircom will do its best to spur that area by unveiling a 2-wire device this fall.

At last month's show, the company introduced a 4-wire, no-coax video intercom, "made and priced exclusively for the homeowner." The small door station and monitor system is priced "economically, around the \$1,000 mark, so that the typical homeowner can afford it," Ito says.

In the hard-wired intercom versus telephone entry system debate, manufacturers cite growing legions of apartment building installers who increasingly seek out simplified products that can help reduce labor costs.

"It's not at all an issue of technical ability or difficulty," reports David Goldberg, VP finance and administration for Lee Dan Communications. "Installers are simply capitalizing on new opportunities to get in and out of jobs faster."

With telephone entry, he notes, "There's a clear advantage over hard-wired in that you don't have to get into each individual apartment to make the connections. You just install it downstairs, plug it into a phone jack and program in the apartment phone numbers."

However, Lee Dan, which makes hard-wired systems and distributes a separate line of telephone entry devices, takes the position that installers who invariably opt for telephone entry may be doing their customers a disservice.

"It can be a shortsighted approach because telephone entry doesn't necessarily always serve building owners' interests," Goldberg continues. Particularly in regions saddled with high-priced telephone service, like the northeast, "Owners frequently end up paying much more for telephone entry over the long-haul than they would for hard-wired."

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WHAT DRIVES DRIVE-THROUGH?

Tektone Sound & Signal Mfg., views the move toward telephone access equipment as "largely positive," especially for suburban areas still active in new construction of larger developments.

"Certainly, telephone access equipment is more expensive than hard-wired when you're talking about the per-suite breakdown on a small building. However it's very cost-effective if you're doing, say, 100 suites. It'll cost you a lot less than hard-wiring 100 apartment stations and installing an entrance panel."

Tektone has brought out a new series of 3-wire common run apartment systems to replace its 4-wire standard, and will add a new telephone entry device to its existing line later this year. Indeed, despite the popularity of telephone access, Mira contends the hard-wired apartment market won't dry up and blow away.

"Owners frequently end up paying much more for telephone entry over the long-haul than they would for hard-wired."

"It'll always be there. Smaller buildings — anything under 10 suites — will tend to stick with a conventional hard-wired, three-button intercom speaker connected to a very simple button panel outside."

Federally subsidized housing is virtually captive to hard-wired "because they can't assume that every tenant is going to have a telephone," the executive remarks. "Whenever the government calls out for an independent intercom system we respond with handsets instead of wall speakers."

Finally, Hiko Shinoda, president of Telecall Communications Systems, expects to see higher system pricing in the office-use segment this year, at a possible risk to that sector's well-being. "While we think the industry will be strong this year, we also think a lot of manufacturers have forgotten what the office intercom is all about," says Shinoda.

(continued on page 33)

Drive-through intercom system sellers anticipate strong results right through year-end, thanks largely to continued demand for lightweight wireless units. "Everyone's going wireless," says Dave Arseneau, Elenex product manager. "They want to get away from the hard-wired systems."

Industry sources suggest wireless sales could account for as much as 25 percent of the total drive-through equipment market this year. Affirms Rich Barker, 3M Co. marketing communications manager: "Fast food operators, C-stores, and petroleum retailers have become increasingly interested in wireless systems because they provide very high quality communications to the customer."

McDonald's Corp., for example, has been installing wireless headset technology for awhile now to reduce errors among its order takers. "It gives the order taker a good level of sound when talking with the customer," notes Barker, and unlike using a standard mic, "sound quality won't change or fade out if he bends over or moves around near the point of sale register."

Overall, 3M projects "continuing strength" in both wired and wireless drive-through products. "We see the point-to-point or point-to-multipoint communications industry as being solid but not spectacular," says Barker.

"We don't necessarily see any tremendous new growth, but we do see a combination of new growth plus a refurbishing," Arseneau predicts about half of Elenex's 1990 revenues will come from updating existing drive-through properties. "There are a lot of stores with older drive-through systems that need to upgrade," he says.

Launching a new hybrid effort, Elenex will create and market complete drive-through security and communication system packages — "a major application goal for us this year," the manager acknowledges. "One area we've talked about and which has been of interest to some of our drive-through customers is the implementation of a package for urban area restaurants and other establishments that require round-the-

clock security."

Elenex says it will modify its existing wireless communication system to enable security guards to wear the belt pack along with the other employees. "The guards won't hear any of the conversation going on between order-takers and customers," explains Arseneau, "but an extra button on the belt packs will allow order-takers or anyone else wearing a headset to immediately page security."

At Burger King, McDonald's and other fast-food chains where as much as half of sales is drawn from drive-through business, even small enhancements that would eliminate customer dissatisfaction with garbled speaker systems and lack of face-to-face contact could pay off royally for the intercom industry.

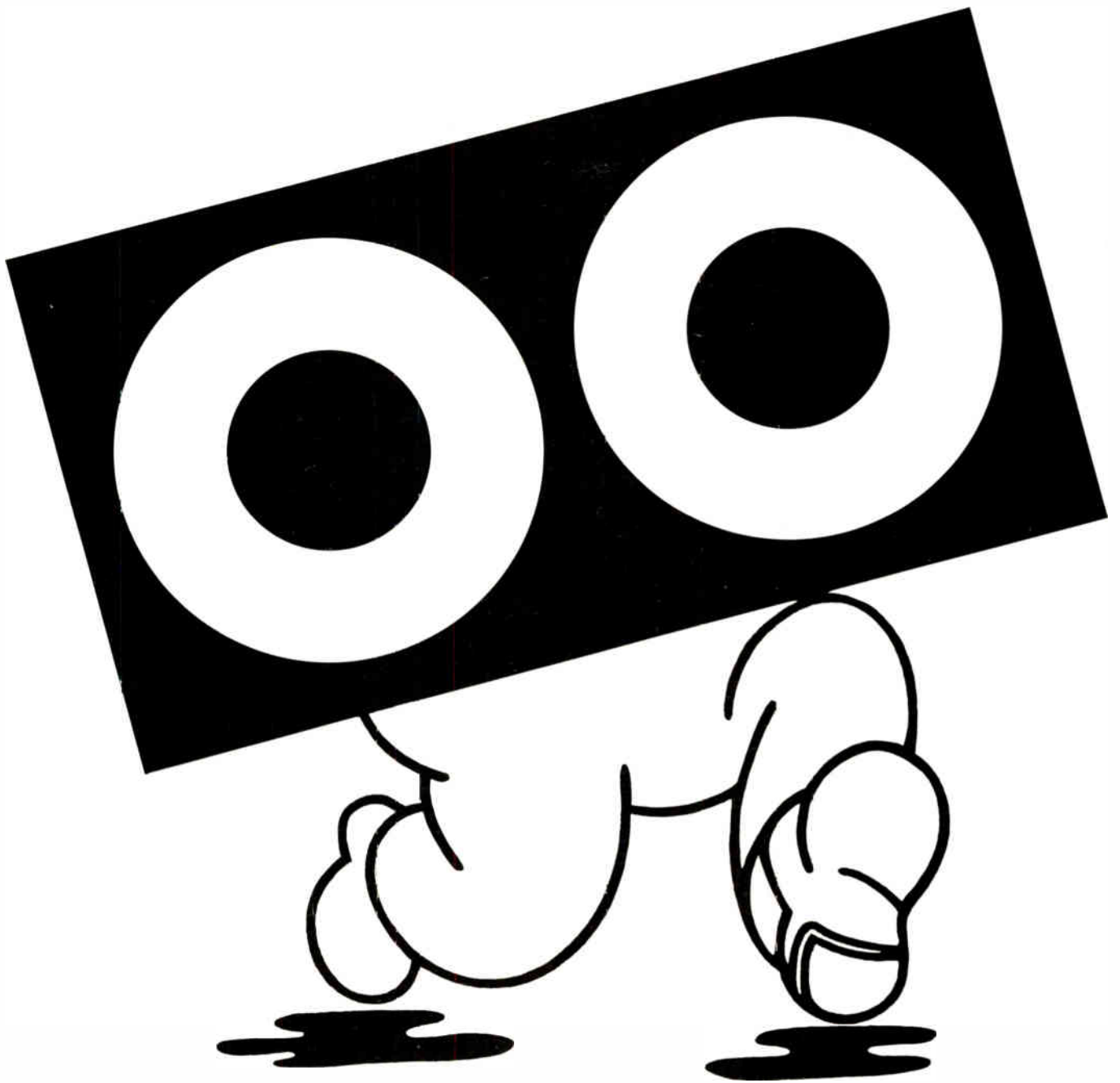
This month, Burger King starts testing a series of technological improvements designed to upgrade the speed and quality of drive-through service and increase customer satisfaction. The tests, occurring at several southern Florida stores, include two-way color TV monitors that allow customer and order taker to see each other; an enhanced sound system; and a display on the customer's screen of his or her order.

Five high-tech packages from several manufacturers will be considered, ranging from a bare-bones sound system priced at about \$1,500 per store to a top-of-the-line video system costing up to \$20,000.

Because franchisees would be asked to foot the bill, the company says a system with video monitors priced at \$6,000 to \$7,000 is likely to be most popular. A decision on whether to proceed with changes for the entire system as well as vendor selection could be made by fall, according to officials.

McDonald's, with about twice as many U.S. restaurants as Burger King, also has been testing improved drive-through service. The company is experimenting with, among other things, double-lane configurations that can serve four cars simultaneously. It's also testing a one-way TV monitor system for order-taking.

—S.P.



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TELLER INTERCOM AT AUSTIN FROST BANK

When Mike Clark of San Antonio's Clark/Robbins Bank Vault and Key Service received the service call from Austin Frost National Bank, he knew exactly what he would find before he arrived on the scene. The bank had complained that its drive-up intercom system was putting out a loud squealing sound. Clark correctly guessed that the squealing sound was caused by cold drinks accidentally spilled by the tellers into the counter-mounted intercom electrical switching. Clark's company is Clark/Ribbons Bank Vault and Key Service.

The bank's old system was wired with a gooseneck microphone and the audio controls permanently mounted into countertop panels at each teller station. An overhead system of lights was used to indicate which drive-up station was in use. The system worked fairly well except when one of the tellers accidentally knocked over a drink while reaching for items in the vicinity of the switches. That's when the squealing started. The single overhead light system was also awkward for the busy tellers to see, and the old units required specific switching to communicate with the individual drive-up stations. Working with more than one station at a time was often confusing and voice clarity and volume was sometimes less than optimal due to varying sound volumes from customer car radios, loud exhaust systems or nearby traffic noises.

Clark's solution to the problem was to install a new system of individual voice switched intercoms (Columbia Scientific Instruments (SCI) Model 4080) which featured the gooseneck mounted microphones and all the switching controls mounted in single consoles.

Clark placed the new bank intercom units at each teller location adjacent to the individual computer keyboards so that teller-hand travel could be kept to a minimum. The tellers also found they liked



The Austin Frost National Bank's CSI Model 4080 intercom in use.

the new intercom's small footprint which saved counter space paperwork and counter clutter.

The tellers also found they could now speak hands off to customers with the automatic voice switching, allowing the intercom to cycle its broadcasting and receiving according to whomever was speaking, rather than with the older manual switching which was slower and error prone.

Clark has been installing intercoms since 1968. His installations have been in banks, food service and governmental applications throughout the Southern and central United States. Clark's business includes bank vault door locks and security systems as well as intercom installations.

The new Frost National Bank units have proven very reliable, according to Clark, requiring only two service calls to the bank. Both of those calls turned out to be

volume adjustments to the outside drive-up station. (This control is easily reached via a screw adjustment on the rear of the Model 4080 console. It is teller-adjustable or can be left to the service tech.) The CSI circuit boards are spray insulated to prevent electrical shorting.

The Frost National Bank tellers can easily communicate with more than one customer through the manual switching system which allows up to four tellers to talk with up to eight drive-up stations. A "hold" mode in the console permits the teller to "hold" one station while talking with another, similar to a modern telephone switching system. A "hold" light blinks adjacent to the appropriate station switch so the teller can always be aware of which station has been left on "hold." The intercom also has teller operated audio sign gain controls on the console to regulate voice volume both at

the console and the drive-up station. The outside station audio control allows the tellers to vary the automatic voice switching sensitivity to adjust for changing outside conditions such as loud or quiet voices, loud car radios, mufflers or street noise.

The intercom controls also allow the teller to completely turn off the outside station volume in the event of excessive

outside noise or abusive customers.

Clark says he found the Frost Bank installation particularly interesting because of the unique wiring requirements. "We arrived late on a Saturday after working hours. With two men, we worked straight through for 12 hours, getting the system up and running by noon Sunday. We had to replace all the wiring, which was in an

underground culvert, and replace it with new circuits. We also had to remove the previous countertop switching components, cover the resulting countertop holes with plates, and connect all the individual intercom units. We disconnected the old overhead switching lights since the new intercoms had their own switch lights on the top of each console." ■

INTERCOMS

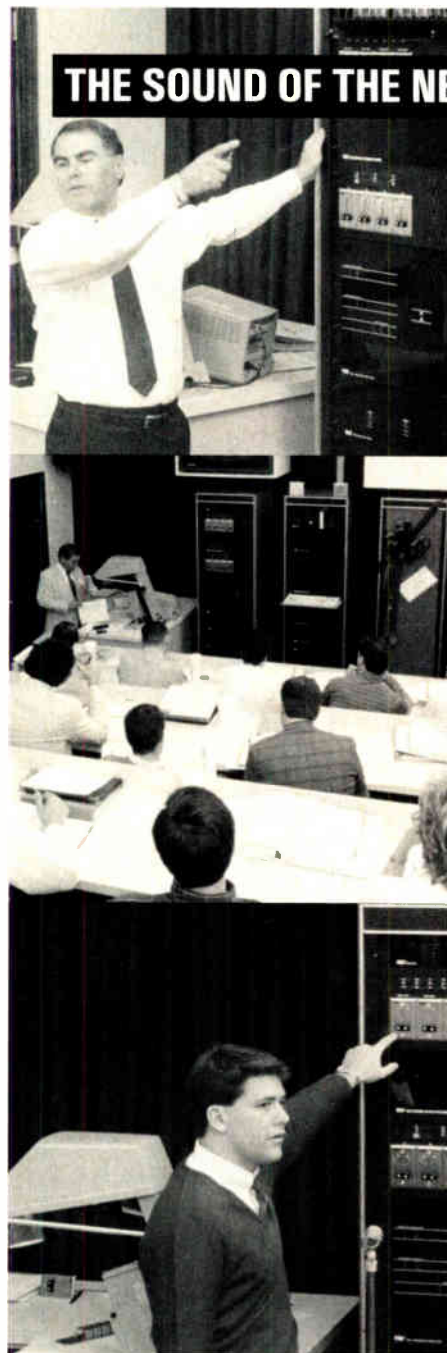
(continued from page 30)

"Intercoms are secondary pieces of equipment — after telephones, computers, copiers and fax machines, all of which are indispensable for day to day operations." While you can't do business without those items, he opines, "You can easily do without an intercom. By putting such a high price on their latest systems, I think many intercom companies are pricing themselves right out of the market."

"Intercoms should be marketed as standalone units — as a fast, instant link between two people for conversation, paging, or what have you."

Citing CPU-based systems with end-user price tags ranging from "\$15,000 to \$30,000, \$40,000, or even \$50,000" per installation, he observes, "You can pay that much for a full-featured telephone system which includes intercom, telephone, paging and everything else in one configuration."

According to the president, Telecall's low-price, features-rich product mix bespeaks the company's enduring operating philosophy. "Intercoms should be marketed as standalone units — as a fast, instant link between two people for conversation, paging, or what have you. They enable the user to get an instant answer. That's what intercom applications are all about. They supplement a total office communications system, making the work place as efficient as possible." ■



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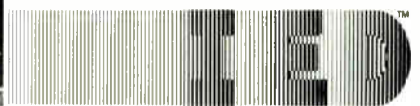
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HISTORIC TRAIN GETS MODERN SOUND

BY GARY ROUSE

The Napa Valley Wine Train, with its 1915 Pullman lounge and dining cars, has been in the news lately as a painstaking process has restored the 75-year-old train to its original opulence. A group of investors has spent millions to carefully refurbish the trains and track to recreate an era when railroads were the main mode of transportation for society's elite.

As the vintage train makes its 18-mile run from Napa to St. Helena, through the heart of the most beautiful wine country in the world, classical music wafts gently through the cars, accenting the turn-of-the-century atmosphere we strived to achieve. Meanwhile, the intercom system keeps service prompt and our crew in close contact.

Selecting and installing a sound and communications system on a train presented some unique challenges. The system had to provide background music for atmosphere, and facilitate staff communication from one car to another to ensure prompt service and passenger safety.

The system had to be modular so that cars could be added or removed as needed. It also had to meet Napa Valley Wine Train standards for the installation of electrical equipment and it had to be compact because space on a train is minimal.

We began our search for equipment by contacting the company that had installed the communications system on Amtrak's passenger trains. While the system they had chosen worked well, it was very expensive and was really more than we needed for the six cars we have been running up to seven days a week since September 1989.

Gary Rouse is Project Engineer for the Napa Valley Wine Train.



The 75-year-old Napa Valley Wine Train has been restored to its original opulence.

Then we presented Muzak's San Francisco office with our needs, and they recommended combining Aiphone's YAZ-90-3 telephone-type intercom paging system with Muzak's 1600 commercial tape deck. A Tones tape exchange program would provide the background music.

The intercom system runs off one power supply system that can operate up to 30 of the YAZ's telephone-type stations. It doesn't require a junction box that wouldn't have worked in this installation.

The loop-wired connections of the system allow each unit to stand alone as a master system, so that the railroad can configure the cars in a variety of ways, and the system will still function as designed. It also would make it easy for us to expand the system as additional cars are restored.

The system's three-path capability also allows up to three different conversations to take place on the intercom system at the same time, and each unit is programmable so that the last two digits of each car's identification number can be used as the call numbers for the intercom system.

Wiring for the system, however, was a little unusual. When the railroad cars are being restored, we virtually strip them down to their shells and remove all the old steam heating apparatus. Then we remove all unnecessary equipment from underneath the car. This makes prewiring possible, but we still have to adhere to stringent electrical codes for railroad equipment. So what we use is a little more rugged than what is required for most commercial and residential applications.

To interconnect the system from car to

car, we used a standard railroad plug. The base of the plug is about six inches in diameter, which makes it virtually indestructible.

A higher insulation rating is required for the wire used in railroad cars, so we used all vibration resistant 16-gauge wire with a 1,000-volt insulation rating at 110 degrees centigrade. Each wiring pair is individually shielded and runs inside conduit.

Since the initial installation, we have added the intercoms to the two locomotives the train uses and are in the process of installing the system in another car under restoration.

One would expect to find etched glass, *Intercom phone in use.*



polished brass, fine fabrics and darkly elegant mahogany lining the opulent 75-year-old cars of the Napa Valley Wine Train. One might even assume the smartly uniformed staff would serve artfully prepared meals on bone china with the usual damask linen, silver flatware and crystal glassware. What one wouldn't anticipate is the advanced sound and communications system discreetly built into the painstakingly restored 1915 Pullman lounge and dining cars.

Completed, the system functions exactly as designed: passengers enjoy pleasant background music while our crew communicates efficiently. ■

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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
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WESTIN GALLERIA HOTEL, HOUSTON, TX

OFFICE BUILDINGS

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CHEVRON DATA PROC. CTR., SAN RAMON, CA
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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

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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.

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

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CALIFORNIA PIZZA KITCHEN, LOS ANGELES, CA
CHILI'S, VARIOUS LOCATIONS
FLAKEY JAKE'S, VARIOUS LOCATIONS
PIZZERIA UNO, BOSTON, MA
RED BULL INN, PITTSBURGH, PA
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IBM, SAUDI ARABIA
JOCKEY CLUB, HONG KONG
MCDONALD'S OF CANADA, CANADA
MINISTRY OF DEFENSE, ROME, ITALY
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STOCKHOLM CITY THEATER, STOCKHOLM, SWEDEN

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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
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BOISE CONVENTION CENTER, BOISE, ID
OREGON CONVENTION CENTER, PORTLAND, OR
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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
RAVANIA MUSIC PAVILLION, CHICAGO, IL
SEA WORLD, SAN DIEGO, CA
SHRINE AUDITORIUM, LOS ANGELES, CA

CHURCHES

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CENTRAL FL. JEHOVAH WITNESS, PLANT CITY, FL
METROPOLITAN JEWISH CENTER, NEW YORK, NY
PUTNAM CITY BAPTIST CHURCH, OKLAHOMA CITY, OK
SIMI VALLEY METHODIST, SIMI VALLEY, CA
ST. THERESA CATHOLIC, PITTSBURGH, PA

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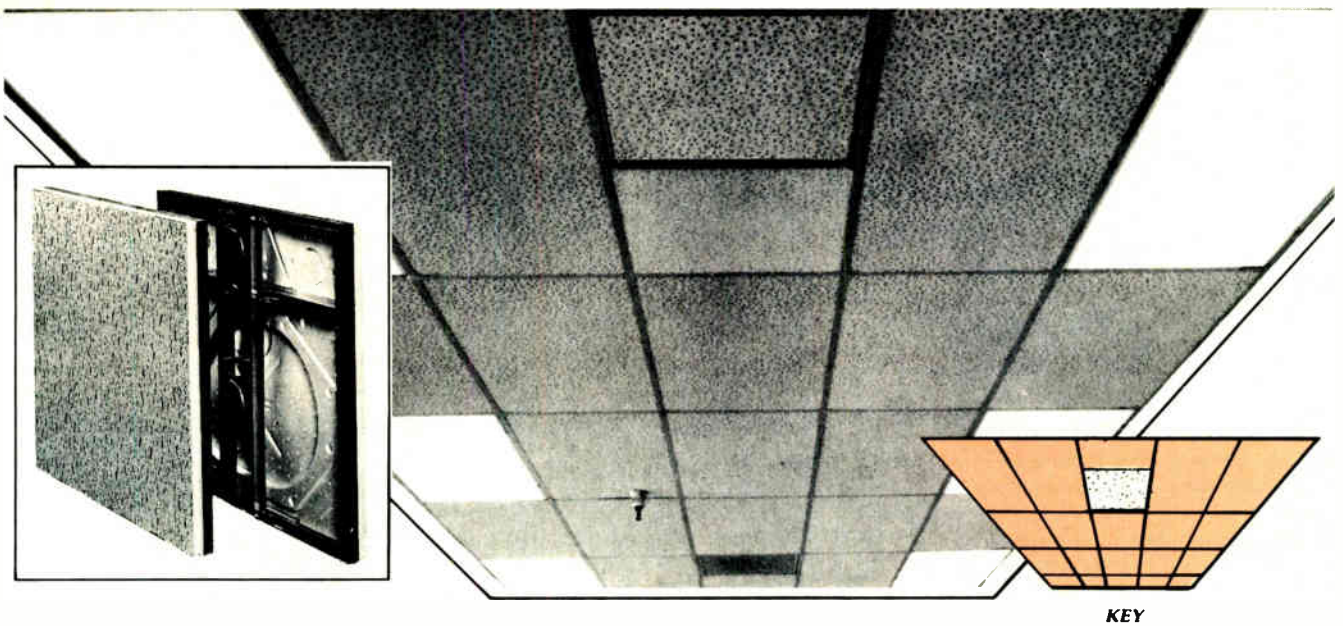
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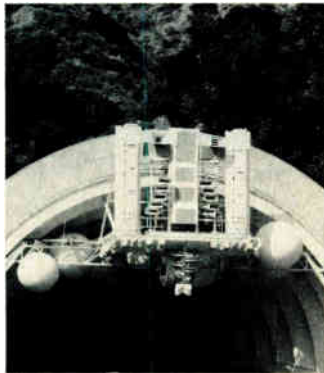
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World Radio History

THE GROWING MARKET

BY DR. KATHLEEN J. HANSELL

The idea of moving images instead of people has been around for a long time. While projections for a world of electronic image interaction have not materialized along the lines of Dick Tracy's wrist TV or Mr. Spock's 'beam me up, Scotty' capabilities, image communications is on the upswing for many practical business applications.

For interactive applications, where the flow of communications is multi-directional and all parties need to have equal access to the channel, interactive videoconferencing provides a workable solution. In this environment, all parties see and hear all other parties. Because of the increasing complexity of display and network requirements to handle full interactivity and because as human beings we know that there is a point beyond which the number of participants ceases to improve the quality of the meeting, interactive videoconferencing generally is used to connect a limited number of people for purposes of interactive discussion. A typical videoconference room may be designed for four to six active participants, and the number of rooms connected in a single conference number two to five.

Interactive videoconferencing can be used successfully for almost any meeting purpose. Typical videoconference meetings include regular staff meetings, project status reports, planning sessions, product development meetings, troubleshooting or problem solving meetings, financial reviews, and the like. While the folklore of videoconferencing would have you believe that videoconferencing should not be used for meetings between people who have previously not been introduced in a face-

Dr. Hansell is President of KJH Communications, Atlanta, Georgia, which provides market research, strategic planning and support services for the telecommunications industry.



A modular videoconference system by Videoconference Systems, Inc., of Norcross, GA.

to-face environment, and that it should not be used for negotiations, personnel matters, and delicate issues, there is no scientific evidence to back up these tenets and plenty of anecdotal evidence of successful videoconferences in exactly these kinds of situations.

Interactive videoconferencing is a replacement for meetings that would otherwise require people to travel to a single location, and the benefits follow accordingly: decreases in travel expenses and lost time; better access to resource people; faster response and resulting action; improved ability to bring the right resources to bear on a particular issue; and increased amounts of communication. It is fair to say that the limitations are obvious, too. Videoconferencing is not the same thing as a face-to-face encounter. The quality of sight and sound is not as good; the environment is more controlled; new communications skills are required; and there are numerous activities of a personal nature that cannot occur on the limited audio and

video channels.

Nevertheless, there has been a substantial increase in videoconferencing. Today there are more than 450 user organizations. The installed base in the United States at the end of 1989 was around 1,930 systems, almost double the installed base of the year before (Figure 1). Sales activities in early 1990 suggest a continued accelerated growth.

Behind this increase in installations are several factors. Primary among them are decreasing costs of equipment and transmission, fueled in part by the ability to videoconference at lower data rates than ever before.

Videoconferencing is generally accomplished with digital, rather than analog, channels. Digital channels are preferred in most instances because they are more likely to be available and because they support videoconferencing with picture quality acceptable for most business applications at lower bandwidth (and hence lower cost) than analog channels.

Of fundamental importance is the video codec, which converts the analog image and voice inputs from cameras and microphones to digital format and compresses the bit stream to an acceptable level for transmission and subsequent viewing. An uncompressed digital video signal requires approximately 90 Mbps of capacity for transmission. In the early 1980s, the lowest compression that would provide an acceptable image was at 1.544 Mbps. By late 1986 and early 1987, new and improved compression techniques allowed for videoconferencing at data rates as low as 56 kbps and for considerably improved image quality at higher data rates. (See Figure 2.)

The introduction of codecs that operate at data rates between 56 kbps and 384 kbps, some priced as low as \$10,000, compared to codecs operating at data rates

COURTESY OF PEIRCE-PHELPS, INC.



Two-tiered videoconference facility for large groups at IBM Corporation in Somers, NY, designed by Peirce-Phelps, Inc.

between 384 kbps and 1.544 Mbps and priced at \$75,000, substantially opened the market for videoconferencing. Today, the installed base of codecs in the U.S. includes more low data rate than high data rate codecs.

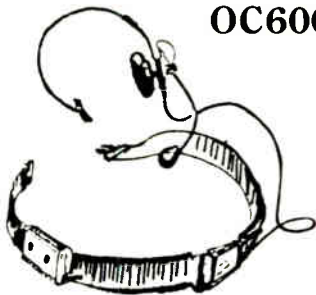
At the same time as lower data rate codecs were introduced, fiber optic networks were sprouting across America, and

with increased capacity came reduced prices. Point-to-point videoconferences at 1.544 Mbps in the U.S. today cost between \$500 and \$650 per hour, depending on distance, down considerably from prices just a few years ago. Figure 3 shows recent price decreases for a 90-minute coast-to-coast conference using occasional-use transmission services operating at 1.544 Mbps (T1) rates. For data rates less than T1, costs are lower. Figure 4 compares today's transmission prices for coast-to-coast videoconferencing at a variety of data rates.

Today, the majority of national videoconferencing is accomplished on terrestrial networks. Occasional use services, which require advance reservation, provide point-to-point connections and multi-point services as well. It is in the multipoint arena.

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VIDEOCONFERENCING

however, that satellite networks offer a unique advantage. The ability to reuse a single channel by "passing the baton," or rapidly changing the location that has transmit capability, reduces the cost of transmission. Usage must be at a certain level, however, to justify the installation of the earth station equipment.

It is unlikely that data rates will be reduced below 56 kbps, which for many users does not yet provide acceptable image quality. There is the promise, however, of improved image quality at 56 kbps and of a continuing decline in transmission costs. Customers of virtual private network services are already able to dial up 56 kbps channels at the same cost as ordinary telephone calls, and for videoconferencing they typically dial two lines. This provides increased bandwidth for the video image and allows the voice to be carried inband as well. On the horizon is widespread implementation of ISDN services, where multiple 64 kbps channels will be available on a worldwide dial-up basis, so that a conference can be arranged at data rates in multiples of 64 kbps, depending on the application.

Of course, the more installations out there, the more likely a user is to place a video call, or to install a system in the



PHOTO COURTESY OF PEIRCE-PHELPS, INC.



Videoconference facility at Merck, Sharp and Dohme, installed by Peirce-Phelps, Inc.

first place. Whereas in the past, each manufacturer's codec operated with a proprietary algorithm that precluded unlike machines from talking to each other, a new standard adopted by the CCITT, an international consultative committee, has already received manufacturing commitment from a number of codec manufacturers. Equipment manufactured to CCITT Recommendation H.261, otherwise known as the "Px64" standard, will roll off assembly lines for the first time in the next few months. While there are still drawbacks to the Px64 algorithm, the objective of universal connectivity suggests to many that videoconferencing could catch on in a manner not unlike Group 3 facsimile machines. This is overly optimistic, but strong growth, exceeding anything we have seen so far in this market, will definitely be an outcome of the converging influences of the Px64 algorithm, continued price decreases in equipment and transmission, and increasing user familiarity with the technology.

Videoconference installations vary from desktop systems to elaborate boardroom systems. Of greatest popularity today are modular systems. The simplest of these provide one single-chip camera, one medium-sized monitor, audio, and limited control capability. More sophisticated systems provide additional cameras for peo-

ple and graphics, dual monitors for preview and graphics purposes, improved audio systems with echo cancellation, and control systems that provide programmable pre-set camera control. Some systems now include interfaces in the conference system for computer-to-computer communication. While most users order pre-designed systems, there are some that for various reasons prefer to custom build their videoconference systems. Custom installations range from obvious do-it-yourself attempts to elegant executive conference room installations.

Regardless of the approach, the concept should always be one of unobtrusive technology. This requires cameras concealed behind glass, low-profile desk-top microphones rather than lavaliers, lighting that is comfortable for the participant but that provides sufficient light for the cameras and not too much to wash out the monitors, acoustic treatment and associated electronics for good audio quality, and a seating arrangement to make the most of the meeting participants and their audio/visual aids. Videoconference room design and equipment selection is always an exercise in trade-offs.

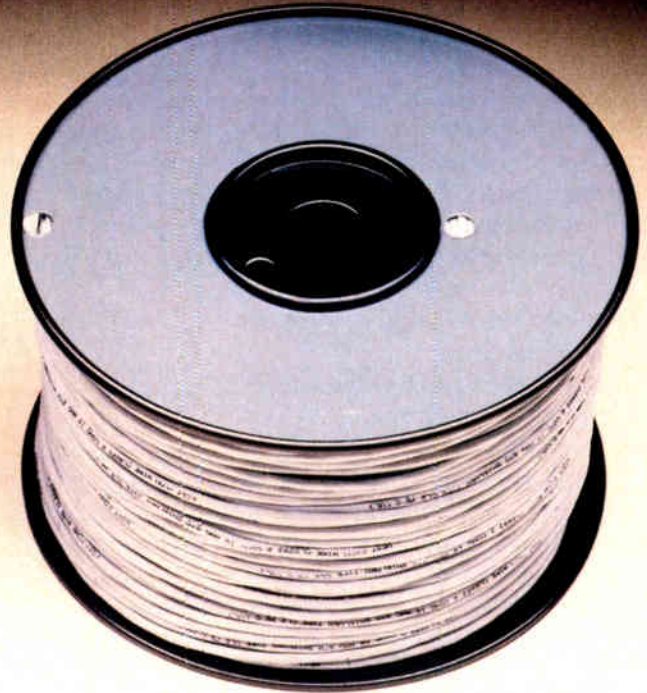
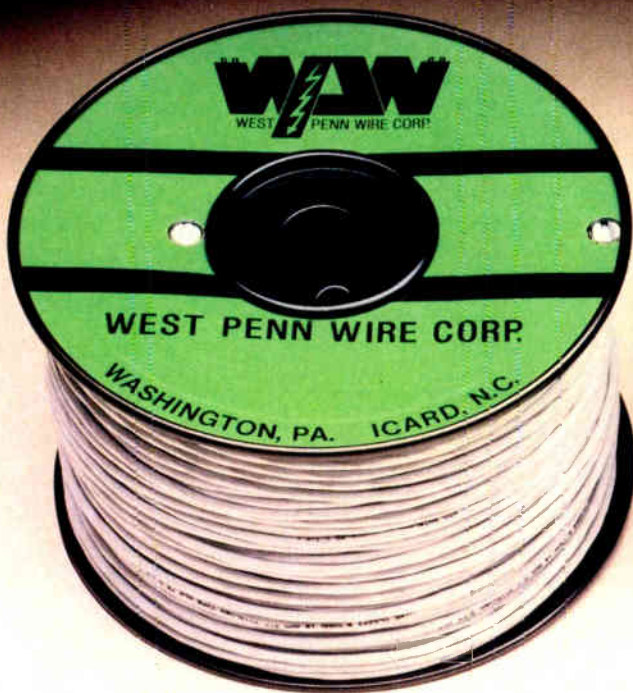
How to get started? First, understand the communications requirements. Who will use the videoconference facility? Your design will be quite different for small

PHOTO COURTESY OF DAVID WAKELY

A custom videoconference installation at Apple Computer's headquarters in Cupertino, CA, designed by Stacy Design/Development of San Diego.



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VIDEOCONFERENCING

groups than for large groups. If users are conditioned to use audio/visual support (overheads, slides, videotape, whiteboards, flip charts, computer programs, and the like), the videoconference environment must also provide that support.

What are the applications envisioned? The image quality required for routine meetings among familiar faces and that required for executive/customer conferences will be different and will provide an indication of the transmission rate required. If examination of product samples, medical images, cartographic charts, and other images that require fine detail, color, and texture is part of the meeting environment, video images may not be sufficient and a separate high resolution graphic system may be necessary.

Where will the connections be made? If the system is for internal use only, compatibility issues are minimal. But when connections to public videoconference facilities, videoconference systems of other users, and especially international locations are considered, choices made for data rate, codec, carrier, and camera/display capabilities take on added significance.

Second, explore the options. Technology

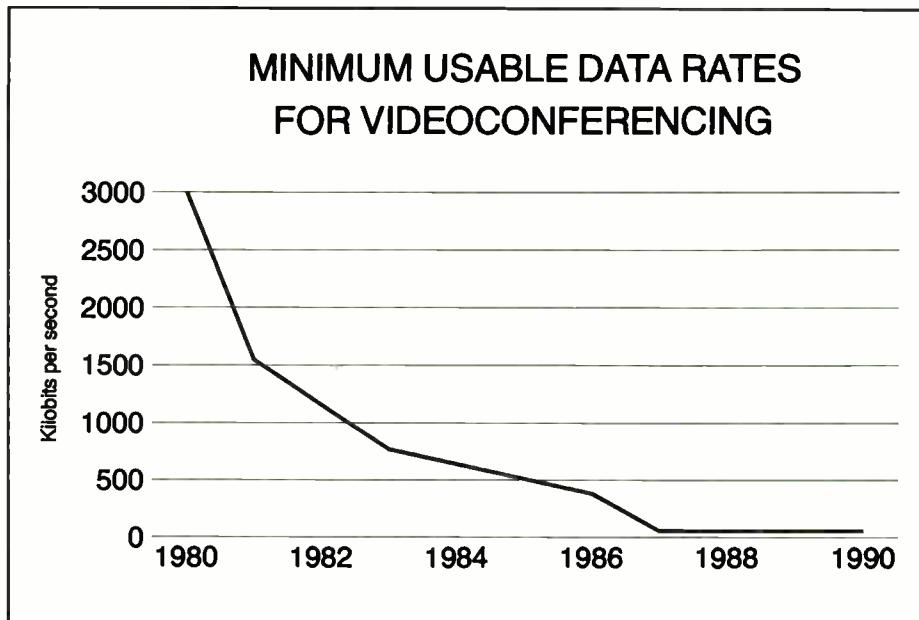


Figure 2.

is changing rapidly. Improvements in image quality, enhanced functionality of conference systems, and decreases in prices are all occurring, and the prudent new user will do some comparative shopping. But don't get caught up in the mode of waiting for the next generation of tech-

nology, because that can last a lifetime. Just as in the personal computer marketplace, improvements are always occurring, and waiting for the next version or the next drop in price can be a never-ending cycle of inactivity.

One of the best ways to explore the options is to talk with users and visit their installations. How to find them? The International Teleconference Association is one source, and the annual ITCA Intelmart program is an excellent environment for picking up pointers and exploring the latest technology.

Third, put in place and execute an implementation plan. A plan of action that includes the systems implementation and the introduction to new users is essential. On the latter score, give careful consideration to the user's for scheduling, training, system maintenance, and on-going promotion.

Finally, remember that videoconferencing is just one of several tools for business communications. Just as we pick up the phone, write a memo, create a spreadsheet, or take off on a business trip, videoconferencing, too, has its place for certain communications requirements. It won't solve all communications woes. But it can add an important additional capability to

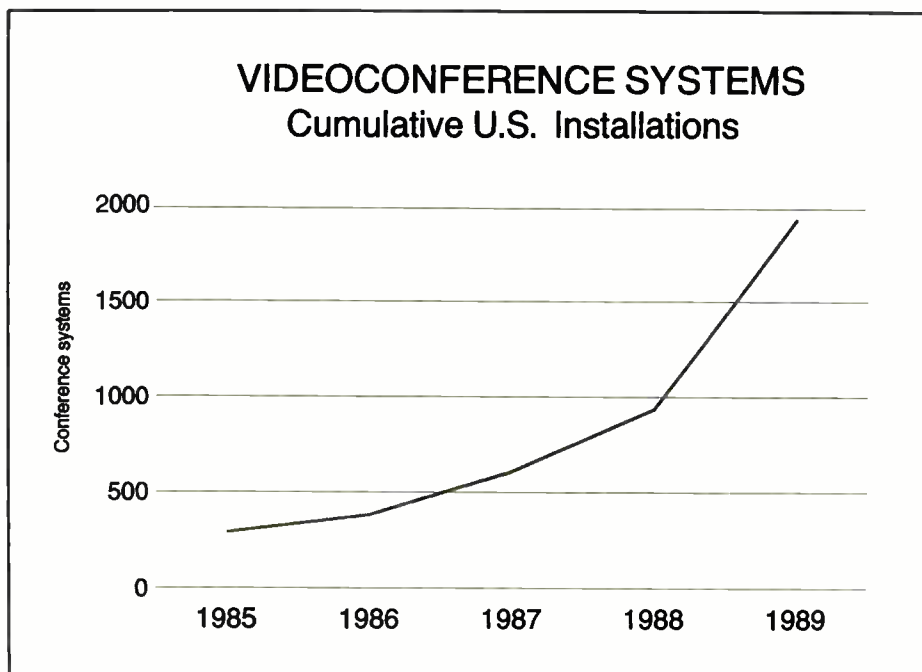


Figure 1.

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1.544 Mbps Occasional Use Service

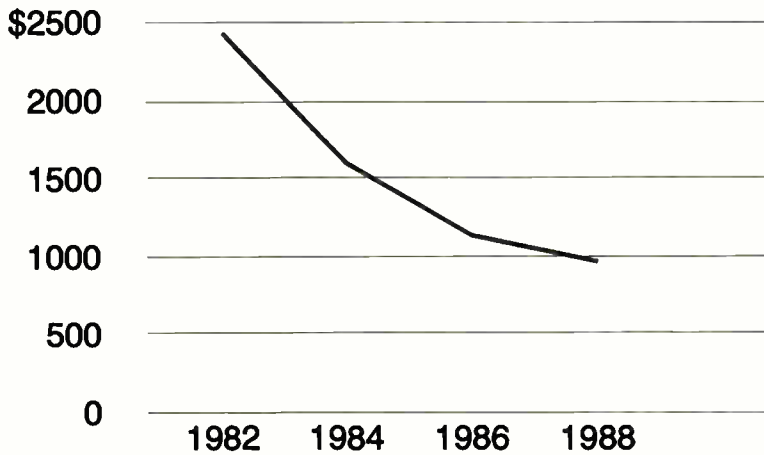


Figure 3.

anyone's portfolio of communications tools. As the number of videoconference installations continues to grow and as videoconferencing becomes increasingly easy to use and economically practical, deciding to videoconference and actually doing so will

require no more thought or effort than phoning, writing, spreadsheeting, or traveling. We may not wear Dick Tracy wrist TVs or be beamed up with Scotty, but we'll find it increasingly desirable to move our images rather than our persons. ■

VIDEOCONFERENCING TRANSMISSION

U.S. Prices at Several Common Data Rates

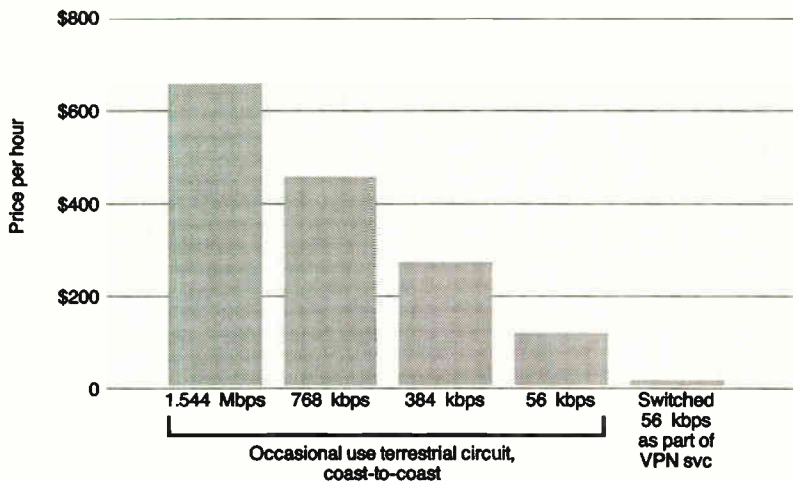


Figure 4.

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ELECTRONIC RANGEFINDERS

BY MIKE KLASCO

Only the size of a cigarette pack, electronic rangefinders are hand-held sonar systems that use pulsed ultra-sound to determine distance. Sound contractors can now measure wire runs, room dimensions, even time delays between a speaker cluster and distributed speakers, all at the push of a button. The cost of these gadgets is very reasonable, with the least expensive available at discount stores for less than \$40 and the most expensive over \$200.

This is a long article, so the “executive summary” is up front. These devices are useful and if you do any field work at all, you should buy one. Many jobs that require two people can now be done with one. These rangefinders are simple to use, take less skill and are more accurate than a tape measure under most conditions. For runs up to 60 feet, the Sonin 60 and Dimension Master Plus are good choices and cost less than \$100. If the points to be measured are always accessible, then you can use the Sonin 150/250 active target system which require a “repeater” (included) to be placed at the point to be measured. Although this can be inconvenient, accurate measurements to 250 feet and beyond are possible with the Sonin 250, which costs less than \$200.

The first sonar systems that were developed during World War II were the size of a room and, even in 1940s dollars, cost the military a fortune. In the 1970s, electronic fish finders and depth gauges began to appear for commercial and recreational uses, but were too bulky and expensive to be considered as replacements for tape measures. The first “tapeless measures” appeared five years ago, but met a resistant market due to size, cost, and performance. Last year over a half dozen hand-held range finders were introduced, priced from \$30 to \$250.

We will briefly describe each of the devices available, and will present a hands-

on review of a few of them by Tom McCarthy of North Star Sound in a future issue. Those of you with long memories may remember Tom as the inventor of the isobar, or perhaps from the review last year of Umbulus, his sound system design program. For Tom’s mission, I selected



The Dimension Master Plus.

what I thought would be the most interesting devices; two units, the Sonin 60 and the Dimension Master Plus, because they are less than \$100 with decent range; the Seiko Instruments HC 1000, which is similarly priced, was selected as it has a unique contractor calculator; and finally, the Sonin 250 because it has the greatest range of all the rangefinders but must be used in conjunction with a repeater target. I had originally anticipated testing the EMS FT 4100 which would have been the most expensive and had the greatest range without needing a repeater target, but EMS appears to have gone out of business.

Electronic rangefinders work like some autofocus cameras. They transmit an ultrasonic signal which bounces off the target and reflects back. The device triggers an internal stopwatch when it sends out a signal, and counts until the signal returns. The time is converted to distance and the result displayed.

Uses of these gizmos are endless, but

a few that might interest sound contractors are determination of wire runs, cable length of rigging, calculation of wall area and room volume (for reverb calculation). Recently, I was preparing a noise survey in a silica quarry which was under consideration as a site for an amphitheater. I used a Sonin 250 to measure the distance from a sound pressure level meter to a B&K calibrated sound source. A tape measure would have been impossible to use as there was a 60 foot deep pit, 80 feet across between the two points to be measured. Aside from not having to risk my neck, I was able to avoid using two people to do what is now a one person job. With the pay-back on tape-less measures resulting in the first few uses, the fate of the tape measure in the 1990s will be the same as befell the slide rule in the 1970s.

Electronic rangefinders do have their idiosyncrasies. Maximum range will increase beyond the rated value at low humidity as a 15 kHz to 40 KHz signal is used and humidity absorbs high frequencies. But other factors will degrade results; noise (power tools, computer/TV monitors), wind (high winds may reduce accuracy by a few percent) and air temperature. To validate readings, take a number of readings and compare. A number of the units, such as the Seiko Instruments, Measurmatic and the Dimension Master Plus, will beep when they have a stable reading. As the distance of the target increases, you must aim more accurately, although the Dimension Master Plus provides a “spotter lamp.” Beamwidth is another factor, as aiming through doorways or archways may interfere with your measurement. To tighten the pattern, Dimension Master Plus uses an array of three transducers to focus the beam. Seiko Instruments uses a waveguide in front of the transducer. Sonin uses signal processing to separate the directly received signal from the spurious

reflections. Aiming at carpeting, curtains, acoustical ceilings, or complex contoured objects will not give accurate readings, as the ultra-sonic beam will be absorbed or dispersed. Of course you can place a hard surfaced tile as the target at the desired location. In the case of the Sonin 150 and 250, this is avoided as you aim at special target devices which pick up the signal and resend it back to the hand held unit. This works fine except when the target location is not accessible, such as a ceiling.

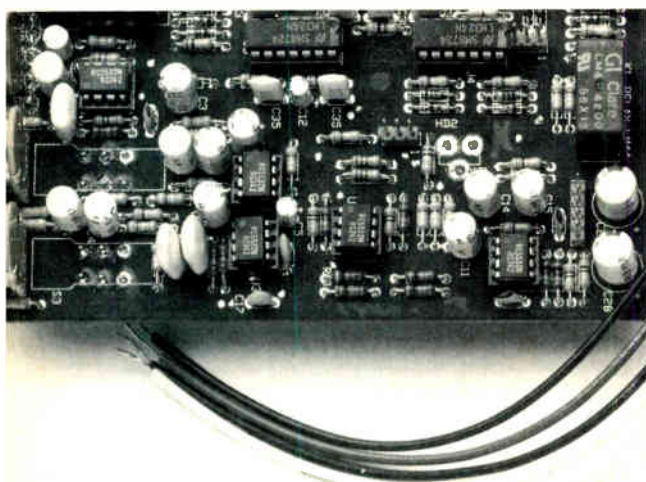
There is quite a bit of difference in other features, functions, and performance among the units in this survey. Sonin has opted for the KISS approach to controls (Keep It Simple, Stupid), while Seiko Instruments has gone all out for the buttons per dollar equation. While the Sonin 250

has four buttons, the Seiko Instruments has eight for range finding /area/ volume and 34 more for contractor related calculations. Obviously, the devices with full calculator functions will have more buttons. In all fairness, in actual practice, they were both easy to learn and use. All the range finders use a calculator or cigarette pack form factor except the Seiko Instruments, which looks more like a Star Trek gizmo whose parents were a flashlight and a TV remote control. The ultrasonic transducer on the Seiko Instruments is located a few inches inside the "flashlight" case and travels up a waveguide/horn for pattern control, while the rest of the rangefinders are direct radiators. Some devices ignore room temperature effects on distance accuracy,

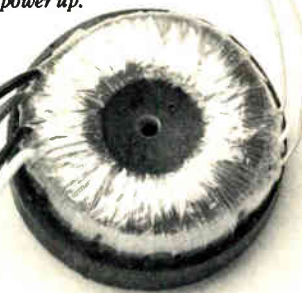


Sonin Electronic Measuring Tools—Sonin 30, 60, 150, and 250.

other units will give you a readout of temperature so you can factor this in, while the most sophisticated devices (Sonin and Dimension Master Plus) will measure temperature and automatically

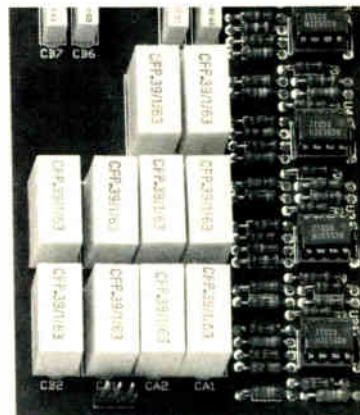


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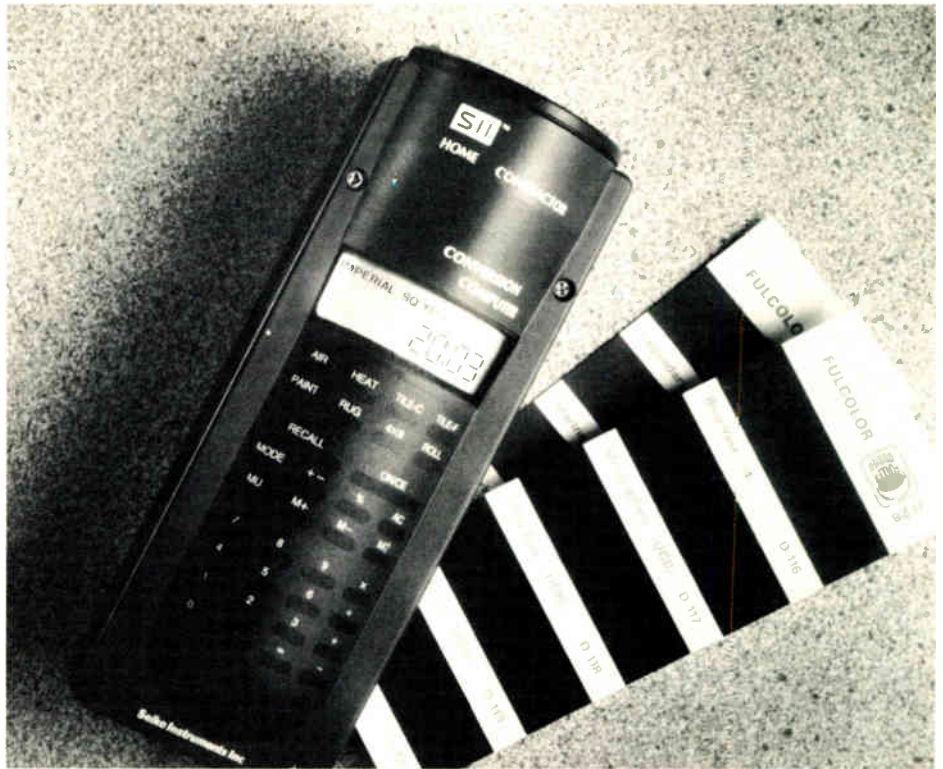
TESTING AND MEASUREMENTS

calculate it into their distance readouts. Two of the Sonin range finders include an active target, that is, a repeater unit that is triggered by the range finder and emits a return signal back to the hand held base unit. This allows for greater range than the other range finders tested. A few of the units will work both indoors and outside; most are for indoor use only. Another unit not only reads distance out, but has a speech synthesizer for voice readings. Most of the range finders also have a few basic calculator functions such as volume and area, with the Seiko Instruments HC-1000 having a few unusual and very special functions for contractors. Calculated Industries, manufacturers of the Dimension Master, also has a "contractors calculator" similar to the one built into the Seiko Instruments, and we will take a quick look at this.

Distribution varies, including some vendors selling direct, while others use retail hardware stores and mail order houses.

DIMENSION MASTER PLUS

I first saw this unit at the CES show last January and was impressed. It has a few features that put it in the same class as the Sonin 60: automatic temperature compensation, tight beam pattern control by using three transducers, error indication on unstable signals on the LCD and two beeps audible indication with one beep for stable measurement. The Dimension Master Plus also has a feature that is unique: a spotter beam for visual indication of where you are aiming. Aside from this, the Dimension Master switches from feet to meters, has autosutoff and a handy memory calculator that automatically figures area and volume, one button conversion of feet/inch/fractions, meters, decimal feet, yards, and inches, including square and cubic. The dimensional calculator works with data taken in by the range finder or by hand entry on the keyboard. The Dimension Master Plus retails for \$99.95 and a version without the calculator costs \$79.95. (Calculated Industries 22720 Savi Ranch Parkway Yorba Linda, CA 92686.)



The Seiko Instruments Home Contractor.

CONSTRUCTION MASTER II

If the Seiko Instruments HC-1000 appeals to you because of its construction computer, but the rangefinder is too limited, don't despair! The Construction Master II is a stand alone calculator that is similar in features to the Seiko rangefinder/calculator. It adds, subtracts, multiplies and divides in feet, inches and fractions (you do not have to convert to tens of inches, etc.). You can also mix fractions like $\frac{7}{8}$ and $\frac{3}{4}$. You can also convert between feet-inches-fractions, decimal feet, yards, meters, centimeters, meters, millimeters, and board feet, as well as convert square and cubic measurements. It does automatic calculations of area and volume and one button calculation of the area of a circle (where was this device when I was in middle school!). For the cost conscious, it does complete material estimating including square and cubic dimension, and unit price key. It will also figure out board feet calculations including dollar cost, third side of a triangle, plus all the other standard functions of a memory calculator. Cost is \$79.95.

(Both the Dimension Master Plus and the Construction Master II will be field tested next month.)

ETEC MEASUREMATE MODEL E

The ETEC Measuremate Model E has a range to 35 feet; a separate model is available for metric. It reports temperature, range is provided continuously. Cost is \$90.

ETEC ULTRAMEASURE

Similar to the Measuremate, the Ultrameasure has a cost of \$130, and readout is by voice synthesizer. This would be useful if you are doing work that requires your eyes to be on some other instrument, or if you are visually impaired. It has automatic shut-off. (ETEC 3208 Commander Dr. Carrollton TX 75006.)

EXACT MACH 5

At \$200, the Exact Mach 5 is the second most expensive device in the survey. The range is to 50 feet. It has a built-in calculator with memory, calculates areas directly, calculates volumes, is feet and meters switchable, reports temperature, includes belt pouch, and has automatic shut-off. (Exact Technologies Box 973, Simpsanville SC 29681.)

HOUSEWORKS DIGITAPE TLM-70N

Price-wise, the Houseworks Digitape TLM-70N is at the bottom at \$40. The range is to 33 feet, and it has automatic shut-off. (International Consumer Brands 126 Monroe Turnpike, Trumbull CT 06611.)

MEASURMATIC

The cost of the Measurmatic is \$50. Range is to 30 feet, the most limited of the devices in the survey. It beeps when measurement is established and has auto shutoff. (Measurement Specialties 1133 Route 23, Wayne NJ 07470.)

SONIN

Sonin's main business is electronic range-finders. At least at first glance, their products appear to be the most sophisticated and appropriate for contractors. I gave two of their four models to Tom McCarthy to test. Apparently Audio Control Industries, a supplier of 1/3 octave analyzers, is going to market Sonin products to the pro audio market.

SONIN 30

The Sonin 30 is the least expensive model, intended for homeowners. Cost is about \$40 and the range is to 30 feet. Areas and volumes can be calculated, the unit can also add and multiply and has memory for cumulative measurements. Inches or meters are selectable; it has low battery indication, out of range indicator, auto shut-off. It's for indoor use only. I passed on this model and checked out the Sonin 60.

SONIN 60

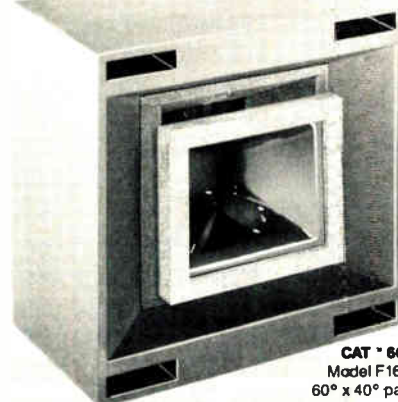
The cost of the Sonin 60 is \$80. It has all the features of the Sonin 30. Range is 60 feet, which ought to enable you to measure most ceilings. For room widths and lengths greater than 60 feet you can stand in the center of the room and add the partial room lengths together. Calculator functions include multiply, add and subtract, areas and volumes; differential measurements, cumulative measurements. Multiple memories enable storing

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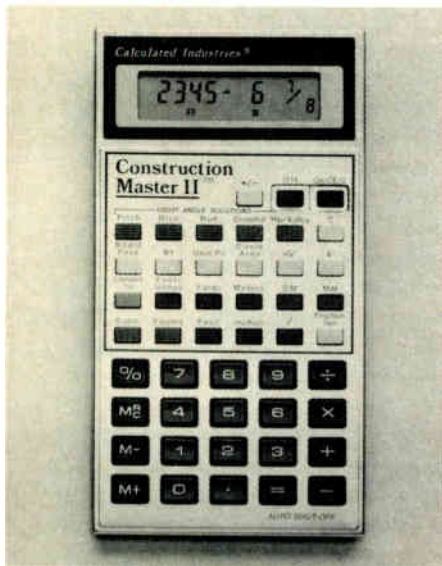
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TESTING AND MEASUREMENTS

a succession of data readings and store linear area and volume measurements. The unit is intended for both indoor and outdoor use. Temperature is continuously measured and compensated for. It features a "smart beam" which rejects nearby obstructions such as measuring through doorways, etc. (also used in model 30).



The Construction Master II from Calculated Industries.

SONIN 150

The Sonin 150 includes a remote electronic target for a range of 150 feet. It is not possible to use the 150 without the measuring target (although a version is on the drawing boards that will be switchable, requiring the remote electronic only for longer measurements). The 150 has all the features of the 60 except that it does not have auto-shutoff on the target (the target is shut off when the lens cover is closed). Like the other models, pressing down on the measurement trigger will make continuous readings. When readings stabilize, you know that you have an accurate measurement. While the 30 and 60 use a 40 kHz frequency, the 150 uses a more robust 33 kHz frequency.

SONIN 250

The Sonin 250 model was specifically designed for outdoor use. It is identical to

the model 150 except for the greater range. The sonar signal has been shifted down from 33 kHz to 25 kHz. For long distance and outdoor use, this is the rangefinder of choice. (Sonin 672 White Plains Rd. Scarsdale N.Y. 10583; Audio Control Industries 22313 - 70th Ave. W, Mountlake Terrace, WA 98043.)

SEIKO INSTRUMENTS HC-1000

The Seiko HC-1000 model is unique, and intended specifically for contractors. Aside from its rangefinder functions, it will calculate how many standard ceiling tiles will cover the roof, how many gallons of paint will cover the walls, air conditioning and heating requirements, and other unusual computations. Some of these "conversion" capabilities will come in handy for calculating other material requirements of a job, or calculating reverberation time of a space. The device even lets you calculate materials costs and profit markup.

The HC-1000 will automatically calculate area and room volume as you enter room dimensions. The rangefinder end of the device is not as capable as the Sonin devices, but this is somewhat made up for in the calculator end. If you have a large area to measure, you can make cumulative measurements and enter them progressively, although this is not as accurate or convenient as a one shot measurement. The device will shut off automatically after 10 seconds from the last keyboard entry.

(The Seiko Instruments will be included in next month's field tests.) (Seiko Instruments Inc. 2990 West Lomita Boulevard, Torrance, CA 90505.)

EMS FT 4100

The EMS FT 4100 is the most expensive unit of the bunch at \$280. The high cost may be because of the built-in Texas Instruments programmable calculator and the unmatched distance without a repeater. Feet-meters are switchable, distance is the longest of the one piece rangefinders at 100 feet. Automatic shutoff and a carrying case are included. If you anticipate doing measurements over 60 feet to targets that are not accessible, then this

would have been the rangefinder to buy. Unfortunately, I have been unable to find a phone number for EMS or to otherwise locate or contact the company. If EMS has simply moved and is being sabotaged by the phone company then I will do a follow-up report. (EMS 295 Lake Shore Dr. Pleasantville N.Y. 10570.)

I think I have rounded up all the viable devices, and most of the consumer grade products as well, although there is bound to be one or two I have left out.

These devices are useful and if you do any field work at all, you should buy one. Many jobs that require two people can now be done with one.

CONCLUSIONS

I briefly played with a half dozen tapeless measures, and they all seemed to meet their claims, especially indoors. For a real hands-on test, see Tom McCarthy's follow-up report next month. My preliminary conclusions are that if you are spending about \$90 then it is a toss-up between the Dimension Master Plus, the Sonin 60 and the Seiko Instruments HC 1000. The Sonin and Dimension Master Plus have more range, while the Seiko Instruments HC 1000 has many unique and useful calculation and conversion functions. If you are typically measuring distances of 60 feet or less (remember you can stand in the center of the room and add measurements) then you may find the Seiko Instruments's range finder adequate. If you work on bigger jobs, then the Sonin 60 will come in handy. Outdoor noise surveys, amphitheatres, stadiums and the like will require the Sonin 250 with its extended range of 250 feet. Perhaps the well-heeled sound contractor's tool kit will have a few of these devices, but certainly at least one. The electronic rangefinder... don't leave home without it! ■



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A MANAGEMENT TOOL: ANAHEIM BID

BY T.G. McCARTHY

If your job includes making sales strategy decisions, producing bid packages or making sales presentations, Anaheim Technologies Inc., 320 5th Av, Troy, NY 12182, has a bidding software tool that may be useful to you.

Many contractors, when we hear 'bidding program,' think 'spread sheet,' or 'scheduling/job management program.' These are useful, and can be all but indispensable for establishing costs and managing resources. But Anaheim Bid is different. Where the other programs work with tangibles, this one helps keep intangibles in perspective. As an Expert System strategy program it can help us direct our efforts in the direction that yields the highest return.

The first thing it can do is help decide whether or not we should even try to bid a particular job. Then, because it can be run and updated repeatedly as the bid takes shape and progresses along the path to its final submission form, it can help prevent runaway costs of sales. For example, there are times when a project may look attractive at first glance, but as more is learned about the specifications, job site conditions, the customer and the competition, it becomes less attractive. The question is: At what point should we cut our losses and abandon the bid? It's a question that we all have occasion to deal with, and one that we answer more by feel than with hard data. Anaheim Bid helps formalize that evaluation procedure. The user is still guided by his or her feelings, inputting data based on guesses and past experience. Then the program, an Expert System, helps evaluate the data and present information in a format that leads directly to a decision. Armed with early warning, one can go after something else instead, directing energies more produc-



Anaheim Bid is an Expert System strategy program from Anaheim Technologies.

tively and minimizing time spent chasing unprofitable jobs.

On the other hand, should the job be worth the sales effort, Anaheim Bid will help the user choose the best sell price. It does that by tabulating a range of sell prices against the likelihood of getting the order and making a profit. For example, based on what I've told it, the program may evaluate my chances of getting a job to be 50 percent if I price it at \$10,000. However, if I lower my price to \$8,500, perhaps I will have a 90 percent chance of winning. Or maybe I could raise the price to \$15,000 and still have a 40 percent chance of landing the order. It's up to me; if I can make a profit at \$8,500 and I want the work, I bid that price. If I'd rather make a killing at the increased risk of not getting the job, I can bid \$15,000. Or I can pick a price in between. In other words, I can set my sell price wherever I want,

and do it with an idea of what my trade-offs are.

Anaheim Bid does even more. It advises me on sales tactics, defining those features that are especially valuable to this client that my company and its products can provide and that the competition cannot.

The program is not difficult to use and it doesn't need to be "primed" with reams of accounting data. It simply asks a series of questions about intangible aspects of the bid, and then evaluates the answers. As an Expert System, questions are presumably based on answers to previous questions, and scores are based on the overall picture rather than absolute values.

To check the program, I ran it using data from past bids. Comparing actual results with program predictions gives me a feel for how well the program stacks up against reality. Here are the results:

CASE 1

Background: A government agency requested bids for 130 microphones to be used in broadcast and sound reinforcement applications. The agency specified a microphone that was of foreign manufacture and is not generally used in the intended application. Having been asked to suggest an alternate, our company demonstrated an equally high quality and more appropriate microphone of American manufacture. Our alternate was subsequently approved. Past experience with the bid requesting agency told us that a buy decision would be based totally on dollar cost to acquire. Having called the factory representative to check on the possibility of special quantity discounts or terms, we submitted a bid approximately equivalent to what the cash tied up in the job would yield if in a passbook savings account.

Setting up Anaheim Bid: I answer a series of questions as they appear on the screen. They are in general terms, describing: the customer, bid usage, cost to do the job, cost to prepare the bid, value of the bidding experience, value of possible follow on jobs, the competition, risks, non-price factors, etc. None of the questions require exact accounting information — just general price ranges, perceptions and opinions. In some cases I have the option of entering values in either dollar amounts or percentages. In this run, it seems that there are about 100 questions which take about ten minutes to answer. When I'm finished, I can change answers, save my file to disk, get a screen printout of the report, or get a hard printout. Should I want to use part of the report in another document, I can save it as a text file and retrieve it in a word processor.

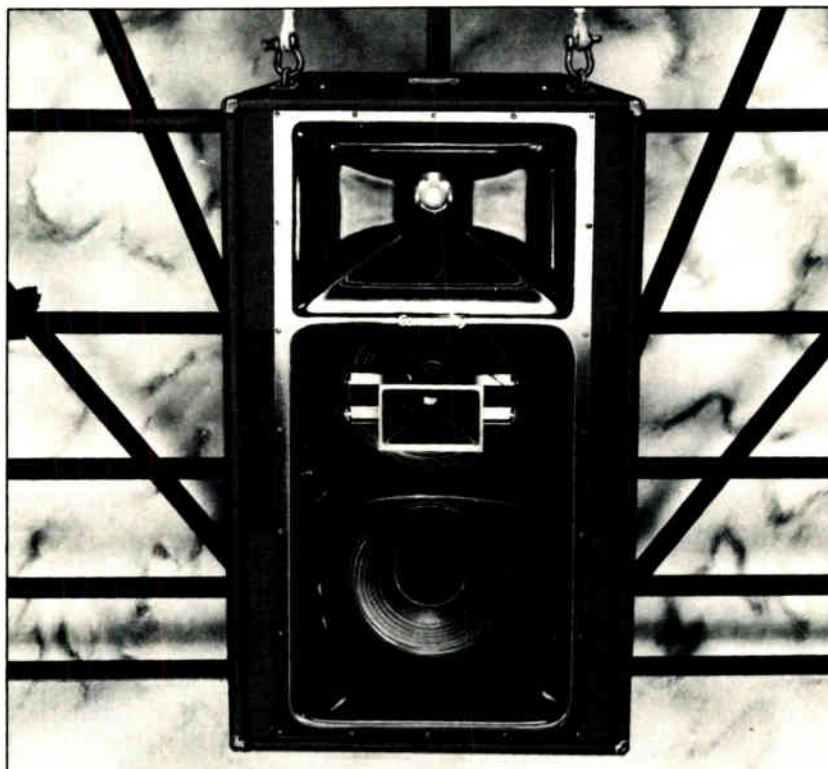
Anaheim Bid Results: A report appears on screen. It's divided into a number of headings: Executive Summary, Bid/No Bid, Price, Risk, and Potential Tactics. The report recommends "Bid on this prospect as you can gain goodwill from this job." But looking at the rest of the report, I can see that it's not going to be a money maker.

Expected return:

Chance of winning	0%
Profit	\$300
Expected gain	\$300
Risk exposure	0%

The report goes on to state that the \$300 gain and the \$300 profit (both are the same \$300) is the result of \$500 worth of goodwill earned against \$200 in costs to

prepare and submit the bid. (The difference between gain and profit being that we could get the job at, say, a negative profit (loss) of \$100, and still have a gain of \$200 in goodwill.) If we want the job, the Price Options section shows that we will have to price it at what turns out to be about 30 percent below our cost to have a 50 percent chance of winning the bid. So, the bad news is that according to Anaheim



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Bid, there is no cash profit to be made by the seller in this job; that the only gain is in terms of good will: Our name will remain on the bidding list, and perhaps the factory representative will take us out to dinner.

What Actually Happened: The award went to a competitor who bid 5 percent below factory invoice cost.

Conclusion: Anaheim Bid is on track. To try and cultivate this agency as a customer is apparently not a profitable use of our business resources. If we wish to maintain our "goodwill rating" with him, we should continue to answer bid requests, "shot gun" pricing the bids high enough to assure a profit if we win, while spending minimum time on details. Because we have a very slight chance of winning, low priority should be assigned to actively perusing orders from this customer. By answering the bid requests, we keep the goodwill rating, and by pricing for profit, we trade dinner on the Rep for not having to take the cash loss of selling product for less than we buy it for.

CASE 2

Background: A government agency requested bids for an intercom system. Our company deals in one of the two brands specified, but ours is the more expensive of the two, and the customer has shown a preference for the other in the past.

This is an excellent test for Anaheim Bid. We will price the bid at regular "make a living" prices, then run the program and follow its recommendations.

Anaheim Bid: Following the same procedure as in case 1, I answer questions as they appear on the screen. In some cases the questions are different than in the earlier exercise. As before, they are in general terms and cover the same bases.

Anaheim Bid Results: The report recommends "Bid on this prospect; it adds to your bottom line profit." It suggests that this may be a "most value wins competition" and recommends that special effort be made to appraise the customer of the benefits of our product and our company over the others. To help us do that, it prints a list of five specific

benefits that should be emphasized.

A Price Options table indicates that we may be able to increase our price by 5 percent and still have a better than 80 percent chance of winning. It also suggests that should we try and raise the price by 14 percent, chances of winning drop to 0 percent.



What Actually Happened: We followed the program recommendations and won the bid.

Conclusion: Two for two. Again Anaheim Bid is on track. This time it got us an extra 5 percent, even though at the start we perceived our product to be second choice with the client.

CASE 3

Background: A manufacturing company requested bids for a plant paging system. The specifications are general in nature, but the requirement is for zone time tones, zone paging, fire warning, and tornado warning. Paging will originate from a number of microphones and by dial access from the telephone system. Logical paging and alarm priorities are defined, and requirements for automatic battery backup on power failure and automatic substitution of failed amplifiers are given.

The company has a number of plants in the state, several of which will need paging systems added or upgraded to meet government requirements. There could be a lot of work here, so there will probably be a lot of contractors chasing this job.

Anaheim Bid Results: The report recommends bidding the job because of its potential to return a profit. It picked up on

the possibility of future work, but did not value that as highly as I thought it might. It also picked up on the likelihood of lots of competition, giving us about a 20 percent chance of winning at the price we would submit.

The strategy section of the report listed eight points that we should be sure to cover in the sales presentation. It indicated that the best answer to the customers' requirements and rapid installation might carry heavy weights in securing the contract. In other words, get the engineering department involved right away, and be sure the installation people are "ready to roll" on a moments notice.

What Actually Happened: We were not low bid, but we got the job. The customer liked our solutions to his problems. We scheduled the installation for a weekend, when the plant was shut down. The equipment went in as planned and was operational when the first shift showed up Monday morning. We have since done paging systems in other plants the customer owns, some of them without having to submit bids.

Conclusion: This is an old job, one we did before we had access to Anaheim Bid, but in retrospect, the results certainly seem to agree with the program's "prediction."

CASE 4

Background: A manufacturing company requested bids for an improved plant paging system. The requirement is for time tones and paging from telephones to the whole plant. The existing system does not have telephone access and is not loud enough in some areas when equipment is running.

Anaheim Bid Results: The program sees a chance for profit here but suspects the job will go to the lowest bidder. It recommends that we emphasize specific features that solve the problems the customer is bothered by. Looking at the Price Options table, Anaheim Bid gives a better than 75 percent chance of winning at the price we actually bid. It appears that we could have bid some 20 percent higher and still had a 50 percent chance of winning.



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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!

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Circle 241 on Reader Response Card

People

Gentner Appoints Directors; New President at Yamaha

Heinsohn and Jones at Gentner

Gentner Electronics Corporation (NASDAQ:GTNR) has announced two recent appointments. Hugh R. Heinsohn has assumed the position of



Heinsohn

Director of Marketing and Elaine Jones has become Director of Corporate Projects.

Heinsohn joined Gentner in 1988 as Director of Corporate Development. He has been responsible for the organiza-

tion of company acquisitions and international marketing, and has been involved in new product development.

His main responsibility, presently, is to manage the company's Sales, Distribution, Marketing Coordination and Customer Support Departments.

Before joining Gentner, Heinsohn served as Vice President of International Sales for Southern Broadcasting Systems Pty. Ltd., in Perth, Australia.

Jones joined Gentner as Marketing Manager in 1983. She has held several positions within Gentner's Marketing Department and has been involved in the development of the Company's distribution and marketing programs. Jones also initiated Gentner's expansion into the audio conferencing and sound contracting markets.

In this newly created position, Jones will be responsible for the implementation of corporate level projects, and will oversee the company's Facilities Management Team.

Aiphone Marketing Transfer

Aiphone Corp. has announced the transfer of Takashi Kaniye from Aiphone Co., Ltd's export department to Aiphone's corporate headquarters in Bellevue, WA. He joins the marketing department as part of a company "cross training" program.

Kaniye's previous experience with

Aiphone includes an assignment with the export division, where he concentrated on sales to Latin America, the Middle East and Africa, and a year in the company's Japanese domestic sales department.

Yamaha Appoints Suzuki

Yamaha Corporation of America announced that Peter Suzuki has been appointed President succeeding Masahiko Arimoto, who is returning to Japan for a new assignment.

Suzuki had been with Yamaha International Corporation for fifteen years — from 1968 to 1984 — before returning to Japan. He is also a Director of Yamaha Corporation (Japan).

During his fifteen years in the U.S., Suzuki was Senior Vice President and member of the Board of Directors of Yamaha International Corporation.

Restructuring for Renkus-Heinz

Harro Heinz, President of Renkus-Heinz, Inc. has announced the restructuring and expansion of the company's sales and marketing organization.

Carl C. Dorwaldt has been appointed National Sales & Marketing Manager and is responsible for all planning, promotion and sales activities. He has held similar positions with TOA and Bogen.

Mark Duncan has assumed the position of Product Manager and will be responsible for directing the company's new product development programs and for providing applications engineering assistance to its sales representatives and dealers.

Graeme Harrison has been appointed European Marketing Manager

for Renkus-Heinz. He is responsible for the company's overall marketing in Europe.

Promotions at Atlas/Soundolier

Atlas/Soundolier has promoted Bud Waters to National Sales Manager in charge of outside sales for the sound contractor. Walter Best has been appointed Sales Manager—Eastern Region while Jim Edwards becomes Sales Manager—Western Region with responsibilities in their respective halves of the United States including Manufacturers Representatives and promotional activities.

Eaton Promoted at Pro Co

Pro Co has announced that William Eaton has been promoted to Pro/Com-



Eaton

mercial Division Sales Coordinator. Eaton has "broad experience in both the manufacturing and sale of Pro Co products," states Charlie Wicks, President of Pro Co Sound, Inc. Eaton is

responsible for working with Pro Co's representatives and for providing service to Pro Co's dealers and end-users.

Stoffo named at Vega

James Stoffo has been named wireless marketing specialist for Vega. Stoffo will be responsible for domestic marketing of Vega wireless microphones and intercommunication systems. He will also provide technical support and training to factory representatives and dealers.

Previously, Stoffo had provided technical marketing support for Vega, and served as a consultant, providing system engineering services to stage and studio sound reinforcement contractors.

CALENDAR

Upcoming Events

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

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

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

SUPERCOMPUTING WORLD: San Diego, CA. Contact: (800) 223-7126. June 19-21.

FIBER-OPTIC SPLICING AND TERMINATION WORKSHOP: Sturbridge, MA. Contact: (508) 347-8192. June 25-29.

JULY

NOMDA '90 (Nat'l Office Machines Dealers Ass'n): Las Vegas, NV. Contact: (816) 941-3100. July 11-14.

VIDEO EXPO: Chicago, IL. Contact: (914) 328-9157. July 23-27.

BASIC VIBRATION ANALYSIS SEMINAR: Knoxville, TN. Contact: (615) 675-2110. July 24-26.

AUGUST

NATIONAL HARDWARE SHOW: Chicago, IL. Contact: (203) 964-0000. August 12-15.

SIGGRAPH: Dallas, TX. Contact: (312) 644-6610.

SURFACE MOUNT '90: Boston, MA. Contact: (800) 223-7126. August 28-30.

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Circle 256 on Reader Response Card

Products

Aphex Intros Audio Remote; Oxmoor's New Mixing Systems

Audio Remote Control

Aphex Systems has announced its Aphex 150 audio remote control system. The 150 consists of two independent self-contained channels. Each channel has servo-balanced inputs and outputs. The inputs feature + to - 15 dB gain control. Fully buffered control ports can be run independently or linked for stereo operation. Multiple controllers can be linked for control by a single remote control unit.

A single potentiometer is needed for full remote control of audio signals in various applications. Attenuation speeds are user selectable. All level settings are protected from power outages by a battery back-up. A Mute function is provided with an adjustable preset.

Circle 222 on Reader Response Card

CCD Camera

Cohu, Inc., Electronics Division has announced the 3310 Series Monochrome CCD Camera. The 3310 Series is a general purpose CCD camera designed for use in applications including general security/surveillance, traffic safety and control, and machine vision/image processing. It also can be used for OEMs and systems integrators.

The 3310 Series features include an interline transfer sensor for blooming problems and a 1000:1 overload capability for video applications prone to streaking problems.

Circle 223 on Reader Response Card

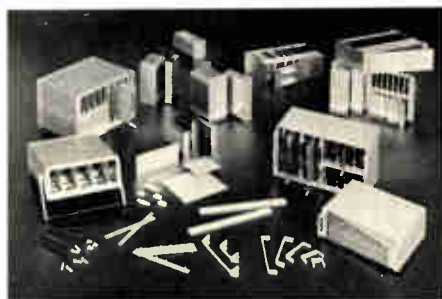


Europackaging Enclosures

Elma has introduced a system of modular, top quality Europackaging modules. They can accommodate single, double and triple height Eurocards. Extrusions are made of clear anodized aluminum, and cover plates are scratch-resistant vinyl-clad aluminum.

The Elma modular system offers a wide variety of options, while drawing utilization of available space for standard or for various card sizes and components. The enclosures can be rack, table-top and panel mounted.

Circle 224 on Reader Response Card



Mixing and Distribution

Oxmoor Corporation has introduced a pair of buffer, mixing and distribution products. The RMX-44, which is configured as four-in/four-out, and the RMX-62 (six-in/two-out) occupy 1-U of standard 19-inch rack space, and weigh under 8.5 pounds.

Front panel controls include input gain trim pots, XL-type input/output connectors, plus a 25-pin D-sub connector that carries the various logic control inputs.

All inputs are designed to handle maximum signal levels of +24 dBu, with a nominal level range of -10 to -8 dBu. Electronically balanced and AC-coupled outputs feature a 150-ohm source impedance, and can drive up to +24 dBu into 600-ohm loads.

Circle 225 on Reader Response Card

Standalone Fiber Optics

Dynair Electronics has announced an addition to its fiber-optic product line, consisting of self-contained video transmitters and receivers. The new standalone units claim signal-to noise ratio equal to coax cable systems without hum and noise pickup. The new line accommodates fiber lengths of up to 5 km without repeaters and provides claimed bandwidths of over 100 MHz for systems up to 2,000 feet.

The LED/PIN diode-based systems come in a variety of package configurations to meet most applications. These units will be available in three distance/bandwidth options for Broadcast, Education, Corporate and CCTV applications.

Circle 226 on Reader Response Card

UHF Wireless Mic System

Vega has introduced a UHF wireless microphone system. The Vega Pro Plus UHF system, which includes the R-662 receiver and T-677 transmitter, features the Dynex III audio processing system. The system claims lower distortion and a wide range of operating frequencies, from 535-820 MHz.

The T-677 bodypack transmitter delivers 150 mW of RF output power and provides up to 1,700 feet of range. The R-662 selectable four-frequency receiver can use either external source power or a battery pack and comes with a rack-mount option. Optional AC and DC power modules are also available.

Circle 227 on Reader Response Card



Cast Frame Loudspeakers

Eden Electronics, Inc. has announced its "Made in the U.S.A." cast frame loudspeakers. The new line features 10-inch, 12-inch, and 15-inch loudspeakers, cast aluminum tweeters and midrange drivers designed for full range, P.A., midbass, subwoofer and instrument applications.

The driver line features edgewound voice coils, cast frames, rear vents, and claims high efficiency.

Circle 228 on Reader Response Card



Modular Mixer/Power Amplifiers

University Sound Inc., is expanding its 9000 Series by introducing two modular mixer/power amplifiers—model 9006-P and 9012-P.

The features of these two models include: locking front panel controls which prevent tampering with volume; single plug-in module or auxiliary program input; variable sensitivity adjustment on rear panel; circuitry which protects system components in event of system failure; and separate speaker output terminals for 4/8 ohms and 25/70 volts.

Circle 229 on Reader Response Card

Matrix Routing Systems

TE Products, Inc. of Framingham, MA has introduced a line of intelligent matrix routing systems for high quality 50 MHz wide video, audio, and stereo or multilevel audio requirements, with or without breakaway.

The VAS-2000 system can accommodate 48 inputs by 64 outputs of video, audio or stereo audio in a 10 U rackspace and is expandable to 192 in-

puts by 192 inputs. The VAS-2040 system can accommodate 16 inputs by 64 inputs of video, audio or stereo audio in a 5 U rackspace and is expandable to 112 inputs by 192 inputs.

Motherboard design permits the mixing of video and audio cards in one shelf. The switch controller is designed to prevent any single point failure to cause a system malfunction, and with slave controllers in adjacent shelves, assures uninterrupted control of the VAS switching system.

A 200 kbs communications interface permits communications over twisted pair or coaxial cable to a family of full function or limited function VAS-MRC remote control panels as well as with integrated machine controllers.

Circle 230 on Reader Response Card

Oscilloscope Probes

Test Probes Inc. (TPI) is offering thin cable 300 MHz repairable oscilloscope probes that fit makes of scopes having 1 megohm input.

A sawtooth-shaped center conductor eliminates microphonics, and provides resistance to breakage from pulling and bending. The modular probes screw together without soldering for on-site repairs.

The 300 MHz TPI probe claims its measurements have less than 3 percent overshoot and 1.2 nanosecond risetime. Some models have an activator pin for readout and an automatic scale factoring on scopes having that feature.

Circle 231 on Reader Response Card



EMI/RFI Engineering Sample Kit

Murata Erie North America is offering a design engineering sample kit of EMI/RFI filters in various configurations and values. Included in the kit are ferrite beads, a variety of two and three lead filters with and without ferrite beads, chip filters, signal line filters, etc., numbering almost 1,000 individual components.

The sample kit is packaged with an EMI/RFI suppression manual that provides information on accepted techniques and design considerations appropriate to minimize EMI and RFI.

Circle 232 on Reader Response Card

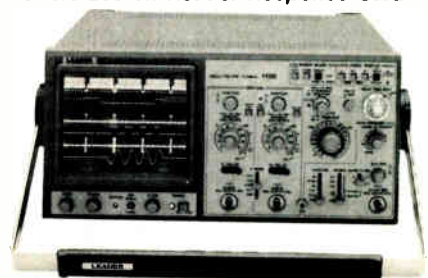


Three Channel Oscilloscope

Leader Instruments Corporation has announced the Model 1100, a 100 MHz, three-channel, dual time base oscilloscope, featuring six-trace capability with 500uV maximum sensitivity and 5 ns maximum sweep speed for easy analysis of low level and high speed signals.

The 1100 features alternate triggering, alternate time base and variable holdoff. The high intensity CRT and triggering controls provide a display of signals. TV-V1, TV-V2, and TV-H sync separator circuits allow for triggering of video signals. Alternate time base allows for simultaneous observation of vertical and horizontal TV signals.

Circle 233 on Reader Response Card



CCD Camera Housings

Burle Industries, Inc. has introduced an assortment of indoor and outdoor housings designed for use with the compact TC650 and TC250 Series 1/2-inch format CCD cameras.

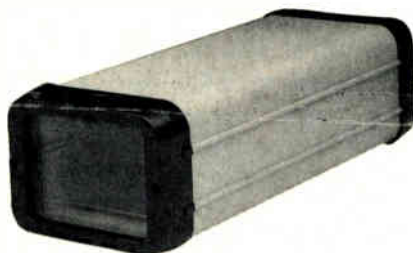
The new line of enclosures includes indoor decorative housings, small indoor domed housings, ceiling housings and outdoor all-weather domed housings.

The new line includes the EH3010 and 3014 indoor decorative camera enclosures, specifically engineered for use with CCD type cameras with fixed focal length lenses. The TC9345MT7 and TC9345MT12 are indoor domed housings for solid state cameras. The TC 9376H is a ceiling housing that features 360-degree viewing.

For outdoor installations, the TC9312 model enclosure has been added to Burle's line of environmental domed

housings. This 12-inch version encloses the camera to provide protection from the effects of wind, ice, and snow, and comes with an adjustable mounting bracket.

Circle 234 on Reader Response Card



Portable Waveform Monitor

Leader Instruments Corporation has announced an upgraded version of its portable, hand-held waveform monitor for on-location shooting. The EFP/ENG waveform monitor, Model 5864A, now

includes dual input capability. It provides 2H/2V MAG and 2H/2V sweep rates in a battery powered instrument that weighs less than three pounds. The 5864A also offers flat and IRE filters as well as a 4 times vertical magnifier that simplifies setup level and black balance checks. It is designed for use with the Vectorscope Model 5854 and SID Signal Generator LCG-413.

Circle 235 on Reader Response Card



TESTING

(continued from page 15)

be at least twice the planar size as the largest wavelength of interest. (Far more accurate and complex calculations are often used.) Noting that diffuse reflectors become geometric reflectors at some frequency, it is important to note that manufacturers are beginning to rate products for both their level of reflection and for the frequency range of interest. Typically, the cut-off in energy from reflective to diffuse occurs proportionately to single wavelength dimension.

In addition to textured surfaces, there are many other diffuse reflectors, including commercial "module systems" (Figure 8) and, most interestingly, QRDs, which are intended to be "directional diffusers" which, within their effective frequency range, have the ability to distribute sound over a predictable one-plane path, with patterns of distribution varying from quite wide to very narrow.

Finally, there are many common absorption products, including fabric-covered acoustical panels, hanging baffles, hanging and wall-mounted resonant absorbers, and carpets, seating, and other "room volume" absorbers.

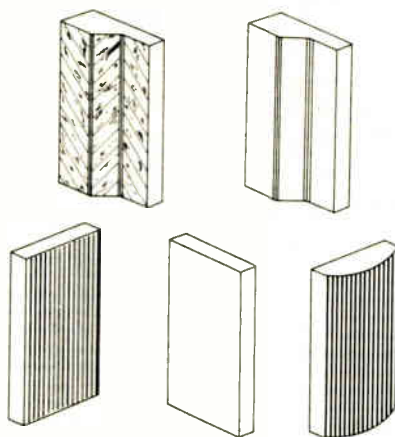


Figure 8. Glen Ballou, Editor — Handbook for Sound Engineers, page 126.

These various absorbers are characterized by their noise reduction coefficient, by their absorption at each relevant frequency of interest and by their general bandwidth effectiveness (narrow-"resonant" or broadband). Part of their function is generally to control room reverberation, and the remainder of their function is to correct potential room anomalies.

TESTING AND RATING

The acoustical field has been moving through a recent change that follows a similar shift in the lighting field many years ago. While it used to be the practice in both fields to consider average performance in footcandles or in NRC, interest in the specific angular and frequency performances of reflectors and absorbers has become far stronger. Over the next few years, it is probably that the standards organizations (ISO and ASTM) will support a standard method for testing the angular distribution to sound from an absorber and a reflector. Time delay spectrometry and the TDS analyzers have made the consideration of directional characterization far more convenient and inexpensive, and Sound Intensity measurement has provided the potential for measuring the sound power, pressure and intensity distribution directly from the surface of the product in question. Next month, we will consider the testing of specific materials via the use of TDA and intensity testing. Exact performance data on real products will be used to demonstrate performance. ■

RESIDENTIAL INSTALLATION

(continued from page 21)

The smaller panels are basic system on/off, local speakers volume control and FM select that changes the station each time the button is pressed.

"You also have the option to turn on things elsewhere," adds Davidson. "You can make the house go over to CD player or turn on the speakers everywhere."

Separate pairs of stereo speakers (Yamaha, Sonance, Design Acoustics and Audio Command modified B&Ws for the bath and decks) are hidden or built in the walls of the master bedroom, master bath, kitchen, kitchen deck, dining room, living room, library, and first floor deck. One Yamaha MX-2000 amplifier is used to power all these speakers. They are wired parallel with audio transformers to vary the impedance levels slightly depending on the load. There is also an impedance protection circuit to guarantee minimum impedance.

An alternate system with receiver, dubbing cassette deck, laserdisk player, monitor/receiver and S-VHS VCR is located in the master bedroom, while an additional radio receiver is in the kitchen.



The house, which overlooks the Hudson River, was designed by Jay Measley.

Both are connected to their room control panels and can be switched on if users wish to hear something different from the main system.

With the owner providing \$20,000 to \$25,000 of the equipment, Audio Command president Robert Kaufman estimates the total price of the house's

A/V system at \$50,000 with an estimated \$10,000 for the satellite dish.

"That's a rough guess if we supplied soup to nuts on the job," says Kaufman. "Most of the time we do supply it, but we often get that kind of arrangement where people want our installation and they have their own equipment." ■

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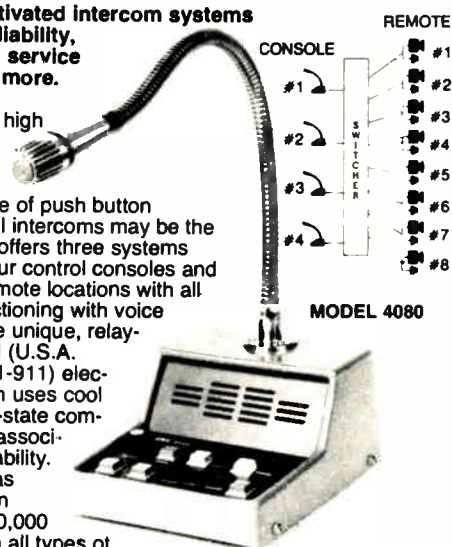
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DRA LABORATORY'S MAXIMUM LENGTH SEQUENCE ANALYZER — "MLSSA"

BY MIKE KLASCO

Obtaining intelligible and esthetically pleasing performance from a sound system cannot be achieved just by selecting top quality equipment alone. An optimally installed sound system requires careful and competent testing of room acoustics, selection and optimization of the proposed design (through manual or computer-aided-techniques) and through alignment and calibration of the system both by ear and with the aid of high resolution test instrumentation.

Since December 1988 *Sound & Communications* has published reviews of predictive analysis tools (computer-based and otherwise) for sound system and acoustical performance prediction. This month we will begin the first of a series of in-depth analysis of test instrumentation for both sound system and acoustical measurement.

The first test system we will examine is the DRA Laboratories MLSSA (Maximum-Length-Sequence System Analyzer). The MLSSA consists of software and a circuit board that plugs into an IBM compatible computer. The intended users are the same that might consider the Techron TEF analyzer and the Ariel SYS-ID system.

The MLSSA system developers and proponents claim that it is a powerful, comprehensive instrument that enables fast and accurate measurements even in noisy environments, with less skill than alternative equipment. For the next three

(MLSSA is developed and manufactured by DRA Laboratories, 607 West Nettleree Road, Sterling, VA 22170 (703) 430-2761.)

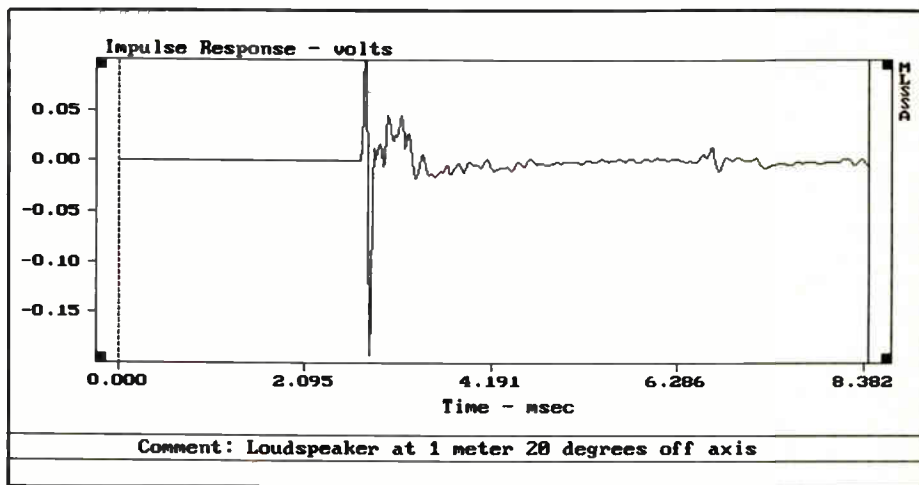


Figure 1. Derived impulse response of a speaker. Vertical axis is volts and horizontal axis is time in 1/1000 of seconds.

months we will explore the MLSSA's performance and evaluate how well it meets these goals, but at this juncture I can say that overall it is an exciting, powerful and top grade piece of test gear. The MLSSA system will be of interest to both acoustical consultants and the knowledgeable sound contractor who is ready to step-up from his real-time one-third octave analyzer.

The MLSSA system is a hardware and software package. Within the limitations of the hardware, the software can expand the functions of the system. Presently, the MLSSA system can perform an impressive battery of tests, including; high resolution frequency response, phase and group delay, 3-D waterfall plots, impedance, distortion measurements, reverberation time, STI and RASTI and noise floor measurements.

The MLSSA system will continue to be explored, including laboratory, field use, and production line applications. This month we will focus on an overview of the instrument's capabilities, hardware requirements, and user interface.

The second test system we will explore is the Ariel Sys ID. The earliest version of the Sys-ID software was awkward to use and limited. During 1989 significant improvements were made in two major software release updates. Another important release is in the beta stage which further enhances user interface and adds additional test functions and test signals, with formal release this summer. I anticipate that the Sys-ID system with the new software release will be ready for an in-depth review immediately after we finish with the MLSSA system. Hyperception, a signal analysis software developer, also offers its Signal Processing Workstation program that runs on the Ariel hardware. We will evaluate their latest release in the second part of the Ariel review.

After we examine the Ariel, we will review the Neutrik followed by the Scantek 830 test instrument and its associated test and predictive measurement software packages. Following the Scantek, I anticipate that the just announced Techron TEF 20 computer (for both Mac and IBM)

test system will be ready for review. Finally, by the end of the year, Audio Precision may be further along with the software and hardware enhancements for their System One/DSP. Software that fully takes advantage of the acoustical analysis capabilities of the System One/DSP is still in development. When its ready, we will review the system.

And now, on to the MLSSA system...

MLSSA

The DRA Laboratories is a new and unfamiliar name to most sound contractors and acoustical consultants. Actually, DRA was founded by Douglas Rife in 1985. DRA first shipped its A2D-160 Sampling Digitizer through Microway, a mail order electronics supply house that specializes in hardware to hot-rod your IBM compatible. The A2D-160 is the hardware for the MLSSA system, but it got little attention by Microway customers who were mostly looking for coprocessors and transputers, not audio analysis systems. A few years later Doug Rife tried distributing both the hardware board and the MLSSA software package through IQS, a small audio test equipment supplier, but eventually he came to the conclusion that to do it right you have to do it yourself. The MLSSA system consists of software and a plug-in circuit board for IBM compatible computers.

DATA ACQUISITION

The test signal is a pseudo random noise sequence also known as a maximum-length sequence (MLS). Although impulses and short square waves can also be generated, they are normally not required. The MLS signal is typically sent to an amplifier and speaker and picked up by a test mic connected to a preamp, which is connected to the input of the MLSSA board. When the operator executes a GO command, MLSSA turns on the MLS, acquires the mic signal, and then turns off the MLS and cross-correlates the mic signal with the original MLS to derive the impulse response. Although most measurements require the cross-correlation to obtain the impulse response, this step can be disabled to look at the raw input data.

Because the impulse response is derived by cross-correlation with an MLS rather than measured directly using a pulse test signal, resolution and noise immunity are very high. Resolution equals 16 bits even though the actual A/D converter has only 12 bit resolution. Furthermore, MLSSA automatically performs autoranging during signal acquisition using the variable gain feature of the board's programmable 8-pole antialiasing filter. Autoranging insures that at least 10 out of the 12 A/D bits are utilized for all signal levels within a 68 dB dynamic range.

Autoranging can also be disabled and input gain set manually, if desired. Additionally, the filter's bandwidth can also be varied from 1 kHz up to 40 kHz.

While the MLSSA hardware has an MLS, square wave and impulse generator, it is not capable of generating swept or stationary sine waves, which are useful for audibly checking for buzzes and rattles, or for use with the MLSSA analyzer for testing distortion. Since a number of CD test discs include these waveforms, they can easily be used with the MLSSA in conjunction with its pre/post triggering capabilities.

Although the MLSSA is sold as a single channel analyzer, a hidden and pleasant secret is that the hardware is a fully functional dual channel data acquisition system. For now, only signal channel operation is supported by the MLSSA software, but a manual and development software for dual channel operation is supplied with the package. In the future, dual channel operation may be introduced, although the maximum bandwidth will be reduced from 40 kHz to 20 kHz (eliminating any chance of the product's success in selling to bats). A more serious limitation is that the very effective 8 pole filter used in single channel operation functions as two 4 pole filters in the dual channel mode. Foresight has eliminated this problem, as the filters are on plug-in daughterboards and faster slope filters can be retro-fitted when needed.

Other development software is included for direct-to-disk recording, which may have future application of capturing very long signals to be analyzed in sections. One application for this capability would be ASC's 80 second duration MATT (Music Articulation Test "Tape") which is on the Prosonus SRD CD.

ANALYSIS AND POST-PROCESSING

For most users, at least at first, analysis will consist primarily of viewing the response curve. To obtain anechoic response curves from speakers in non-anechoic environments, the operator views the derived impulse response. This function is the same as using a storage oscilloscope. The cursor is moved to the

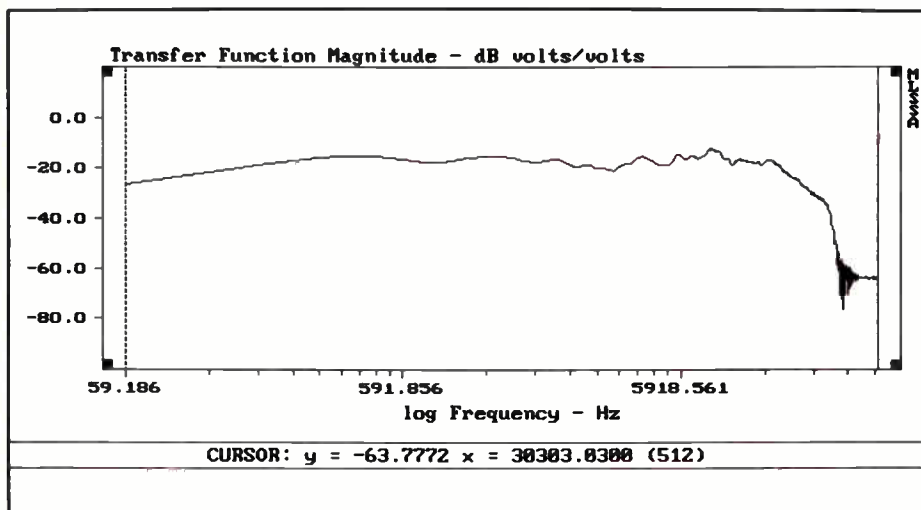


Figure 2. Frequency response of a speaker, with MLSSA bandwidth set for 60 Hz - 10 kHz. Measurement range can be set down to 1 Hz or up to 40 kHz.

SOFTWARE REVIEW

very onset of the signal and this point is marked on the screen by using one of the special function keys. The cursor is then brought to the end of the speaker's signal, but before any reflections from the floor, walls or other nearby objects. The space from the very beginning of the graph's X axis to the onset is the transit time it took the signal to travel from the speaker to the microphone. The impulse signal that the MLSSA derives may contain a few humps, and these might be the different arrival times from the woofer, midrange, and tweeter. The arrival times will vary with different designs, depending on if the woofer is horn loaded, or if a compression driver/horn is used, or if a super tweeter is used. Speaker systems specially designed for time alignment will (one hopes) show coincident arrival time, with a single arrival hump. Other irregularities in the curve immediately following the speakers' arrival may be cabinet edge diffraction effects, internal box reflections, and reflections off of adjacent surfaces (mounting hardware frames, other cluster components, etc.). At first this may seem a bit like reading tea leaves or palm reading, but the arrival times can be read-out in feet or inches and the offending surfaces can be usually spotted by observation (and a tape measure), moved or modified, and the measurement retaken. Becoming familiar with the time domain is part of

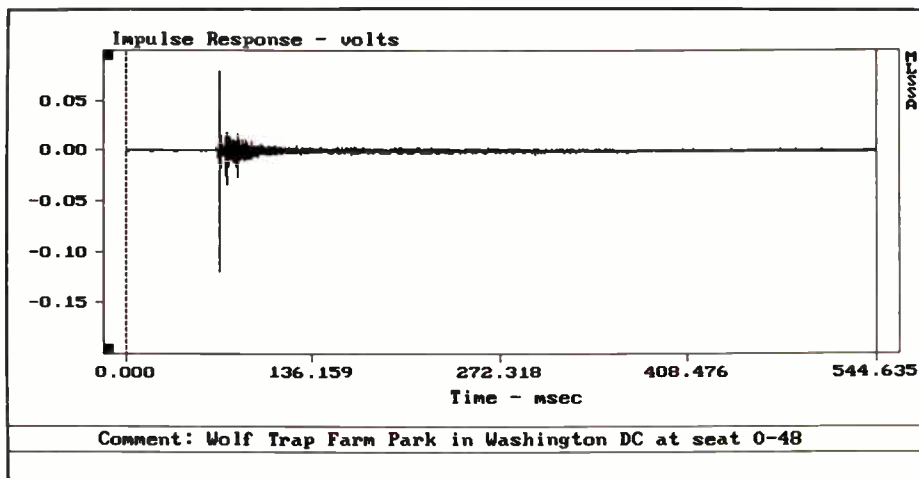


Figure 3. Derived impulse response of a hall. Note the time axis is over 1/2 seconds, while the speaker plot time axis is 8/1000 second in figure 1.

growing up from one-third octave analyzers. The MLSSA makes this transition less painful than other time/frequency/energy analyzers I have used before.

The MLSSA offers an Energy-Time-Curve, which is unfiltered. Users trained on the TEF system normally would view an Energy-Time-Curve (ETC) display rather than the impulse response. A few TEF users who looked over the MLSSA's ETC remarked that the "signature" appeared subtly different from what they were used to seeing. This is because the ETC on the TEF is filtered (narrow band), while on the MLSSA it is unfiltered (wide band). This is slightly different from the TEF system analysis, so a filtered option is being provided which can emulate the sweep bandwidth of the TEF. This soft-

ware based option should be released by the time you read this.

You may view the waveform and ETC with the base line in time or feet. On the Y axis, the amplitude is in volts for the raw data and dB for the ETC. The next step is to look at the frequency response; two keystrokes are pressed and in a moment the response is displayed. The resolution is very high, more than adequate for critical lab work or any field application. Smoothing is also provided, with the options of one-third and single octave resolution. Dynamic range is over 80 dB — again, sufficient for any application and roughly equivalent to the TEF and Ariel. The pseudo random noise test signal is highly immune to spurious noise, and averaging is also included for especially noisily conditions.

Assuming the operator has some prior experience with real time analyzers and at least a rudimentary understanding of the concepts of time domain analysis (such as one-third octave instruments such as the Ivie 30 with RT60 module, dbx RTA 2, or the IQS 401 FFT analyzer), useful measurements can be made within a week, although full use of the system will take longer. Experienced users of high resolution acoustical analysis equipment may find that they have full use of the MLSSA system in a day or two. Frankly, the MLSSA setup and test procedures are relatively intuitive, and not anywhere as ambiguous as the TEF. On the other hand, far more application information is available for the TEF system as it is a more mature

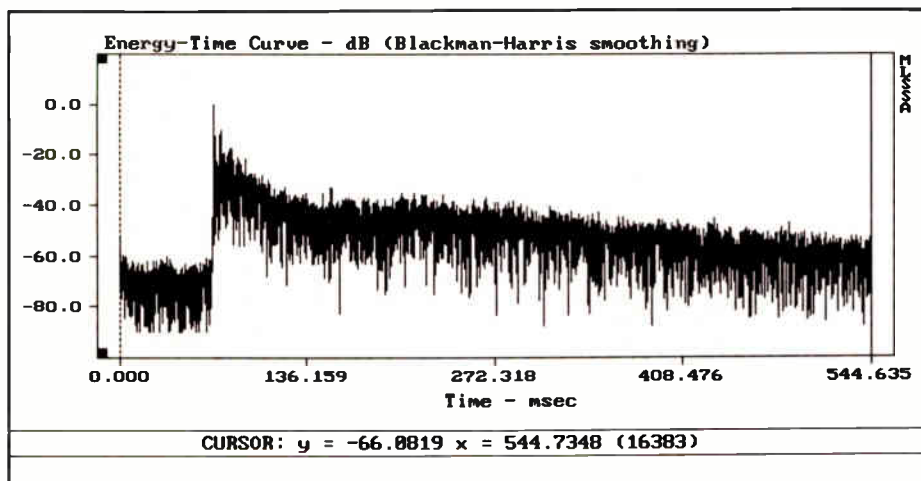


Figure 4. Energy-Time Curve for a hall. The MLSSA etc. is unfiltered, while the TEF's plot is filtered, so appearance is slightly different.

package. Reference level calibration on the MLSSA is awkward (Doug Rife, MLSSA's developer, will fix this on the next release) and a number of functions available on the TEF (such as polar plots and FTC) have yet to be developed.

Once you can figure out how to measure frequency response, you can use the MLSSA as a tool for testing speakers, setting electronic crossovers and equalizers. By looking at the impulse response and the Energy-Time-Curve, you can time align clusters and set delays between main clusters and distributed speakers. The phase angle response and group delay (in milliseconds) can also be viewed.

The present software release (5.26) already includes dozens of additional measurements, ranging from impedance curves, Bode and Nyquist plots, reverberation time, intelligibility (STI and RASTI), and 3-D time/frequency/energy plots. Users will find the MLSSA is powerful, useful, and practical, even if they start with only a basic understanding of audio measurement techniques. Of course, to get full use of the system, expect to spend time reading and studying acoustical phenomena.

HARD REQUIREMENTS

For field use, an ideal configuration of the MLSSA system would be to build it into a laptop computer. We will explore

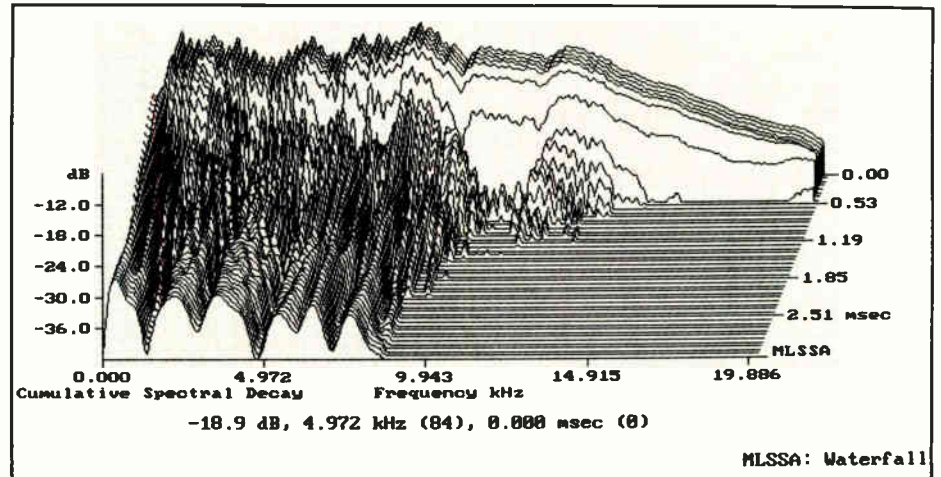


Figure 5. Time-Frequency-Energy plot of speaker, with time axis set for 3 ms.

specific lap top configurations next month, but the trick is to find a 286 or 386 unit that accepts a full size XT expansion board and a coprocessor.

The MLSSA will work with any IBM compatible. A math coprocessor chip is required for the empty socket on the computer's motherboard. We will explore the differences in performance between the three brands of coprocessor integrated circuits during this series. A CGA, EGA, or VGA graphics adaptor is required. The monochrome Hercules standard is not supported, but monochrome CGA and gray scale VGA has special support, which aids MLSSA's operation with portables. The MLSSA circuit card will plug into an 8 bit (XT style) slot. It is a full length card and will fit into any desktop IBM compati-

ble, but only a few portables. A hard disk is not required, but at least a high density floppy disk (such as a 3.5" floppy on a portable) is needed for efficient operation.

HARDCOPY

The software directly supports Epson, OKIdata, HP Laserjet, and IBM Proprinter printer control codes. Next month we will experiment with third party printer control software for color printouts.

SOFTWARE INSTALLATION

The only crude aspect of the MLSSA that I have so far encountered is in software installation. Considering that software installation is the new owner's first contact with the product, it is most unfortunate. The user must know how to edit the autoexec. bat files and use a file editor to set up the graphics configuration. While file editing is not complicated, a simple multiple choice configuration from within the program would be more appropriate. The user must inform the software of the serial numbers of the hardware filters for calibration purposes, which I think should have been prepared by the factory. Also a warning to write down the serial numbers before installing the board would have been in order. These are minor complaints, but first impressions are important. The developer will have this cleaned up this month, so I will re-evaluate this function before the end of this review series.

The interface to the real world consists
(continued on page 70)

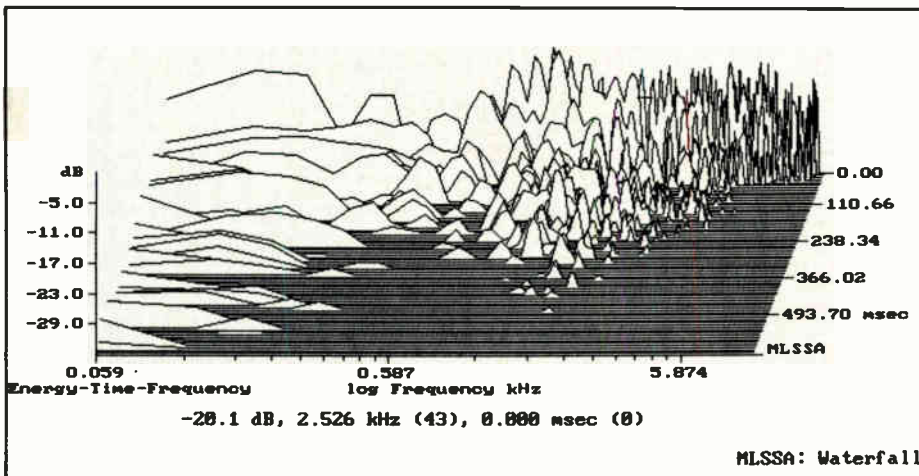


Figure 6. Time-Energy plot of hall with time axis set for 1/2 second.

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SOFTWARE REVIEW

(continued from page 67)

of three phono jacks (RCA jacks) and a 9 pin D connector. One phone jack is the test signal output. A second jack is for the input signal from the mic (or whatever is under test). A second RCA input is for the second input channel. Clock input/output and external trigger input are various pins on a D connector, which is a less than wonderful choice of connector style since this is exactly the same connector used for video monitors. As most CGA, EGA and VGA adaptors have at least one RCA jack (for composite video output), unless you have just installed the MLSSA board, you will have a mystery (if you disconnect the monitor) as which is the test system and which is the video adaptor. The quick cure is to label everything, although the MLSSA board should have been labeled at the factory.

Of course this is all minor and perhaps indicates that there is a lack of anything serious for me to complain about.

Most of us are not inspired by RCA jacks on our instrumentation, but not much else will fit on a XT/AT buss card (BNC?), although Ariel manages to fit miniature balanced XLR connectors on their card. Roughly a line level input is required, so an outboard mic preamp will be needed. B&K, Aco Pacific, Jensen, Larson Davis and others can provide this. As computers use switching power supplies, their insides are not a happy place for a high gain mic preamp; conversely, a mic preamp dangling from the side of your laptop by an umbilical cord is not the ideal solution. Additional thought to this is required, perhaps some sort of modified expansion chassis such as is available for the Toshiba 3200 (it fits under the case and becomes part of the portable). Both XLR connectors, mic preamp and power supply could be built in, along with the MLSSA card.

USER INTERFACE

The user interface aspect of the MLSSA is one of its most attractive features. Although the MLSSA is a sophisticated and powerful instrument, it is presently the easiest to learn and use. All commands are listed on the bottom of the screen. A hierarchical menu scheme is used and will be familiar to users of programs such as Word, Xtree and AcoustaCADD. Menu commands are executed at the top menu layer by typing the highlighted (and different color) letter of a menu selection. This action immediately presents you with

the next menu level selection. Pressing the highlighted letter of your selection at the new menu level continues on to the next level and this process continues until the final level (of obscurity) is reached. At the final menu level you may be prompted (depending on the particular command) to enter a filename, a number, or to select an option from a list. I found that the response required was not always obvious, but by pressing the F1 key the help screen would come up and generally explain what was expected. The help menu is contextual; that is, whatever operation you are doing will be reflected in the type of help offered by the system. The program provides a status line between measurement chart and the menu. At any menu level, short of the point at which the command is actually executed, you can abort the command and return to the top menu. This is more helpful than you can imagine, at least for the new user who is fumbling through the operation.

By comparison, the current software release of the Ariel only occasionally allows you to escape from half-witted moves. Another minor but appealing feature of the MLSSA software is the ability to get to the file directory without leaving the program by hitting the arrow key.

SET UP PARAMETERS

One of the most serious drawbacks to the TEF system is the level of expertise required for accurate setup of the instrument's parameters. The MLSSA setup parameters are somewhat more predictable. Additionally, the starting parameters can be automatically loaded when you start the program (or anytime later without leaving the program) by entering the appropriate setup file, for a loudspeaker, or a room. Once the program begins, any of these parameters may be modified, and if you desire, saved as a new setup file. Any number of setup files can be created, such as for testing tweeters, electronic reverbs, halls, or whatever. The Ariel Sys-II) presently allows only one setup configuration (additional setup files could be saved in other sub-directories and swapped with the existing setup file when needed, but this is not as simple as MLSSA system).

GRAPHICS MANIPULATION AND SPEED OF OPERATION

The MLSSA is a high resolution analyzer, not only in the way it measures, but also in its graphics presentation. In the

VGA mode on a 14-inch color monitor, visually it is matched by few computer based systems or conventional analyzers.

The small monochrome display on the TEF is just not comparable to VGA color graphics. The Ariel's graphics are comparable to the MLSSA, and the optional Hyperception Workstation software (that runs on the Ariel board) actually makes better use of color to aid visualization in the 3-D spectrogram mode than the MLSSA and Ariel's Sys-ID, but that is another review. The 3-D display on the MLSSA is excellent, with many usable options. Speed of the MLSSA 3-D display, when used on a slow 286, is a bit less than a TEF 12+, but a 386 MLSSA or even a fast 286 smokes the TEF. We will discuss the actual data acquisition times for the different systems next month.

The ability to examine any part of a waveform or segment of a response curve is excellent. By using the marker and cursor, the segment to be examined can be stretched to fill the screen, or the entire waveform can be compressed to fit into the display window. The vertical axis can also be expanded. Both axes can also be compressed, and you can scroll left or right or up and down. The cursor is available in the 3-D mode, which is a unique feature. The autoscale feature will give you the greatest resolution or you can set the scale yourself. Aside from getting more accurate results, autoscaling makes testing unknown systems less tedious. The defaults provide you with the best starting point settings. Amplitude range can be 80 dB+ or less than a few dB, depending on what you are looking for. When looking at the frequency spectrum, the zoom and unzoom features are still available. The power to see every thing you wanted to know (and more!) can be fascinating.

Next month we will look at a few applications for the MLSSA, including quality control/proof of performance of equipment before it leaves the shop, lab evaluation of compression drivers, and bass reflex alignment tuning. We will also briefly discuss your choices of the math coprocessor integrated circuit, required by the MLSSA (and Ariel and many other engineering software programs). The last part of the review will focus on field applications of the MLSSA system including room acoustics (RT60 and RASTI), setting electronic crossovers and equalizers, and time alignment of clusters between clusters and distributed speakers. ■

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