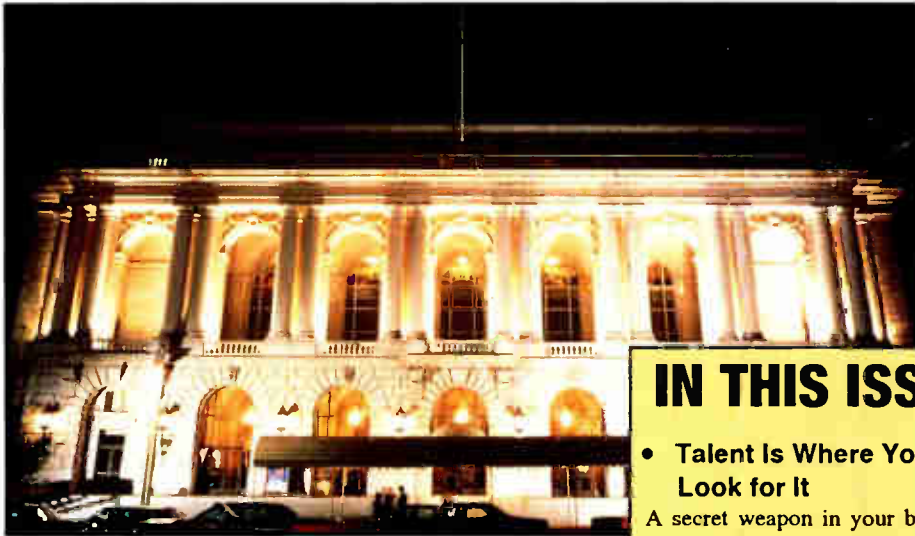


SOUND COMMUNICATIONS

Volume 38 Number 9

September 30, 1992

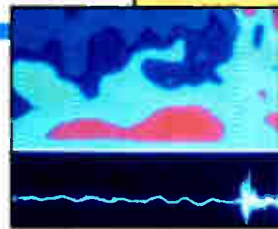


THE SAN FRANCISCO OPERA HOUSE

Roger Gans mixes physics with music as he designs the sound to make Puccini proud. Digital sampling, MIDI transmission and SIM equipment all play their parts. **44**

THEATER TRENDS

New installs and retrofits are keeping some contractors busy. How? And why? How does this market segment relate to riding the economy? Opinions from the field. **38**



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- **Talent Is Where You Look for It**

A secret weapon in your business? In a male dominated industry, women may offer new talent and new tactics to increase profits. A contractor reports. **32**

- **Consultants' Spotlight**

Craig Janssen arrived in the U.S. seven years ago. Today his work at Acoustic Dimensions includes designing quality systems within budgetary limitations. **14**

- **Test Gear**

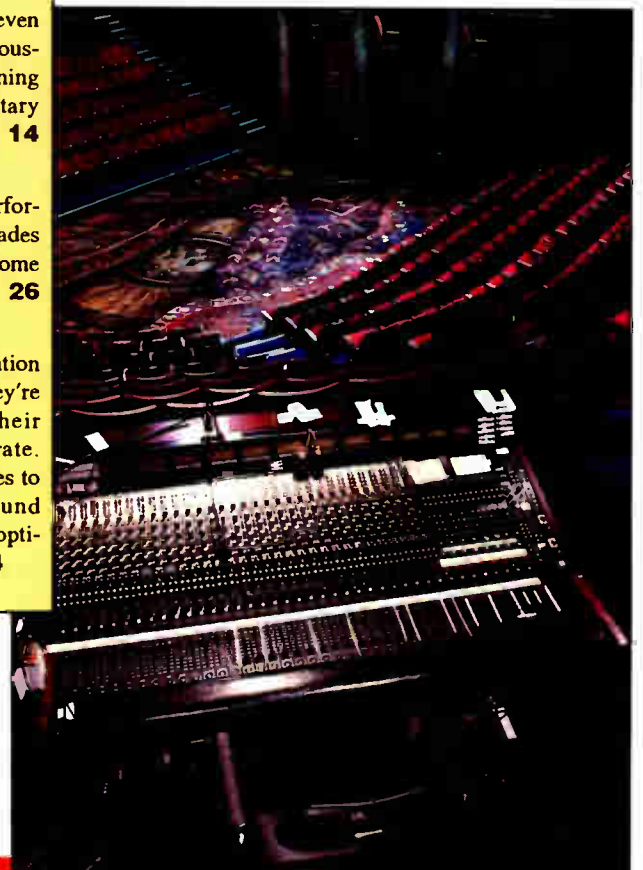
An informal overview of high performance acoustic analyzers. Upgrades from the heavy hitters — and some new guys on the block. **26**

- **Sound Quality, Part 4**

American corporations pay attention to sound quality — when they're shown what their products generate. From heart valves to intereoms, sound quality can be optimized. **64**

TOLSTOY ON BROADWAY

Broadway sound designers Bernard Fox and Gene Perla were enlisted to provide the sound for a new musical adaptation of Anna Karenina. The theater-in-the-round setup and an orchestra pit that didn't allow the percussionist a view of the conductor made Tolstoy's masterpiece a logistical challenge for the veteran sound team. **56**



2-input, 3-output multiway tap digital delay line with 16-bit Delta-Sigma A/D converter and a 48 kHz sample rate.

Sound Simple? It is!

*Introducing the IDL™ 1000
Digital Delay Line Processor From
Peavey*

Don't let the technicalities scare you. This sophisticated piece of equipment is designed to eradicate the old nemesis of sound architects —



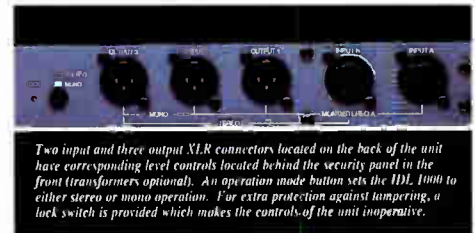
A sliding security door is provided on the front panel to prevent tampering with input and output level controls.

time alignment of multi-speaker sound systems.

The IDL™ 1000 digital delay processor from Peavey Architectural Acoustics will make the task simple and accurate. With over 1.3 seconds of delay (over .25 of a mile), the IDL 1000 can align multiple speaker systems in churches and auditoriums, to even the largest permanent installations such as arenas and stadiums. Within an array, individual drivers can be aligned in 20.8 microsecond increments. If needed, a second delay line can be formed that dynamically shares the switching to stereo "B" and output 3.

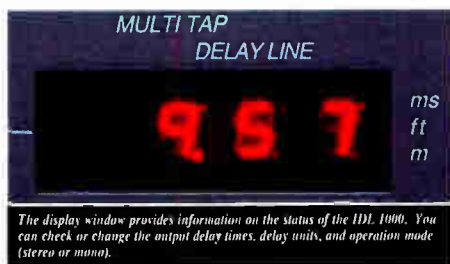
distortion low as well as to maintain a full 20 kHz bandwidth. Both the inputs and outputs are electronically balanced and use XLR connectors. Transformers for the inputs and outputs are optional.

To further speed setting the delays, the display can be set in units of milliseconds, feet, or meters. The IDL 1000 has a mute button for each output which can also be programmed to compare the current delay settings to a zero delay. The IDL 1000 utilizes a 16-bit Delta-Sigma A/D converter and a 48 kHz sample rate to keep the noise and



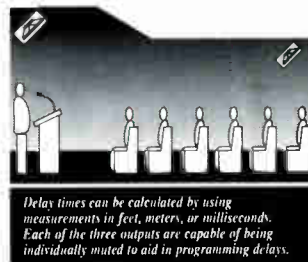
Two input and three output XLR connectors located on the back of the unit have corresponding level controls located behind the security panel in the front (transformers optional). An operation mode button sets the IDL 1000 to either stereo or mono operation. For extra protection against tampering, a lock switch is provided which makes the controls of the unit inoperative.

The IDL 1000 — simply brilliant.



The display window provides information on the status of the IDL 1000. You can check or change the output delay times, delay units, and operation mode (stereo or mono).

Setting the IDL 1000 is a breeze with its 4-digit LED display and its variable rate increment and decrement buttons.



Delay times can be calculated by using measurements in feet, meters, or milliseconds. Each of the three outputs are capable of being individually muted to aid in programming delays.



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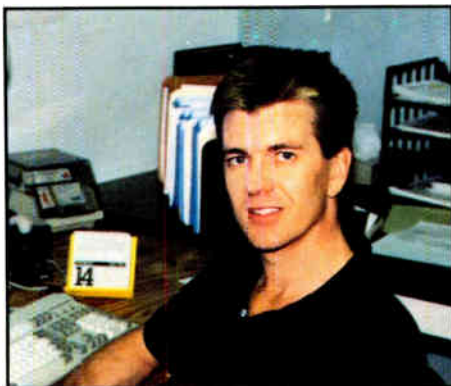
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By Mike Klasco

A reexamination and update of the various analyzers reviewed in these pages including MLSSA, SYSid, analyzers from Audio Control, Sound Technology and Techron's TEF.

HEALTHY THEATERS

By Maria M. Conforti

In a recession, it's nice to know that at least one market segment is not shrinking. This small but healthy market, according to contractors we surveyed, might actually be growing.

THE SAN FRANCISCO OPERA HOUSE

By Pamela Michael

Ingenuity, patience, and skill are requirements for Roger Gans, sound designer for the depression-era opera venue; a theater that combines a 19th century music form with 20th century technology.

BROADWAY SOUND DESIGN

By Jeff Ader

The new Broadway production of Anna Karenina had potentially serious logistical challenges that had to be overcome by the sound design team of Fox and Perla.

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BOOK REVIEW: THE LOUDSPEAKER DESIGN COOKBOOK

By Mike Klasco



Introducing The Shure SM102. Now The Choice Is Black And White.

The new Shure Microflex™ SM102 makes the job of choosing a miniature condenser microphone an effortless one.

With its flexible, 6-inch gooseneck, the SM102 is easy to set up and aim. And its high sensitivity and smooth frequency response assure a clear and natural sound.

Compare directional characteristics. You'll find the SM102's cardioid polar pattern exceptionally uniform throughout its frequency range, which accounts for its outstanding background noise and feedback rejection. What's more, it has the lowest self-noise in its class, so you pick up distant voices down to a near-whisper

and assure the intelligibility of every word.

And with a choice of in-line or wall plate preamps, both with switchable gain, the SM102 gives you the unmatched flexibility to hang it any way, anywhere.

In fact, the toughest decision you need to make is black or white. Take your pick.

The SM102 is a proud member of the new Shure Microflex family of miniature condenser microphones. For more information on the **SHURE®** *microflex™* Shure Microflex products, call 1-800-25-SHURE. The Sound of the Professionals ... Worldwide.

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NEW QUAM BAFFLES BAFFLE VANDALS

These new Quam baffles frustrate vandals while they build and protect your profits. Because they protect your loudspeaker installations, you can use them effectively in prisons, subway stations, stadiums, parks — anywhere there's a good chance of bad behavior.

The security secret of these new vandal-proof baffles is the potent combination of high tensile strength 14 ga. carbon steel, plus a durable interior steel screen to give the speaker further protection, and security socket screws for mounting. The white powdered epoxy finish is virtually chip-proof and scratch-proof.

Round and square baffles are available with recessed speaker enclosures to fit all popular 8" loudspeakers. Full details are in Quam Tech Spec TS-44. You've been asking for baffles like these; now ask for your free copy of the literature.

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WorldRadioHistory

NEWSLETTER

CCTV SEMINARS IN NOVEMBER

The Closed Circuit Television Manufacturers Association division of the Electronic Industries Association will sponsor its first CCTV Educational Seminars November 9 through 11 at Le Pavillon Hotel in New Orleans. Two concurrent sessions are planned. One session addresses the end-user's need for base level knowledge of closed circuit video systems. The other focuses on bringing the dealer/designer up to date with recent equipment upgrades and system design changes.

Presentations will include the following topics: System Integration; Time Lapse/Event Recording; Signal Transmission Techniques; Switching; Multiplexing; Housings/Domes; Pan/Tilt Controllers; Cameras; Lenses; Lighting; Coaxial Cable. Registration for the seminars is through the CCTMA at EIA headquarters, 2001 Pennsylvania Avenue, N.W., Washington D.C. 20006. Those registering before October 16 will receive a \$50 discount on the registration fee (\$250 versus \$300).

RECOTON TO ACQUIRE AMBICO

Recoton Corporation has signed a "nonbinding letter of intent" to acquire Ambico, Inc., the manufacturer of camcorder and video accessories. The acquisition is subject to negotiation of a "definitive purchase agreement" and Board approval by both Recoton and Ambico as well as Ambico's sole shareholder, Stephen Bender.

SUIT DECIDED

A five-year-old lawsuit has been decided in a German court in favor of Aphex, which sued Behringer shortly after its formation, claiming patent infringement. None of the products falling under the lawsuit are currently in the Behringer product line, according to Scott Goodman of Samson Technologies, the U.S. distributor of Behringer.

The Sixth Chamber of the Frankfurt Provincial Court reportedly found that all "past and current versions" of the Behringer "exciters" infringe on German patent number 2711083 covering the Aphex Aural Exciter. The suit was brought by Aphex Systems Ltd. and AKG of Germany, Aphex's German distributor. AKG Manager Heiner Groepke, in commenting on the decision, said, "We are very pleased with the results. We hope that the judgment will make all those merchants who supported proprietary rights feel confirmed in their beliefs."

Behringer, a German manufacturer of signal processing equipment, was founded and is headed by Ulrich Behringer, a 30-year-old German-Swiss musician who began designing hardware for his own purposes while working his way through school. Samson became the U.S. distributor last year.

ERA LOCATOR PUBLISHED

The Electronics Representatives Association has published its 1992/93 edition of the Locator, the international directory of manufacturers' representatives in the electronics industry. The 1,800 member firms of ERA (which now sell in excess of \$40 billion annually in electronic products for over 8,000 manufacturers) are listed in the directory according to their geographic chapters.

ALAMO DOME INSTALL BEGINS

The Alamo Dome stadium currently under construction in San Antonio will have an audio system installed by Proshow U.S.A. According to Crown International, the stadium will have a Crown IQ System 2000 controlling the audio system. Bruce Main, executive vice president of Proshow, said several Crown SMX-6 intelligent multiplexers will also be used for several of the conference areas throughout the stadium.

GROUP ONE DISTRIBUTES AVX

Group One Ltd. has been chosen as the exclusive U.S. representative of AVX Systems. AVX's amplified hearing systems are centered around induction loop technology. Four products have been introduced: three induction loop current drivers and the "Integrator 5," which allows up to five loop systems to be combined into one coherent system.

NEWSLETTER

NEW PRICING STRUCTURE AND WARRANTY FROM TOA

TOA Electronics has instituted new pricing policies for its Engineered Sound products, along with a new five-year warranty plan. The pricing structure includes a substitution program which awards contractors special price breaks when TOA products are substituted for other manufacturer's products included within a specification. Special design/build pricing is offered to contractors involved in "situations where plans and proposal development are required on a negotiated project." A third pricing program gives "substantial discounts . . . to contractors preparing specifications published for bids." And Engineered Sound dealers are now offered a discount on all TOA commercial products incorporated into design/build or contractor specified projects.

Support programs outside the new pricing structure include system design support, performance bond support, TEF support, a product evaluation program, and a sample program.

JBL PRO FAX SYSTEM

JBL Professional has announced the implementation of "Flash Fax technology." Using the system, anyone with access to a fax machine can receive JBL Professional product, pricing or technical information via fax by using their touch tone telephone. The information is then sent to the fax machine of the caller's choice. To access flash fax, the inquirer dials 818-895-8190; a voice menu directs the caller through the processor. Once the request is keyed in from the phone, the information is sent "within minutes."

PELTON MARSH KINSELLA MERGES

Pelton Marsh Kinsella, Inc. has merged its operations with those of Carter & Burgess's Event Facility Design Group. Carter & Burgess, the Fort Worth, Texas based engineering firm, has additional offices in Dallas, Austin, Houston, Arlington, Midland, and Fort Myers, Florida. Pelton Marsh Kinsella will continue to operate under its own name from offices in Dallas. With the merger, PMK has a staff of 16 professionals, including five registered professional engineers. PMK's more visible recent projects include the Fiesta Texas Show park in San Antonio, which opened in May, and design of sound systems, acoustics and rigging for the new Penn State University Convocation/Events Center. PMK provides acoustics, electro-acoustics, and audio/visual/video services. The Event Facility Design Group (formerly Variable Acoustics Corporation) provides theater consulting services.

INTERNATIONAL DJ EXPO IN NOVEMBER

The International DJ Expo, to be held November 9 through 12 at the Sheraton Chicago, will include over 20 panels and workshops. "Dance Club Design Trends" will include club owners, designers and DJ's discussing the "nightclub of the '90's."

PATENT AWARDED

Noise Cancellation Technologies, Inc. has announced that it has been awarded a patent for its in-wire selective cancellation system, which "reduces noise and interference in a variety of communications and electronics applications." According to the company, the technology covered by the patent can be used in applications including voice/telephone, music, facsimile and modem data transmissions. Two sets of electronics signals are fed into the in-wire system. The first is the desired or primary signal along with the undesirable noise. The second is a reference signal, developed by the system, and a timing signal generator which together cancel the noise.

IMA AND NAB JOIN FOR CONFERENCE

The Interactive Multimedia Association and the National Association of Broadcasters have announced that they have formed a partnership to conduct the NAB MultiMedia World Conference and exhibition in Las Vegas April 19-22, 1993. IMA Managing Director Philip V.W. Dodds will chair the NAB MultiMedia World Executive Committee, which will develop the conference program. NAB MultiMedia World: Merging Video, Audio and Computers will be held each year in conjunction with and on the same dates as the NAB Convention. The 1993 NAB convention is expected to attract more than 54,000 professionals from more than 60 countries.

WHEN IT CAME TO BEHRINGER WE LET THE EXPERTS MAKE THE NOISE.

Leading experts in recording, film post-production and live sound are discovering the many advantages of the Behringer 2-channel and 8-channel DeNoisers. They know Behringer takes the noise out of the dirtiest signal path without altering the audio quality. Their reactions show why Behringer is now the most talked about name in professional audio circles.

"Simply lovely. Smiles all around. Room agreement was unanimous: We want this thing on all our tracks." **Mike Joseph—Editor REP, March 1992**

"I have used similar 'single-ended' devices on the mixes of 'Ghost' and 'Godfather III' and found the Behringer Mark III to be superior in every category—from ease of operation to final result.

"Consequently, I am—without hesitation—recommending to LucasArts/Skywalker Sound that they buy at least four channels of Behringer Mark III DeNoising for each mixing console here and in Los Angeles; a total of twelve mixing rooms."

Walter Murch—Film Editor and Music Mixer, LucasArts/Skywalker Sound

"If the phrase *noise floor* is in your vocabulary and you would prefer that it was not, get a Behringer single ended noise reduction unit to the top of your *got to have one* list." **Robert Scovill—Sound Engineer/Mixer, Rush/Def Leppard**

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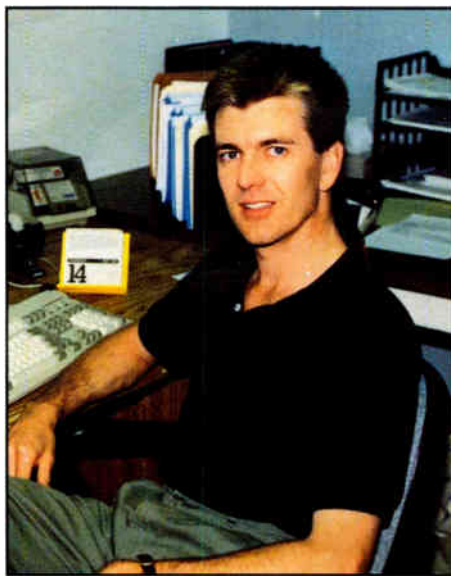
WORKING WITHIN THE BUDGET: CRAIG JANSSEN OF ACOUSTIC DIMENSIONS

By Gregory DeTogne

Craig Janssen has contributed his talents to a variety of top installations in the U.S. and overseas since his arrival in this country seven years ago.

Having migrated to the States following stops at many points on the map, beginning with Zambia, the place of his birth, Janssen now calls Dallas his home. The Lone Star State first became his official residence when he was with the Joiner-Rose Group. Today, he manages the Dallas design and consulting firm Acoustic Dimensions, along with partners Vance Breshears and David Kahn.

Among his better-known achievements, Janssen has penned designs for the UK's Sheffield Arena and the Anaheim Stadium. And while these sizable venues serve as larger-than-life showcases for his talents, he is also widely known for his work in houses of worship, where budgets are often tight, yet system demands are high. When *Sound & Communications* caught up with him recently, we asked him about sanctuary sound and how churches can obtain the best bang for their buck. Not being the type who is short on words, he offered up ideas based upon his experiences, and used an installation he did at the First Baptist Church, West Monroe in



Craig Janssen.

Monroe, Louisiana to illustrate his points. By definition, the West Monroe job was one where he found himself in need of a full concert-level three-way system, but only had the cash for a two-way. An overview of the installation and how he resolved the dilemma is detailed in the text that follows.

Sound & Communications: From an acoustical standpoint, what is the environment like at the First Baptist Church, West Monroe?

Janssen: The sanctuary provides a pretty reasonable acoustical environment, actually. It seats around 1,000 people, and is fairly narrow, so it has some nice sidewall reflections which work well. I don't have the figures in front of me, but a good educated guess would put the RT-60 between one and two seconds. If I had to find a flaw with the environment, one thing that

can be said is that the place tends to be slightly dead because the floor is carpeted.

Sound & Communications: How did the project evolve?

Janssen: It all began one day when the previous system dropped dead in the middle of a service. Fortunately, a portable system was at hand, so it was rolled out and put to work until the church could find someone capable of dealing with the problem. I was called in while I was still with Joiner-Rose. After reviewing the situation, I made some comments and offered some options. Ultimately, what it came down to was that they didn't have a lot of money, yet they wanted a quality system. As a result, they decided to build the new system in a series of phases, the first of which was done under the Joiner-Rose

**THE TROUBLE WAS
THAT THERE WAS NO
WAY THEY COULD
AFFORD THE
PURCHASE PRICE OF
A FULL-SCALE,
THREE-WAY SYSTEM.**

umbrella. The system was further refined under the direction of Acoustic Dimensions, and while most of it is complete at this point, there still are a few additions which will be made.

Sound & Communications: Baptist churches aren't known for being a place where solemn, staid services are held. What kind of sound reinforcement needs were addressed in this

Gregory DeTogne is a freelance writer and publicist whose clients include Community and TOA.



Interior of the First Baptist Church of Monroe, Louisiana.

application?

Janssen: They wanted a strong music system with a clear and crisp sound. The trouble was that there was no way they could afford the purchase price of a full-scale, three-way system with subwoofers

that would supply substantial low-end and midrange. And due to space considerations, I really didn't want to use large format horns anyway. What they really had was the budget for a two-way system, but I'm no fan of two-way systems in

these types of situations either. Fortunately, Community's RS220 had just hit the market, and I was in the process of evaluating it for use at the Sheffield Arena. After playing around with the compact box for a while, I came to the point that I was pleased with it, and felt that it offered the best bang for the buck in its price range.

Sound & Communications: With the loudspeaker components selected, what did the initial design call for?

Janssen: My design originally started out with two clusters: a central one and another delayed one at the rear of the sanctuary. Once again, due to budgetary constraints, the central one was to be installed first and the delayed one would be assembled as the money became available. After installing the central cluster, however, it was decided that an addi-

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ATTENDING THE AES TEST AND MEASUREMENT CONFERENCE

By Mary C. Gruszka

Portland, Oregon, during the height of its annual Rose Festival activities, was the beautiful setting for the AES's first Test and Measurement conference in May.

About 160 registrants, papers presenters, and organizing committee members enjoyed the Portland sun, scenery, and Rose Festival Waterfront Park activities along the Willamette River just across the street from the hotel. Inside, they were exposed to a group of papers that indicated just how diverse the field of tests and measurements is.

Why test and measurements? "It's a topic that always gets a moderate amount of interest at conventions," notes Richard Cabot, convention chairman, and Vice President and Principal Engineer at Audio Precision. "We find the papers sessions are usually reasonably well attended. We've seen a lot of new advances in measurements lately, like multi-tone techniques. And there's new equipment, like low-bit rate coders, that require radically different measurements, so there's been a lot of discussion of techniques on how to measure them."

The conference was divided into five main topics: Electronic Measurements (chaired by Bruce Hofer, Audio Precision); Electronic Measurements Workshop (Cal Perkins, Harman Electronics); Digital Measurements (Stanley Lipshitz, University of Waterloo); Sub-



Richard Cabot, convention chairman, and Vice President and Principal Engineer at Audio Precision (left) and AES President Roger Furness.

jectively Relevant Objective Assessment, Parts I and II (Louis Fielder, Dolby Laboratories); and Acoustical Measurements, Parts I and II (Vance Dickason, Voice Coil). Thirty-two papers were presented.

"This conference was unique as far as the AES is concerned in that it's the first one to have a combination of invited and contributed papers," Cabot says.

Papers covered a wide range of measurements and applications. Here are highlights of some of them.

ACOUSTICAL MEASUREMENTS

James Lee (Portland State University) presented a very understandable overview of the Wigner distribution in his paper "The Wigner Distribution: Sound Fields in Time, Frequency, and Space."

"The Wigner distribution is a method for representing the time and frequency domains as a single graph," Lee writes in his paper. It is especially useful in "analyzing spatially distributed signals and systems" and representing sound fields such as those found in concert halls.

Lee pointed out that Sabine's assumption of a uniform energy density in an acoustic space is usually not found in reality, and that the single number reverberation time does not adequately characterize an acoustic space. The Wigner distribution, however, gives some way of describing a non-uniform energy density field.

Lee demonstrated this with graphs produced by Yoshio Yamasaki of Japan. He compared a classical 19th century concert hall, with its rich diffuse sound field, with a modern hall which had a series of specular reflections as its sound field.

"For the first time we have incontrovertible quantitative experimental evidence that diffuse fields are structured in a fundamentally different way than fields generated by multiple specular reflections in succession," he writes. (Lee said during the question and answer session that he was not familiar with TEF measurements of concert halls.)

This has ramifications for sound system and concert hall designers. "There are several computer programs that purport to model the response of auditoriums to large 'cluster' loudspeaker systems. Without exception these programs compute the distribution of reflections by means of 'ray-tracing,' that is, by assuming trains of multiple specular reflections and computing the resulting energy at stations of interest. The audio engineer... should be aware that the

Mary Gruszka is a freelance writer from Edgewater, New Jersey.

design assumptions that are reflected in his model are fundamentally erroneous.”

TEF measurement techniques applied to automated loudspeaker testing were described by Donald Schwing (Techron) in the paper “Loudspeaker Production Testing Using the Techron TEF System 20 TDS Analyzer and Host PC,” co-authored by Don Keele (DBK Associates and Consultant to Techron).

The system allows an engineer to define a number of tests and test sequences that will be performed by an often lower skilled operator on a loudspeaker production line. Measurements include time (ETC), frequency (TDS), harmonic tracking, impedance, phase, FFT spectrum, harmonic distortion, THD and THD+N.

Pass-fail limits can be entered. These limits can be determined in four different ways: manual entry, measurement

of a standard, batch statistics, and re-running batch measurement data in mock production runs.

Comparison tests between the rejection rates of the computer-based system

THE AUTOMATED SYSTEM WAS MORE CONSISTENT AND ACCURATE.

and actual human testers showed that the automated system was more consistent and accurate in finding failures.

Impulse response measurements were discussed in a number of papers.

Paul Kovitz (Pennsylvania State University) described “Two Maximal Length Sequence Devices for Measuring Room Acoustics Parameters.” He noted that

the measurement conditions must be “stationary over the measurement period,” and that careful choice of the sequence length is necessary, and that averaging is needed to improve the signal-to-noise of the measurement.

David Griesinger (Lexicon, Inc.) also recognized the problem that most acoustic measurement situations are not stationary and stable over time. He described “Impulse Response Measurements Using All-Pass Deconvolution,” which he says overcomes this problem.

In this system, the stimulus is pulse or a click that has been passed through a series of all-pass filters, and then reversed in time. Griesinger used the Ariel 32C board with a DAT recorder and also a Lexicon 480 to produce the stimulus.

The stimulus is played into the room under measurement and the response is



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*Patent pending

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recorded on another DAT player. "The hall data on the DAT is played back into the 480 and deconvolved in real time," Griesinger writes. The advantages to this technique is that the stimulus can be any length, according to Griesinger, so the stability of the room is not a factor.

A Macintosh computer program optimized for obtaining impulse response measurements of rooms and scale models was described by J. Polack (Technical University of Denmark) and others in their paper "The Midas System for All Scale Room Acoustics Measurements."

This measurement system can operate with different types of sources, such as a spark or pseudo-random noise, as the stimulus. The result is the impulse response of the room under test. Processing the impulse response results in the reverberation time, energy ratios, center

time, amplification, lateral energy, speech transmission index, and signal to noise.

The program uses a numerical compensation for air absorption allowing models to be used in ambient air, instead of being filled with nitrogen or other gases. However, according to the authors, "the technique adopted in MIDAS for compensating for air attenuation does not allow a reconstruction of pressure impulse responses, but only of echograms. As a consequence, auralization. . . is not yet possible. Research is presently being undertaken in that direction."

John Meyer (Meyer Sound Laboratories, Inc.) in his paper, "Precision Transfer Function Measurements Using Program Material as the Excitation Signal," described algorithms that obtain the response of a system by using program

material as the excitation source.

"The primary advantage of source-independent measurement is that it is the only known technique which is unobtrusive and can provide acoustical characterizations in the presence of an audience," Meyer writes. "When implemented using standard FFT instruments, however, significant errors are encountered due to the characteristics of typical program material signals and noise contamination."

The algorithms, signal thresholding, coherence blanking, constant-Q transforms, and vector/smart averaging eliminate or reduce of a number of these problems, according to Meyer.

The importance of making binaural measurements was noted by David Griesinger in the paper mentioned above and in another paper he presented, "Measures of Spatial Impression and Reverberance Based on the Physiology of Human Hearing."

Mahlon Burkhard (Sonic Perceptions) demonstrated this quite dramatically in his paper "Merging Subjective and Objective Acoustical Measurements," co-authored with Klaus Genuit (HEAD Acoustics).

He writes: "A human listener receives information simultaneously through two ears thus enabling interpretation of spatially complex sound events that a single measuring microphone misses. Thus an aurally-adequate sound measurement and analysis system needs to capture or record sound events binaurally as can be done with an artificial head measuring system and with an analysis system that has evaluation algorithms analogous to human hearing."

He described the BAS system which does just such an analysis, and showed color slides of measurement results.

DISTORTION MEASUREMENTS

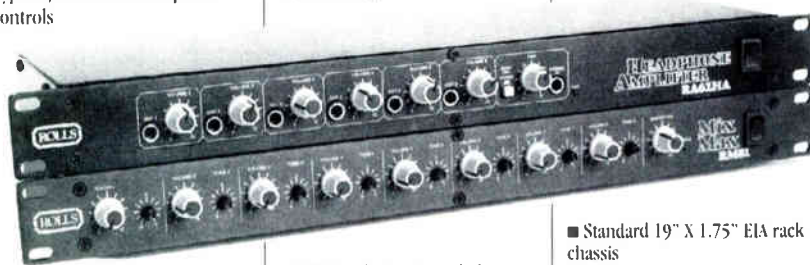
Distortion measurements of systems, electronics, or transducers give an indication of the types of non-linearities that are present. There are many different types of distortion measurements, and

THE INS & OUTS

ROLLS has 3 new rack units the RA62HA headphone amplifier, RM81 and RM83 mixers. The RA62RH will power 6 pairs of headphones with six 1/4" headphone outputs, 1/4" stereo input on the front, right and left 1/4" inputs on the rear, and 6 bypass jacks. The front panel controls

include 6 VOLUME, and 1 PAN controls, MONO/STEREO and power switches. The RM81 is an 8 ch mike/line mixer with phantom power. The controls include 8 VOLUME, 8 TONE and MASTER VOLUME controls. The RM83 is a basic stereo mixer with all 1/4" ins and outs.

The controls are 8 VOLUME and MASTER VOLUME. There is a channel muting feature for remote muting of any or all channels. The RCA jacks can bridge several RM81s or RM83s together. All this at a cost of \$200, \$290, and \$290.



RA62HA Features

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ROLLS RM81 MIXMAX Features

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- 8 1/4" jacks that can be jumpered to either line in or line outs
- Wide range tone controls on each channel

ROLLS RM83 MIXMAX 2 Features

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- Standard 19" X 1.75" EIA rack chassis
- 8 mute pins for remote muting of any or all channels



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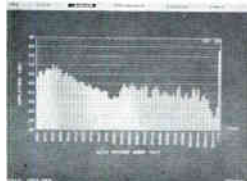
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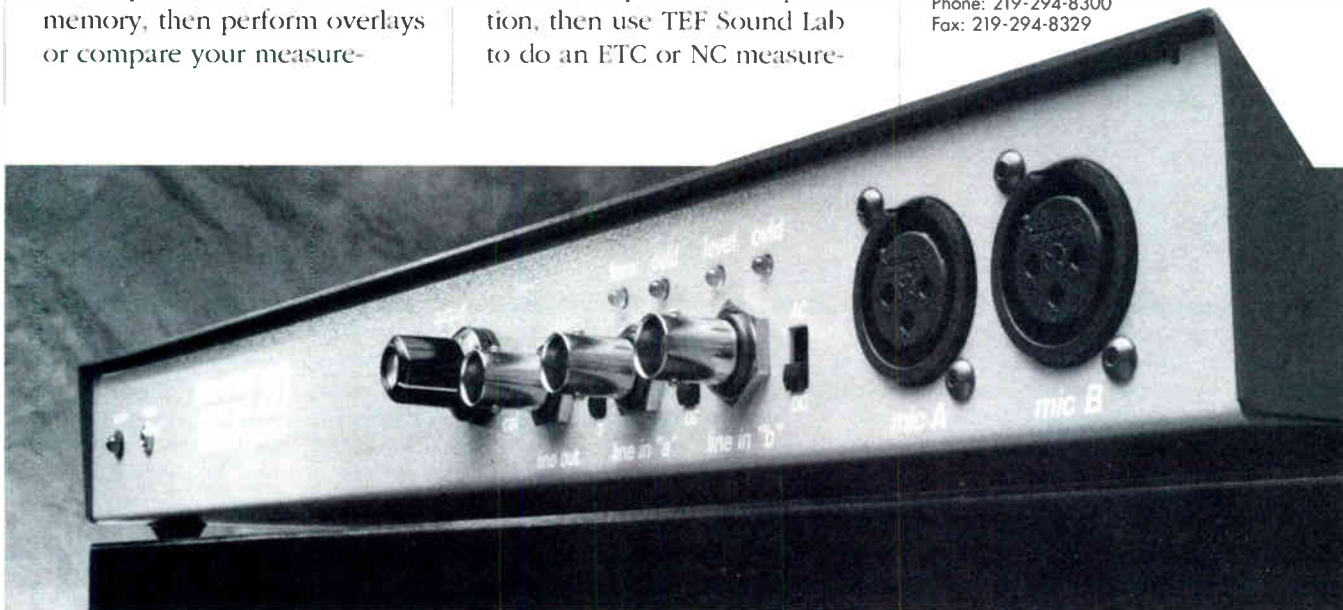
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World Radio History

each has an application.

Richard Cabot (Audio Precision, Inc.) in his paper "Comparison of Nonlinear Distortion Measurement Methods," gave a good tutorial on types of distortion, their causes, and different ways of measuring it.

Harmonic distortion uses a single frequency as the source signal. Any harmonics of that frequency measured at the output of the device under test is distortion. The measurement is commonly made by notching out the input frequency and measuring everything else that is left, which will include noise (hence the THD+N). A spectral analysis of just the harmonics eliminates the noise component.

One problem with harmonic distortion measurements is that the distortion products quickly fall out of the bandwidth of

the device under test as the frequency of the fundamental is increased.

The SMPTE Intermodulation test uses a 60 Hz and a 7 kHz signal summed

TWO DIFFERENT SETS OF BEAT FREQUENCIES CAN BE PRODUCED.

together. In the 4:1 mode, the low frequency is four times the amplitude as the high frequency tone. The sum and difference products around the higher frequencies are the distortion products that are measured.

The CCIF IM distortion test uses a pair of signals that are closely spaced apart, for example 14 kHz and 15 kHz. If the system under test is non-linear in

some way, two different sets of beat frequencies can be produced. One set, the lower frequency set, is the difference frequency and its harmonics (1 kHz, 2 kHz, etc.) are produced when even order or asymmetrical non-linearities are present. The second set surrounding the high frequency input signals (13 kHz, 16 kHz, 12 kHz, 17 kHz, etc.) is formed when odd order or symmetrical non-linearities are present.

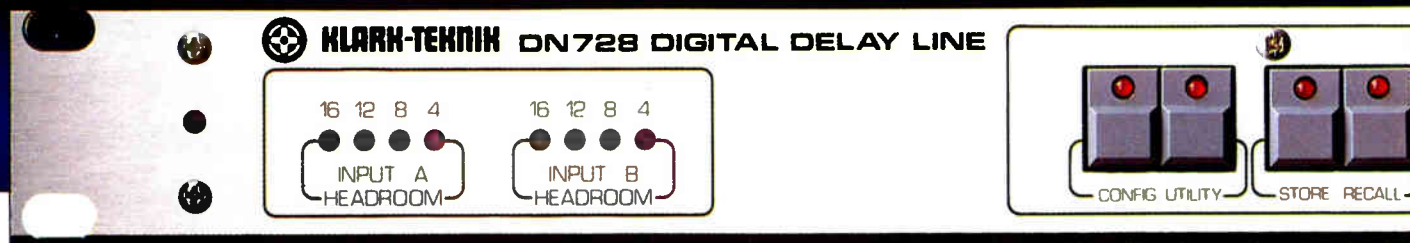
The FASTest total distortion measurement uses a sum of several sinewaves with user defined frequencies, phases, and amplitudes for the excitation signal. Distortion products that fall between the stimulus frequencies are measured and plotted.

Focusing on electronics, Cabot compared eight measures of distortion on five different distortion types.

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Using the two inputs and six outputs, you can

configure the DN728 precisely to suit the day's task. Choose 'Stereo' for three ganged stereo outputs. 'Dual' to define memory splits and assign each of six outputs to either input. Or 'Mono' for full memory allocation and all six outputs assigned to one input.

It's an easy choice with all options quickly set on the clear LCD display in time, distance or video

fields. In distance mode, there's even a temperature compensation facility.

What's more, you can save frequently used set-ups in 64 user memories – each storing the settings of every single parameter. And there's no need for security covers – a control lock-out system and password protection prevent unauthorised access.

He investigated output stage non-linearity, output stage asymmetry, crossover distortion, hard slew rate limiting, and input stage non-linearity with SMPTE 1:1 and 4:1, CCIF 2nd and 3rd, THD+N at 1 kHz and 20 kHz, DIM30 and FASTtest total distortion. He found that some measurements are more suited to revealing certain types of distortions better than others, but in many cases the different distortion measurements tracked each other.

Steve Temme (Briel and Kjaer Instruments) discussed some of these and other distortion measurements, in "Why and How to Measure Distortion in Electroacoustic Transducers." He advocated more use of two-tone measurements since the distortion products remain within the pass-band of the device under test. He also discussed an intermodulation mea-



Scene from the AES Test & Measurement Conference.

surement for transducers, transient distortion, and other distortion measurements that may have a limited use.

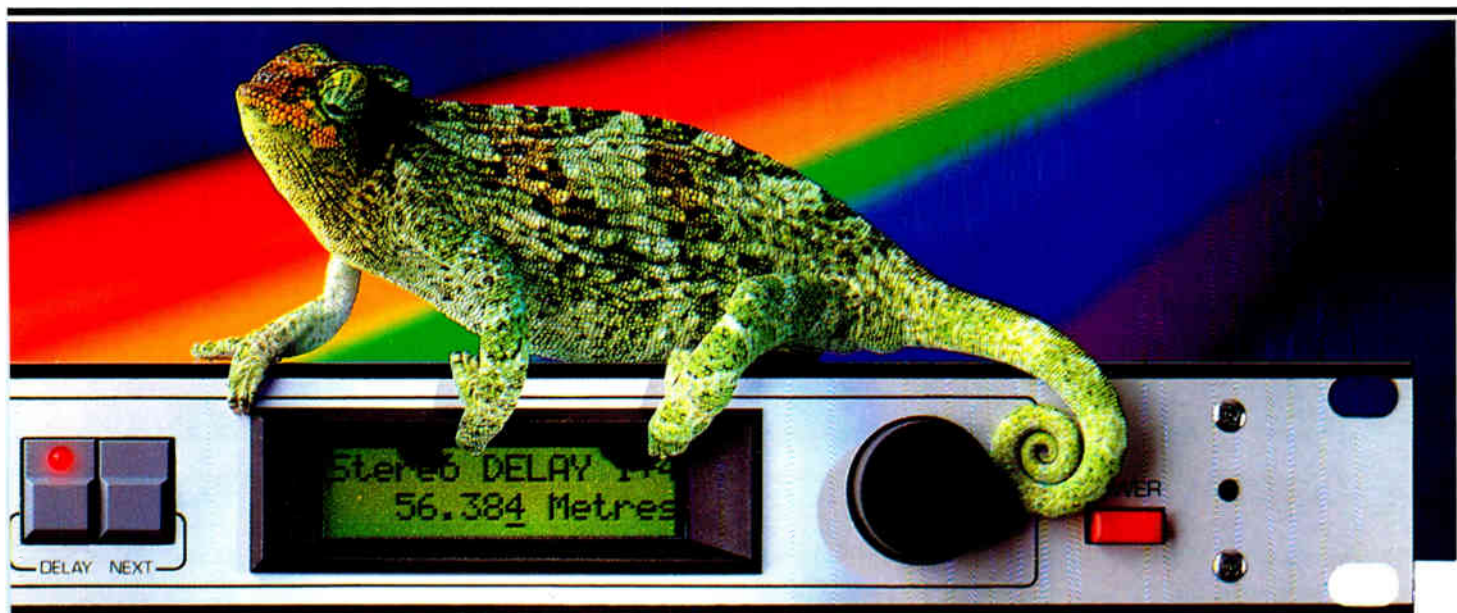
Temme described how these distortion measurements can be made on transducers without an anechoic chamber using the Time Selective Response (TSR) technique as employed in the Briel and Kjaer 2012 Audio Analyzer.

How well distortion can be measured depends upon the instrument used to perform the measurements. In "Test and Calibration Applications of Multitone Signals," Robert Metzler (Audio Precision, Inc.) described a method of calibrating distortion analyzers by using an instru-

ment (such as the Audio Precision System One) which can create a frequency spectrum that mimics distortion products, but with a known and accurate value.

In the process of testing out this technique on a number of different distortion analyzers, Metzler discovered certain problems that differentiated distortion analyzers.

Some auto-null analyzers "have accuracy problems when the distortion product is dominantly odd (especially third) harmonic," he writes. "The notch filter frequency tuning and nulling circuitry may be confused by any odd harmonic energy present, causing imperfect fun-



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damental rejection with consequent measurement errors which are usually phase-dependent.”

The type of filter used to notch the fundamental also affects the measurement result. A two-pole notch filter will not completely filter out the second order harmonic as well as, say, a four-pole filter.

“This insertion loss causes the analyzer to display a lower value of distortion than the true value when distortion is predominantly second harmonic. This second-harmonic attenuation is frequently the largest single error source in many distortion analyzers.”

The moral of the story: test the test equipment.

SYSTEMS

Cal Perkins (Harman Electronics) conducted a workshop titled “Measurement Techniques for Debugging Electronic Systems and their Interconnection.”

He chided manufacturers of electronic equipment for not considering how their products will be integrated into a total system (or in other words, connected to some other piece of gear).

“The point here is that the customer should be able to purchase a group of components, buy some cables, and plug it all together without having to worry about chassis ground lift straps, cutting cable shields, and exotic power distribution systems. The current state of the art demands that the user have more technical competence than the group that designed the equipment.”

He noted, as an example, that there is not a standard for grounding schemes inside a piece of equipment and that often the only way to know what kind of internal grounding system a manufacturer uses is to open the top and trace out the grounds with an ohmmeter.

“In some cases, only the PCB design draftsman knows exactly how the shielding and grounding is done. Because of the time pressures to release a product to market, the quickest approach that works on the bench is the one chosen for production, and the systems approach is

ignored or rationalized away,” he writes.

To help educate the user, Perkins discussed topics such as RFI detection and elimination, cabling, balanced and unbalanced inputs and outputs, common mode rejection for both input and output, grounding and shielding problems, AC power line distribution and distortions, problems caused by equipment power

supplies (especially switching ones), and load distribution problems (such those common to 70V distributed systems).

Perkins also demonstrated that connecting up a piece of test equipment to a device in order to diagnose a problem often causes additional, and often unsuspected, problems. Fortunately, he offered

(Continued on page 72)



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September 1992 25

Acoustic Analyzers

A Second Look at the High Performance Variety

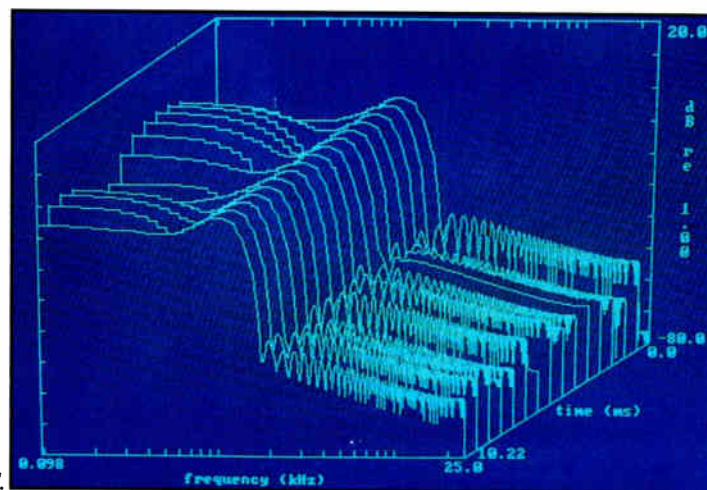
BY MIKE KLASCO

About three years ago I began our series of reviews of audio analyzers. The series included the sophisticated computer-based analyzers like the MLSSA and SYSid systems, the basic but competent Audio Control realtime analyzer, and recently I took a look at the Sound Technology RTA-4000 which is sort of a missing link between computer-based and standalone test gear.

Since I began reviewing test gear in these pages, DRA Labs has updated the MLSSA software from the 6.0 that I reviewed to release 8.0. Bell Labs/Ariel has made dramatic advances with SYSid since I reviewed 2.0. The current version 4.0 is a match for the competition and 5.0 will be released in time for the October AES. I never reviewed the earlier stand-alone TEF machines because, to be frank, I felt that the operation was too ambiguous and counter-intuitive for the bulk of our readers. The new computer-based TEF 20, along with TEF's new RTA (real-time analyzer) software, is intended to directly address this issue. When the TEF 20 was first introduced, the software was too premature for an in-depth review. Since the TEF 20 has been around for awhile, I think it is time for a close look.

Perhaps the most interesting development in acoustic analyzers is the LMS System from ATI. This is a computer-based analyzer that offers much of the performance of the MLSSA, SYSid, and TEF systems, but costs only \$1,200, in-

Mike Klasco is the Technical Editor of Sound & Communications magazine.



Ariel's SYSid.

cluding a calibrated mic and preamp!

LMS

Because the LMS is both simple to operate and cheap, it will be extremely appealing to sound contractors, so in an upcoming issue we will start our next series of reviews with the LMS system. Usually, after I write a preface to an article and refer to a future test, I get all sorts of calls and letters wanting to know the results from readers who don't want to or can't wait. So, if you want the bottom line on the LMS, my conclusion is that it is far more useful than a 1/3 octave realtime analyzer, but lacks the speed, freedom from rejection of extraneous noise, and analysis power of its more expensive competition, such as the SYSid, MLSSA and TEF systems. I should point out that I liked it enough to buy one for a friend.

I have already completed my preliminary testing of MLSSA 7.0 (the review

will be on 8.0) and SYSid 4.0 (the review will be on 5.0), so here is a quick look at what each analyzer currently offers.

MLSSA

The MLSSA system that was reviewed was a beta version of release 6.0. Since then, MLSSA has achieved great success, especially with speaker designers, and increasingly with the more sophisticated sound contractors. When I reviewed release 6.0 I found the operation intuitive and enjoyable. Aside from testing frequency response, time response, impedance and other speaker driver tests, MLSSA offered special features for sound contractors: RT-60, intelligibility and more. I have been working with release 7.0, which has been out for about a year, and software installation is even easier with many new features added, such as polar response, remote data acquisition by use of a DAT machine, and a type of pseudo

Intermodulation distortion test. Distortion analysis is not MLSSA's strong point because it is only a 12-bit system and its signal generator can only produce pseudo-random noise and impulses. MLSSA 8.0 will have just been released by the time you read this and new features include faster processing time, a longer time-base display for any given bandwidth, expanded file import and export facilities and quite a bit more.

Although MLSSA has been criticized as being inherently limited by not being dual channel nor having a DSP engine like the TEF 20 and SYSid, these limitations are actually not as "dead-end" as they seem. Actually, the hardware board

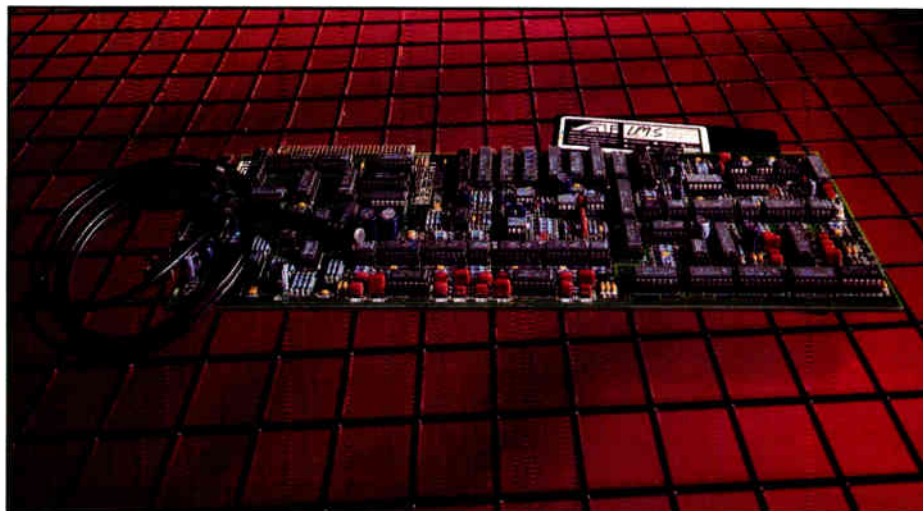
Actually, the hardware board that MLSSA uses is already dual channel.

that MLSSA uses is already dual channel, but for dual-channel operation the filter daughterboards would need to be replaced (they are presently cascaded to achieve the desired slope).

As to the lack of number crunching power, MLSSA depends on your computer's math coprocessor. The 486 RapidCAD CPU upgrade that Intel is offering for 486 computers is significantly faster than the 386/387 combination, and the 586 "P5" will be about five times as fast as the 486 (at least for the FFT type of computations that MLSSA requires). These new computers offer number crunching performance roughly comparable to the DSP engines used in other test systems. We will take a closer look at this as well as the other strengths and weaknesses of MLSSA 8.0.

SYSID

SYSid means *SYStem identification*, or total characterization of whatever is being tested. The potential of the SYSid



ATI's LMS system.

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September 1992 29

A SECRET WEAPON: WOMEN IN THE CONTRACTING BUSINESS

By Evelyn Reis Perry

At the NSCA Expo in Anaheim, a seminar organized by NSCA board member Miriam Evaslin of Pro Tec Electronics was targeted towards men but presented by women in the industry. The title of the presentation was “Women in the Marketplace.” Evelyn Reis Perry, president of Carolina Sound, was one of the speakers. We’ve asked and received Ms. Perry’s permission to print a transcript of her talk, which follows — Editor

I have heard that the reason Moses took 40 years to get the Israelites through the desert is that — even then — *men wouldn’t ask for directions.*

Wait a minute sir! Lock that door. This is not going to be a male bashing session.

As a matter of fact, I love men. Some of my best friends are men. Some of my employees are men. I’m married to a man. In fact, I have two men children.

But it seems to me that there was a reason that after God created man, he went back to the drawing board and

Evelyn Perry is the president of Carolina Sound.

made some additions and corrections. These changes didn’t necessarily make this second person better, just different.

And those differences may be the secret weapon that your business — Mr. Owner, or Mr. Manager — might use to double your sales, to manage the teamwork in your offices or to direct the technical division.

It is a well known fact that the very characteristics which have made women the leaders and successes in their communities, their churches, their volunteer work, and their families are the traits that make a service business thrive.

We are the nurturers — the builders of relationships, the caretakers, the listeners, the compromisers, the communicators.

Aren’t those the same traits that build the long term relationships with your customers and employees?

Aren’t they the same skills (problem solving, relations building, listening, communicating), that make for consultative selling instead of bulldozing?

Sometimes, the roadblocks for us are innocuous. I found, in starting our business, that the men I would call on — whether bank loan officers or customers — did fine in relating to and respecting me when there were just the two of us. But if I brought a man with me, whether my husband (who is VP of our company) or my technician, I would get a limp handshake, a patronizing look that could have been a pat on the head, and the rest of the conversation would be directed at the man in the room.

The fact that I was the CEO and GM didn’t really matter. It was uncomfortable to them; and the man with me was, for them, more of a “known quantity.”

It has taken eight years in the indus-

try, but those same men now call on me and they know who directs the day to day operation of our company. Their respect and their comfort level have been raised.

And here’s the key: Their business is the better for it. They have sold our company more product than they did before I was there. The bankers have made us solid loans which have been repaid. And they now have a different slant on both our and their business than they would have received from a male counterpart.

**OWNERSHIP
(SOMETHING MANY
OF YOU WILL
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LOOKED MORE AND
MORE ATTRACTIVE.**

Could you be making the same mistake? When you talk about the “girl” in your office, or your secretary? It is not the word “girl” that is offensive; it’s the fact that you can’t see past that word to the person and the package of talent she brings to you.

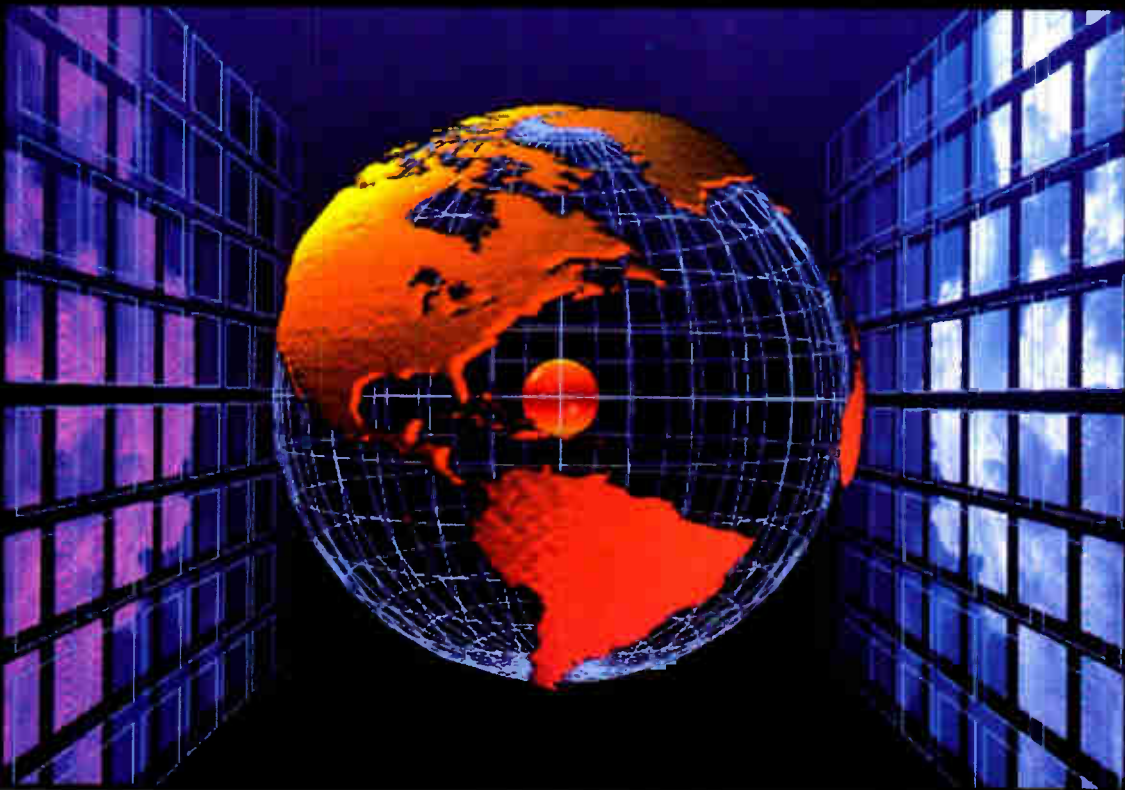
Could you not be seeing past what she *has been* doing for years to what she *could be* doing for your company?

Is it possible, gentlemen, that in your office there is a woman who could apply all of those skills she has used to keep your office — or you — running, and apply that to sales or to management, or to installation! And make you rich!

Let me share with you how I got into the sound, video and Muzak business, because I think it is relevant.

I had been in management for government and private non-profit corporations

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WorldRadioHistory

lieve that women leaders are better at sharing power and information. Their egos don't get in the way as much. This sharing tends to create more loyalty and less criticism during a crisis.

This and other studies do not necessarily suggest that women leaders are more or less effective than males, only that there are strong

differences in style.

Georgette Mosbacher, former Chairman and CEO of her own cosmetic company, has said: "Women realize that the playing field is not even and that women have more obstacles to overcome than men do." But successful women find it more productive to concentrate on overcoming the obstacles,

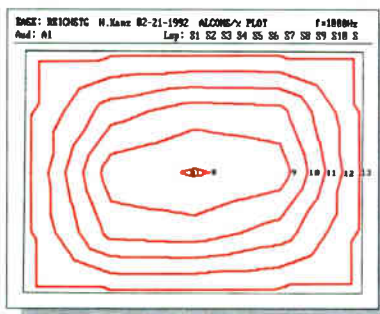
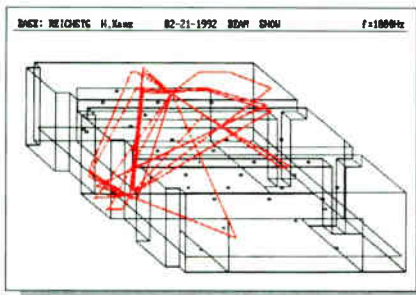
not whining about them.

And I suggest to you that successful men can see past old standards and discover a new secret weapon for the future of their business. The successful women that I know do not find themselves at war with men. And the successful men recognize that giving women the opportunity to shine can only be of

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SUCCESSFUL WOMEN FIND IT MORE PRODUCTIVE TO CONCENTRATE ON OVERCOMING THE OBSTACLES, NOT WHINING ABOUT THEM.

benefit to both. Women I have seen in non-traditional jobs have in common great energy and enthusiasm for the choices they are making for their lives.

By the year 2000, women will own more than half of all small businesses in this country. These women face incredible challenges, but their achievements lie in circumventing personal roadblocks

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and finding their way to the other side — without succumbing to the victim mentality.

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Theaters and Auditoriums

Flexibility Makes for Good Business

BY MARIA M. CONFORTI

All the world's a stage, but it takes a smart contractor to maintain status as a major player in the theater and auditorium market. Opinions vary over whether or not the market is growing, but Sound and Communications' contacts expressed a belief that it is not shrinking.

"I think that market's pretty good, because a lot of it is on budgets that were settled a while ago, and they don't ride the economy quite as much as an individual's purchases," states Ivan Schwartz, concert sound marketing manager for Electro-Voice. "For example, there may have been a theater that four years ago said, 'In two years we will start a renovation project; in three years we will have a new sound system.' So that money was allotted a couple of years ago."

Theater/auditorium work is steady, says Thomas J. Frericks, Jr., president of Copp Systems, Inc. of Dayton, Ohio. "We typically see two to three, maybe four [theater/auditorium installs] a year, and that's what we've seen in the last 10 or 12 months. . . . [A]round the country, you're probably seeing an increase in auditoriums and theaters."

The market is small, says Jay Johnson, CEO at Central California Electronics,

Maria M. Conforti is a freelance writer in the New York area.



Hutchison Community College Theater in Hutchison, Kansas.

but it is growing. "A lot of people are redoing their systems, retrofitting," he explains, adding that he's done more of this kind of install recently than he had in the past. Johnson adds that most of the retrofits are for systems from 15 to 25 years old.

Increased consumer sensitivity to sound quality spills over into theater/auditorium work, says Mark Mayfield, marketing communications manager, of Bose Corporation's pro products division: "There's more of a heightened sense of what quality sound is all about. . . . With the rise of the compact disk player, there's a sense of quality

sound out there that wasn't even there five years ago." So it's not surprising that two primary concerns have increased in importance today, says Gerry Barclay, marketing services coordinator for Crown International: "Feedback is always a big concern, and proper mic placement is always something that's debated."

"The flexibility of the system — the need of the client to be able to broadcast live, to record, to do many different things — is the most requested new thing that we've seen," Johnson says. "They still want good sound, ease of operation, but flexibility is probably the number one

new thing that they're adding. For some reason or other, they weren't able to use the system that they already had for a particular program or event that they needed to do, and that generated the need to replace their system."

"We've got systems that within five years are being taken out," Frericks echoes. "They're perfectly good systems, it's just that they haven't been operated properly for the last couple of years, and the client feels that they need a new system to improve the sound. That's not usually the case. It's just usually that they need to be trained properly. Quite often, we'll go in and help them through it, even though we didn't install the system. We feel that gives us a better rapport with the customer down the road. Quite often, we'll go in and say, 'Here's what it takes to get you back up to where you were four or five years ago, and we

For some reason or other, they weren't able to use the system that they already had for a particular program or event.

don't think you need a new system.' On the other hand, some of the customers have hired a consultant who has told them they need a new system, and we kind of quote that job tongue-in-cheek. We won't try to go around the consultant and create bad blood."

Many non-profit organizations emphasize cost, Johnson adds, and they are often willing to sacrifice quality for dollars. "We feel that if we're going to put our name on, there has to be a certain quality about it. When they get down below that quality, it is really not something that you want to get your name on. So it's better to walk away from those at that point," he says, adding that it isn't always necessary to walk away. Instead, contractors can work with willing cost-

conscious clients in stages by starting out with a basic but expandable system.

For high school and college installs, pragmatism rules. "In the educational market," Frericks reports, "it's 'How can we keep the kids out of it?' They want a professional system, but on the other hand, they've got a bunch of kids who think they can rebuild the world. . . . We try to design systems—or suggest a consultant to design systems—with the least number of buttons possible, the digital equalizers, the power amplifiers that don't have the controls on them for the students to play with it. We like to lock everything up as much as possible and usually only give them the components that they need to be associated with—the mixing board, cassette player, and CD player." Corporate clients seek sophisticated control systems, adds Frericks, "so when they make a selection, they have the proper audio channel routed to the proper speakers."

"We're seeing more sensitivity to intrusive sound systems on the part of the theater owners and auditorium operators," states Mayfield. "They know that they need sound systems, but they're concerned about how much room it takes and what it does to their sight lines." Since aesthetics are becoming more important, Mayfield continues, speak-

ers are getting smaller.

"A lot of the speakers that are going into the auditoriums, at least in northern Kentucky, are the redesigned boxes with the horns and the speakers in them," concurs Jack Toerner, president of American Sound & Electronics, "as opposed to the separate horns, drivers, and bass kits, which makes it a little easier for some to work with."

"The popularity's growing of packaged

A lot of the speakers that are going into the auditoriums, at least in northern Kentucky, are the redesigned boxes.

systems, of full-range single boxes and high- and low-frequency box systems, as compared to traditional horn/driver-based box systems," Schwartz says. "A lot of this is due to customer demand, of having to do more high-level sound reinforcement; they want a system that will basically be compatible to the technical requirements of whoever's coming in to use the system."

Due to the aforementioned demand



Example of an American Sound install in progress. The central cluster is hidden behind a grille centered over the stage. At the rail are acoustical panels to be hung. The walls are fabric covered fiberglass panels. This is a Jaffee Acoustics design.



The Topeka Performing Arts Center in Topeka, Kansas. A Coffeen Fricke & Associates design.

for flexibility, clients are “outgrowing” their mixing consoles, Schwartz says. “There’s a lot of problem-solving in that, having a lot of different types of media and trying to reproduce a lot of different types of formats of things. They’re looking more for consoles that have more

line inputs, switching flexibility, matrix in and out, and so on. There are a lot of facilities that have modern speaker systems, but fairly traditional mixing consoles.”

“Computer control is upcoming in theaters, as it is in other facilities,” says

Barclay. “Theaters will also have remote control via computer, so that all the amplifiers, and the mixing in the future could actually be taking place on a computer screen. Theaters will be keeping up with the rest of the sound market, and try to keep on the forefront of the market and have the latest and greatest in sound products. . . . Wireless is really important on stage.”

“I think wired mics are becoming obsolete,” echoes Johnson. “They’re still using them — don’t get me wrong — but more and more I think that obsolescence is setting in. Proper installation, time alignment delays, proper technique in installation and using the equipment that’s available today to properly lay it out, and using good instrumentation when you’re laying it out is the hottest thing today, because it’ll improve

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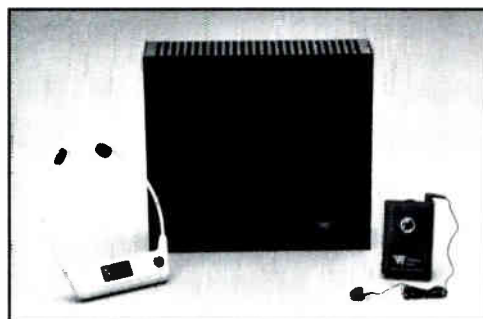
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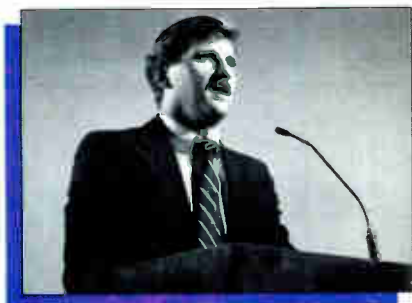
While the market remains viable, watch your back: It’s a jungle out there. “It’s very, very competitive,” Frericks says. “I’d like to see things better, hopefully within the next few year. I’m not sure how some contractors can install a properly working system with the kind of dollars they’re currently bidding.

“Look at the bottom line; look at the real cost for doing a theater or auditorium system,” Frericks advises. “A good system takes some tender loving care to properly educate the people on the use of that system. You really need to sit down and make them understand what they have so that they can use it to the fullest extent possible.” Since school



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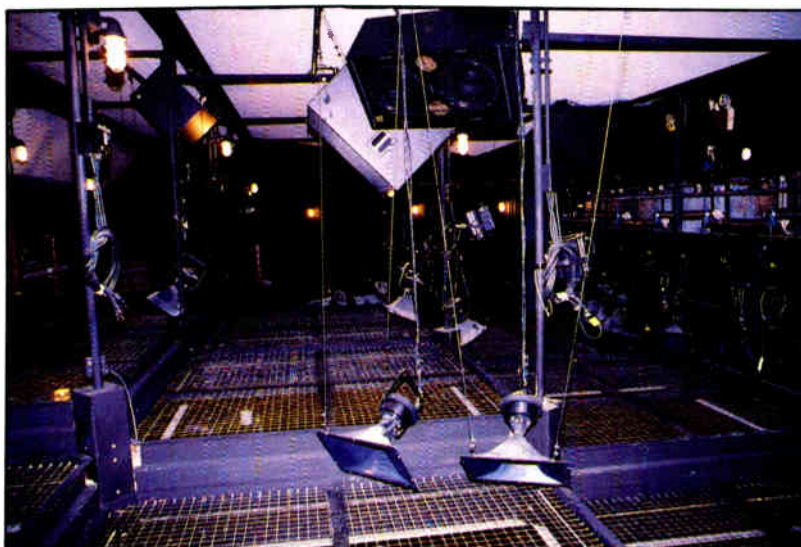
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Loudspeakers above tension grid at the Drama Theater of Johnson Community College in Overland Park, Kansas.

auditoriums are frequently used for town meeting facilities, it's important to train adult school personnel on the systems, not just students. "For systems like this," Frericks says, "putting them in is one thing, but babysitting them for a year or two is another thing, and that's where

the costs come out."

Know which work will profit you the most. "Contractors are becoming more sophisticated in going after bigger jobs because they're just not making enough money going after bread-and-butter small jobs," Mayfield notes, "and they're look-

ing toward manufacturers for help in getting the bigger jobs." The retrofit market is the most profitable market, says Johnson. "The new construction market has the weakest profit line in it. In the retrofit market, they come to you because they've heard of you and know that you can do the job, and therefore you have a little bit better focus and attention of the customer, and you can really do a better job."

It also helps to have some big guys in your corner. "Involve the manufacturer more," Schwartz advises. "I know for a fact that all the manufacturers, especially the larger ones, have gotten very

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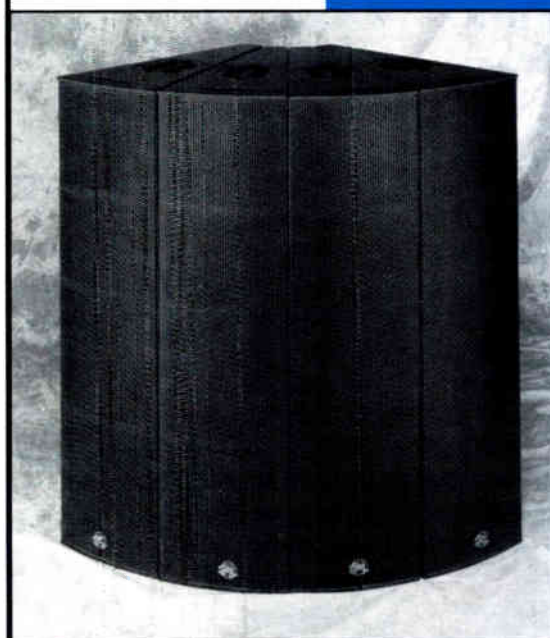
involved with working with their customers to help in the proper application of product or product modification. I think that for the more successful contractors, part of their success is a very good working relationship with the manufacturer."

"I've always thought that our customers who do the best don't take the time to look to either side of them, they keep moving forward," observes Barclay. "It's natural for some to look around, but if they keep going forward to see what works best for them, then the other people are going to be watching them." Contractors should keep proper system design for the facility and for the

I know for a fact that all the manufacturers, especially the larger ones, have gotten very involved with working with their customers to help in the proper application

application top priority, Schwartz says. "There are a lot of end users in facilities that are saying 'I want Brand X box system,' and it may not be in their best interest to do that. It's more and more important that contractors and consultants are involved in specifying the correct systems. There's still no replacement for a properly designed, well thought-out system."

"We've got a little saying around here: We'd rather be the second guy in than the first guy in," Frericks says. "We tend to think we're a little more customer service oriented than 'the first guy in,' and we want the client to experience the difference between our way of doing business and the guy that ran in, put the system in, and ran out the door and didn't shake their hand." ■



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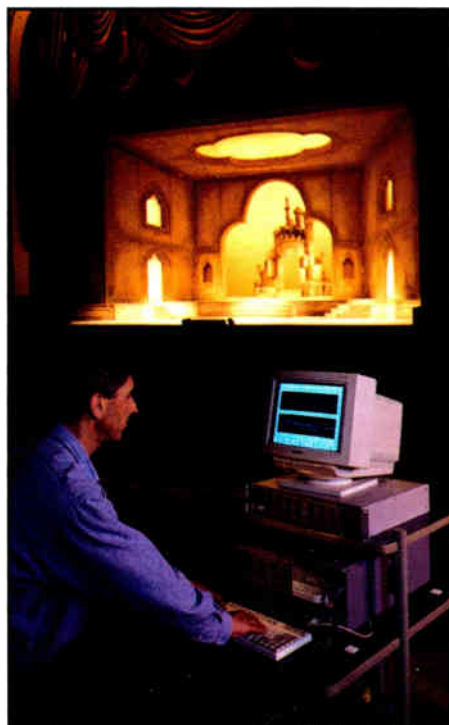
A Merger of Physics and Music

Roger Gans at the San Francisco Opera House

BY PAMELA MICHAEL

Opera is the plural of the Latin word “opus,” which means work — work of art, in this case. And yet those Italian wordmasters of yore knew whereof they spoke in more ways than one. Mounting an opera production is work of an intensity and complexity rivaling that of a military campaign or lunar construction project. Imagine a situation in which a full orchestra, large chorus, soloists, plus assorted sword carriers and other players perform what amounts to a symphony, dramatic play, choral work, and ballet on the same stage all at once, generally with the enormous cast swaddled in noisy, elaborate costumes flouncing their way around massive sets that play mean tricks with sound. Work indeed for all involved, particularly the sound designer.

Overcoming the acoustical obstacles presented by even the most minimalist opera (and there aren't too many of those) requires ingenuity, patience and skill. These qualities are amply represented in the person of Roger Gans, sound designer for the San Francisco Opera. Gans is charged with creating soundscapes for what is essentially an 18th- and 19th-century art form that must find a 20th-century audience. To do this, he utilizes advanced



Roger Gans with his instrument, the SIM System II.

technology with the enthusiasm of a zealot, and the sensitivity of an artist. (The music/technology gene pool must run very deep in the Gans family: brother David — a musician and computer whiz — is producer of the nationally-syndicated “Grateful Dead Hour” radio program. Roger Gans said the two played music together as teenagers, then went their separate musical ways.)

San Francisco's opera house opened its doors in 1932. The ornate beaux-arts style 3,252-seat house is known officially as the War Memorial Opera House. The stage area is 134 feet wide and 84 feet deep. The height from stage to roof is 14 stories. Barely visible 14 stories up is a fine net stretched across the house to catch any pieces of the elaborate plaster ceiling ornamentation that might have been loosened by the Loma Prieta earthquake. Luckily, says Gans, very few pieces have fallen. The Opera House did sustain enough damage, though, to require repair and reinforcement; the company will be forced into nearby temporary quarters at the Civic Auditorium in 1996, while the historic building is being renovated. As a registered landmark, the grand Opera House is worthy of restoration on several fronts, and the building's history is political, as well as musical and architectural: the United Nations Charter was signed there in 1945. Roger Gans told us that workers still occasionally unearth conduit from the translation cables installed in the '40s for the UN conference that resulted in the founding of the UN.

Today's War Memorial Opera House is part of an elegant arts and government complex surrounding Civic Center Park that includes Davies Symphony Hall, The Museum of Modern Art, City Hall, the public library and other massive for-

Pamela Michael is a freelance writer and frequent contributor to Sound and Communications who lives in Berkeley, California.

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The stage area of the house is 134 feet wide and 84 feet deep. The height from stage to roof is 14 stories.

mal structures.

Sound & Communications spent a morning poking around the darkened Opera House with Roger Gans — backstage, on-stage, underneath the stage, in the booth, in the pit. He showed off the Opera's snazzy advanced model SIM machine — the "Source Independent Measurement" system from Meyer Sound, just across the bay in Berkeley. The SIM technique has been most prominently used for special sound events such as televised live broadcasts, but also for live theater. Recently SIM has been finding application in permanent installations, with the War Memorial Opera House being one of the most notable.

The basic SIM machine consists of a 486 computer (an MS-DOS platform computer with 8 megs of memory, set up so you don't have to deal with DOS). It has a standard footprint, rack ears, and has a 115 megabyte removable hard disk with 1.4 floppy. Sound Designer Gans, who along with his head sound man Max Christensen shapes the sound of all the stage productions at the Opera House, eagerly demonstrated [for Pam Michael and Mike Klasco] the capabilities and creative uses of this nifty piece of equipment.

Sound & Communications: Why does the Opera need a SIM machine?

Roger Gans: There's so much audio folklore in theater and opera sound, so many strong, divergent opinions about what sounds good, and why. We need measuring instruments that are going to help identify in a common language what it is that we are hearing. Here at the Opera

we have a new musical director [Donald Runnicles], and he's experimenting a lot with the orchestra pit. He doesn't always like the balance from the house, the pit, or from listening to our archive recordings, so he's making changes — they have put the violins on risers, moved the winds, and so on. The problem is that the Mae-

Workers still occasionally unearth conduit from the translation cables installed in the '40s.

stro is in the pit, and when something is changed he is unable to hear it from anywhere but the podium. Plus, there are at least five other people listening with at least five other opinions. What's needed is a way to quantify and identify the various acoustical elements in order to get some common data to correlate everyone's experience.

Sound & Communications: Our experience with this class of acoustic analysis equipment is with the Academy Awards and other events where there's a narration mic and a bunch of mics on performers, a bunch of mics on the orchestra. You've got an endless succession of talkers, some right up on the mic, some three feet away, with no way to drag the person closer. And some of them are mumblers, to boot. That's the only time we've actually seen it used. They're us-

ing this type of approach to get a couple of more dB gain before feedback, but that's not what you're talking about here. You're talking about actually enhancing the quality of the sound.

Roger Gans: Yes, feedback EQ is one of the procedures available, and in fact, it's a single channel measurement, so it doesn't use the real power of the machine. Feedback is an interesting problem itself that I think a lot of people don't think through. The typical monitor mix scenario is, "Well, okay, we don't have enough gain in the system for the artist," so they push the system up in level until it starts ringing and put a filter in to correct it. Next one, put a filter in, next one, put a filter until it starts ringing at multiple frequencies. Then that's as far as you go. Then they back the gain down so that they have some extra level for the artist. All the filters that have just been put in to stabilize the system are now 6 or more dB cuts so it's only flat if you are willing to ride the level near feedback. Unfortunately, that's also where the system becomes very unstable. It's an interesting problem.

Here at the Opera, we're concerned mostly with frequency response, time delay, and relative levels of the different systems. These are the factors which create the subtle imaging that makes so much difference in our work. For example, say there is a chorus offstage which because of the scenery or the orchestral balance is not being heard properly in the house. What we will do is try to get a speaker on or downstage of the group which is time delayed to the source so that we can reinforce their sound without changing the apparent direction. At the same time, we will have another speaker farther downstage which is time delayed to the first one and can be added in if we don't have enough gain before feedback because of the proximity to the source microphone. At a certain level, the image will start to shift towards the second, or louder speaker. These are the kinds of trade offs which

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World Radio History



San Francisco's War Memorial Opera House opened in 1932.

are necessary to make it work.

The important thing is that I have all of this information, the relative levels and delay times calculated ahead of time with the SIM machine so that I have them at my disposal when we rehearse that part of the opera.

Sound & Communications: So most of the work you do with the SIM is in pre-performance?

Roger Gans: Yes, the productions are so large and expensive and there are so many people working on them that it's virtually impossible to be able to stop and try a sound cue like this a second time. Can you imagine 120 people standing around on-stage while we say "Shhhh..." and take measurements. When we do have the stage we can get the measurements we need quickly.

The impulse response will give us a time delay in under a second which can then be entered into programmable delay units. Individual speaker responses can be analyzed from multiple locations using the Meyer 2403 Interface Network [a patching and routing subsystem which is used to select which locations are to be analyzed at any given time]. Equalization and levels can then be set which are more likely to be close to "flat frequency response and equal sound pressure level" than from a single mic position.

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It's helped us to get more work done, and we're able to be much more flexible. For instance, when the summer season began, before they put all the scenery in the air, I had all of our speakers set up in different locations, got all their time delays, and programmed the external delays. Once the scenery is in, it is much more difficult to get these measurements. With this "raw" data recorded on disk, I can now compare the responses with those in different scenery.

We don't amplify the stage or the orchestra pit as a matter of course. In a world class opera house, the singers are expected to project and the building is supposed to have good enough acoustic resonance that the balances will be good. It's a matter of opinion whether this house does those things. I happen to think it's pretty nice, but I'm just the sound man.

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like a recording. They could stay home and do that.

Roger Gans: It's part of the classical music tradition. You find a lot of guys, especially the old-school European conductors, who are against amplification just on general principles. I suspect that they have had some pretty miserable experiences at the hands of sound people in the past. After all, it wasn't until just recently that reinforcement equipment got to an acceptable level of quality. The thing that disturbs me is that some of the younger musicians are against "electronics" because they feel that it is against tradition. I call this "tradition for tradition's sake."

What I am trying to do here is (like any theatrical department) to support the performances. I'm looking to things that the original composers, the "masters,"

are asking for in their scores. We are using the new technology to create the effects that have in some cases eluded opera companies for years.

For instance, in Verdi's *Otello*, there's a big thunderstorm in the first act. He has a low organ pedal cluster which is

You find a lot of guys who are against amplification just on general principles.

held through the entire scene. It is not particularly audible under all the action and its effect is obviously to create an uncomfortable feeling because when it

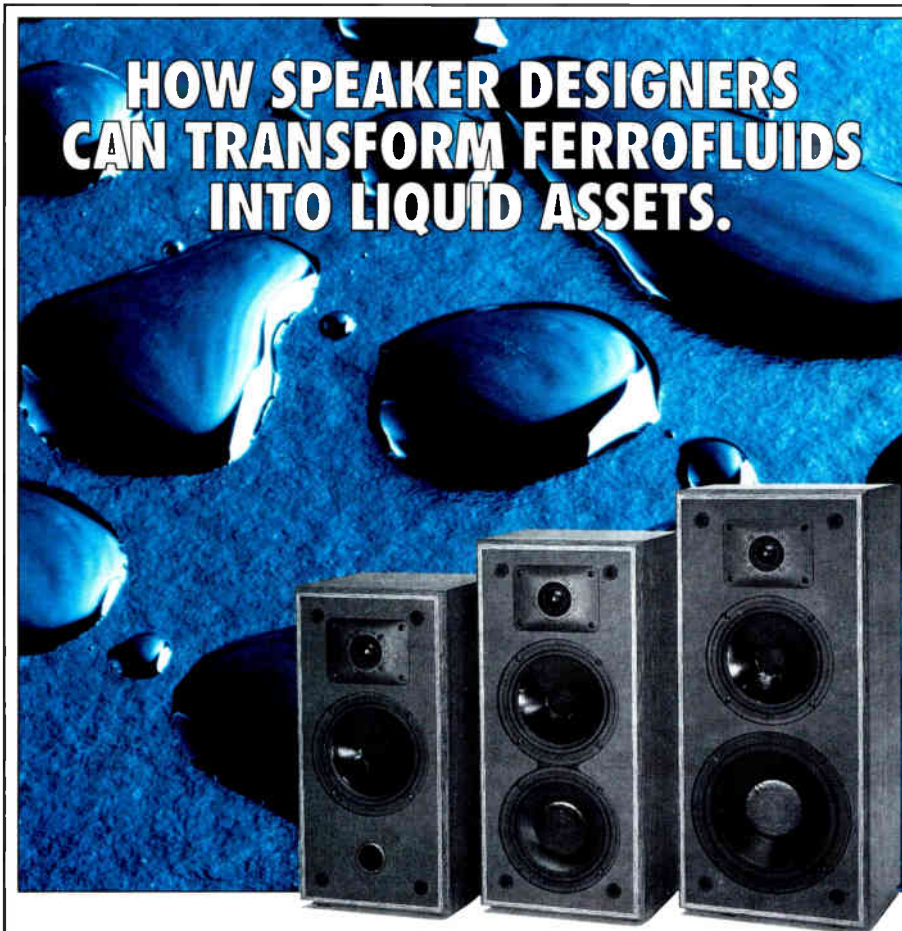
goes away at the end of the scene, you feel the release. The thunder and lighting cues themselves are very specific. He gave instructions for distance and level in musical terms.

Sound & Communications: What's the notation for distance?

Roger Gans: The terms are Italian. *Molto lontano* means very far away, *lontanissimo* is very, very far, *vicino* is close, *meno vicino*, less close, etc. So you can see that they were very specific in their instructions. My feeling is that they were doing everything possible they could to get the dramatic effects for their operas and if they were around today they'd be using everything available.

Sound & Communications: With glee, no doubt.

[As we talk, Gans demonstrates several effects on an EMAX 2 sampler and



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Yamaha KX88 that's hooked up to a Macintosh for processing and other functions. The Mac is set up with the Sound Tools, which has hardware and software that enables the user to record digitally onto a Mac hard disk, and provides an array of post-production capabilities — editing and such. All of this is on a wagon which is outfitted with a small video monitor that gives the player a view of the Maestro during performance or rehearsal, and a talk back feature. This whole array is wheeled up to the backstage for performance. The artist plays it out of sight of the audience, taking cues from the conductor like any other musician via the video monitor.]

Roger Gans: So a score will call for a thunder cue or a church bell. What we do with this setup is to record a sample, hopefully from a DAT or CD directly

onto the Mac via Sound Tools, manipulate it, and send it to the sampler on RS-422. It is assigned to a key or group of

The artist plays it out of sight of the audience, taking cues from the conductor like any other musician via the video monitor.

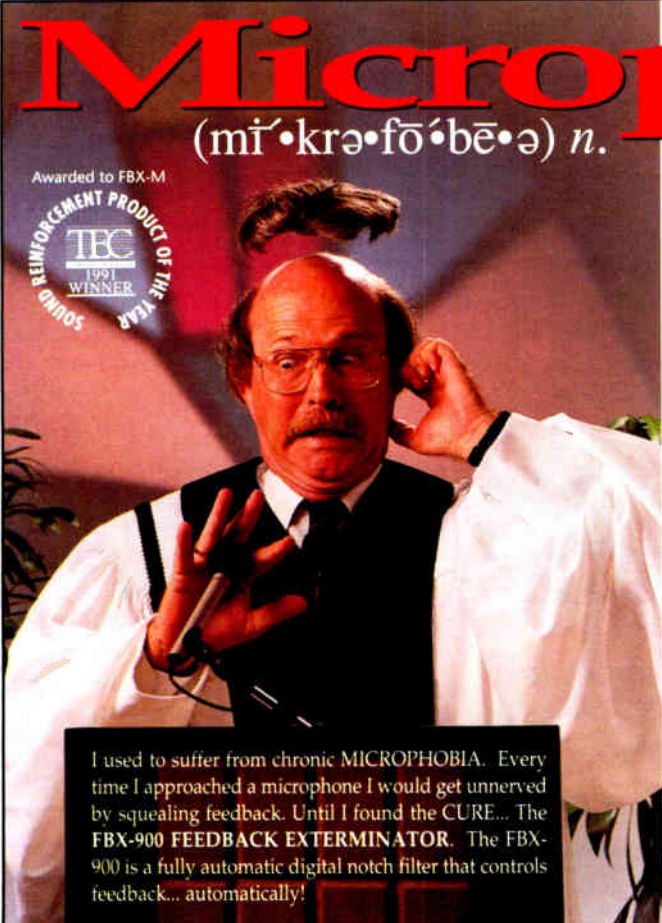
keys via MIDI, and saved on the EMAX hard disc. There it stays in the digital domain until it plays through the sound system during a performance. A few years ago, we were rolling multiple tape cues for each of these effects; now with

the sampler setup we have something that is more like a musical instrument. The responses are instantaneous, the keyboard is touch sensitive, and we have made the transition from rigid and technical, cue-one-cue-two sounds to something much more artistic. The musician playing the instrument is under the direct control of the Maestro like everyone else in the orchestra.

It has been a difficult transition; I've had some people say, "I've studied music for 25 years for this?!" [Gans hits a thunder key. A loud crack reverberates through his small office.] But once they start playing it on-stage, they begin to realize the possibilities and become more interested. This is the sort of technology that I feel really makes a difference. We set a maximum level on the sound system and the musician has control of the


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dynamics with the touch-sensitive keyboard. If the Maestro feels it is too loud, he handles it just like he would any instrument in the orchestra, and indicates with hand gestures to lower the level.

Sound & Communications: What else are you working on now?

Roger Gans: One of the things I'm working on now is to switch all our effects to stereo. All this thunder and such is now in mono. This fall, we're doing *Tosca*, the opening show of the season, in fact. The beginning of the third act has a very interesting section where it's dawn in Rome from the perspective of Castel San Angelo and as the sun comes up all the different churches are ringing their matins (bells). It's all scored in. Look. [He shows us the score.] There are about fifteen different bells from different locations.

Sound & Communications: When the bells get closer, it's not just amplitude, right?

Roger Gans: We'll do it with a combination of speaker location, reverb, and EQ. There are at least eight different speaker locations and I've got eight outputs on the sampler. The last bell in the section has historically always been a challenge — an E two octaves below middle C. There's not a tube chime in the world that can do it. You should almost be able to feel that bell more than you hear it. It has to be created acoustically, meaning that I will have to experiment with samples and the sound system in the actual set to adjust the resonances to make it work.

Sound & Communications: You could almost draw it in with Sound Designer, or take a bell and transpose it, stretch out the wave form.

Roger Gans: Exactly. We had some Japanese Taiko drummers perform here last week as part of the Pacific Rim concert we did. I'm thinking about taking the attack from something like that and pasting it onto one of the big bell samples

I have. I'll use the SIM machine to observe the harmonic structures of the bell cues that I have, and with programs like *Alchemy*, where you can do harmonic editing and pitch shifting, create a whole series of bells.

I have some old analog carillon recordings which I'm going to take over to Fantasy [the Berkeley-based record/film/post-production facility] to get processed on the Sonic Solutions equipment. I've got to get them cleaned up before I can put them to work.

There's also the possibility of getting some real specific data on the actual bells. It is obvious that Puccini was inspired by a scene such as this when he composed this piece [which premiered in Rome in 1900], but there is a rumor that he used specific pitches from actual churches which were there at the time, many of which still exist. If they do, maybe we can record them. If not, research may reveal the bell maker and other similar bells might still be in the countryside or something. Or we might be able to find some old recording of the bells, do a frequency analysis, and attempt to simulate the real bell with our new technology. The possibilities are very interesting.

Sound & Communications: A real merging of physics and music.

Roger Gans: That's what I really like about all this. I didn't come into it as a "techie." I came in from an artistic point of view. All these things are tools to get specific jobs done.

Sound & Communications: How long have you been doing this at the Opera?

Roger Gans: About 12 years. I started out in theater and along the way have done a lot of live concert work and consulting as well.

Sound & Communications: What led you to the SIM?

Roger Gans: Years ago John Meyer [President of Meyer Sound] and I discussed the need for a big speaker source that could create the acoustic power and compete quality-wise with live music. It is the most difficult of A-B comparisons;

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live music playing along with music through a speaker. That's where it started for me. We bought the first MSL-3s sight unseen for the Opera about 1980.

Sound & Communications: That's before Meyer Sound moved to Berkeley, right?

Roger Gans: Yes, they were still in San Leandro. A few years later, about 1983, we began experimenting with the Pavarotti arena concerts and around that time John and Bob McCarthy [head of the SIM department at Meyer] were developing SIM. We tried out one of the first bare bones SIM systems, which was basically a switch box and a dual-trace analyzer, on a Pavarotti concert in Reno. It was apparent to me that SIM was something we had to have at the Opera House. The issue was only how

practical and how affordable it was. But it was obvious that it was something you needed on every show, whether you're doing a Pavarotti concert at Madison Square Garden or working with a small club system. There was no way around the fact that these systems interacted with the room and with each other and that they needed to be corrected. We also needed to be able to quantify the results and continue to perform the corrections once the audience was in the room. That's how Source Independent Measurement really got rolling for me. Of course, all of that technology has proven extremely useful here at the Opera House.

I have done some very interesting, sort of off-the-wall things with SIM. For instance, we had a church bell effect which was playing during a chorus scene.

The fundamental note of the bell was on pitch but the third or fourth harmonic was prominent and was throwing the singers off the pitch. I analyzed the cue with SIM, found the offending harmonic, put a narrow filter in, and solved the problem without destroying the realistic effect of the bell in the scene.

[We move to the massive stage, set with a Viking ship prow. Gans describes the speaker setup.]

Roger Gans: We have a basic proscenium speaker system of two Meyer UPA-1s per side which is our only real permanent installation. Everything else is pretty much patchable and flexible. Just inside the proscenium, Meyer UPM foldback for the stage from boundary layer mics in the orchestra pit and talk-back mics at the conductor's and director's location. On the inside of the torus stage right



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and left, we have specially constructed double boom arms which hold UM-1s. On a pipe upstage, there's a pair of Meyer MSL-3s with model 650 subwoofers. I generally will use the MSLs as a main source for a cue like thunder or a cannon shot and add the other speakers on time delay for presence, keeping the sound image upstage. This fall, Meyer Sound is loaning an MSL-10 [its largest speaker] for the upstage position to handle the *Tosca* bells and the cannon and organ in the First Act. I will then move the MSL-3s to the house organ bays and use them as time delay speakers for the 10.

[We make our way to the sound booth which is set up with AB Systems, QSC and Meyer amps, a Lexicon reverb, B&K 4006 mics and both the Schoeps MK4 and MK5 mics. Gans demonstrates a few functions on the SIM machine.]

Sound & Communications: How much training does it take to operate the SIM system? For a sound contractor to spec in a system like this, he'd have to be able to advise the client about personnel and training, too.

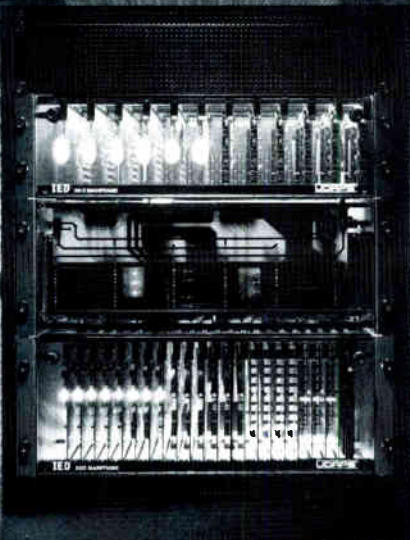
Roger Gans: The new SIM system is very user friendly. It is designed to be taught to people with little or no previous experience in a three day course. This is enough instruction to operate the machine for basic measurements, and the software is designed to lead you through a set of procedures. Like any software/hardware combination, the more proficient you become with the system, the more useful it becomes.

At this point, the Opera uses the SIM machine mainly for setups and to recall data from disk. To restore an EQ setting, it's a matter of a minute or so to duplicate

a curve to within 1/10 of a dB, the whole frequency range. Time delays can be checked every day. Next I am going to start doing some measurements to help quantify some of the orchestra pit changes we were discussing earlier. We can do this by comparing a mic or mics in the pit with mics elsewhere in the house. We can also use this same method to compare different seats in the house to address complaints about the acoustics.

We are supposed to vacate the Opera House in 1996 for earthquake repair, going over to the Civic Auditorium for a year. By then, I intend to have a disk full of data to help me re-create the acoustics over there. What's perhaps more important is that I will have that data when we return to the house to see if the acoustics have been changed by the renovation. ■

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Broadway Sound Design

Anna Karenina Receives Sound Design Treatment from Fox and Perla

BY JEFF ADER

When I recently stopped by to see Bernard Fox and Gene Perla of Sound Designers Studio in New York City, I found them in the middle of designing a sound system for a new Broadway musical production of Tolstoy's "Anna Karenina." It is being performed in the Circle in the Square Theatre on 50th street west of Broadway.

The shape of the theater and instrumentation used in the production presented some unique problems. We'll explore the solutions in this article. First, a little background information is in order.

As sound designers for Broadway productions, Fox and Perla's recent credits include *City of Angels* and *Sweeney Todd*. The bulk of original sound effects for most of their Broadway show productions are produced at Sound Designers Studio by Chief Engineer Dan Tramon. There are two rooms, both well equipped for multitrack digital audio and specialized audio effects [The rooms are owned jointly with Richard and Peter Fitzgerald of Sound Associates]. Both men have



View of the stage from mix position.

extensive experience performing and/or engineering. Gene Perla is a noted musician and Bernard Fox has numerous engineering credits. Both have owned their own facilities individually and have received many awards and nominations in the audio and music fields.

For this project they relied heavily on computers for line drawings and documentation of chronological changes in all aspects of their involvement. They also utilized the fax for constant communication between all parties involved with the production. They had input with the decision-making process early in the production that allowed them the ability to affect the changes necessary.

One of the obstacles they needed to overcome was a set that consisted of three pairs of French doors. The French doors marked the entrance to the stage and allowed the actors and actresses to enter and leave the stage. When the doors were open, the orchestra volume level and sound were quite different than when they were closed. The solution to this was to amplify the orchestra. A Meyer triamped system was used in stereo, suspended approximately 18 feet in the air over the orchestra from a grid pipe. Instruments on the left were fed to the right speakers and vice versa. The result is that regardless of the doors being opened or closed the sound of the orchestra appears to come from the orchestra area. The system also helps to fill in the light percussion, cello, trumpet, reeds and the high end of both pianos in this

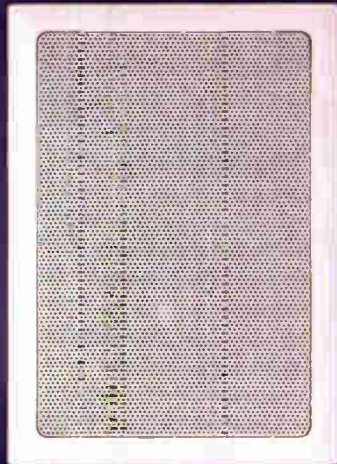
When he's not writing for Sound & Communications, Jeff Ader is Director of Technical Services for Simultaneous Wireless Interpretations in New York City.

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musical production.

Another problem was the space allocated for the orchestra. When the space arrived at its current layout, the

The percussionist couldn't see the conductor because he was separated from the conductor by two pianos, a cello, trumpet and reeds.

percussionist couldn't see the conductor because he was separated from the conductor by two pianos, a cello, trumpet and reeds. Fox and Perla's solution was to use a small TV camera



Photo by Richard Laird

Left to right: Bernard Fox, Gene Perla.

trained on the conductor at his piano and small video monitors for the percussionist and other musicians to watch him.

The first four speakers were set on one delay time and the next four on another delay time.

The Circle in the Square Theatre is a theater in the round. The theater resembles a "T," with the audience seated around the long stem in a "U" shape. This presented some difficulties for miking the actors and providing audio monitors that would not interfere with the sound that the audience hears. Again, because of the french doors, the actors could not

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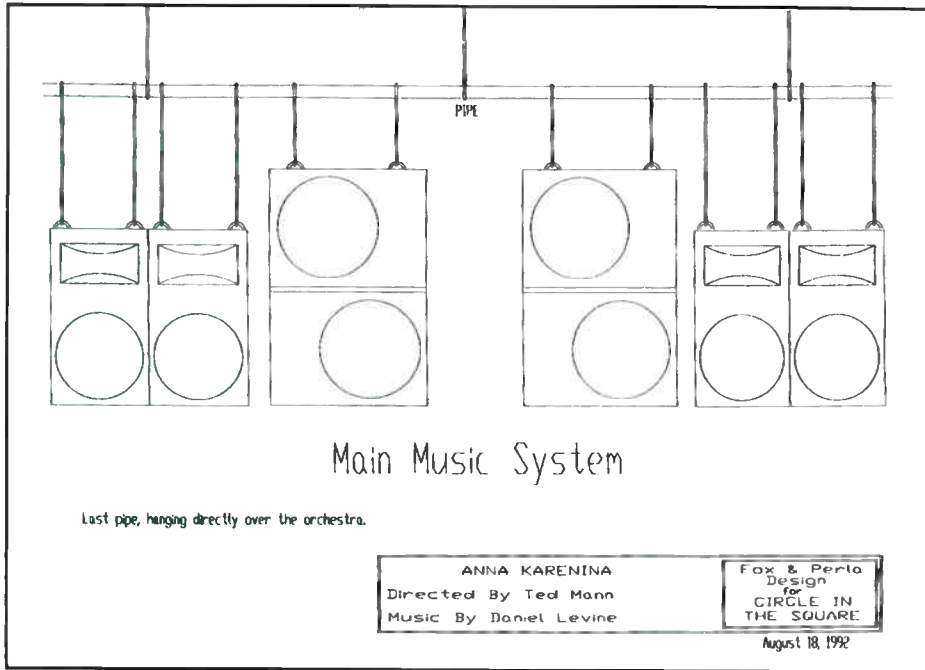
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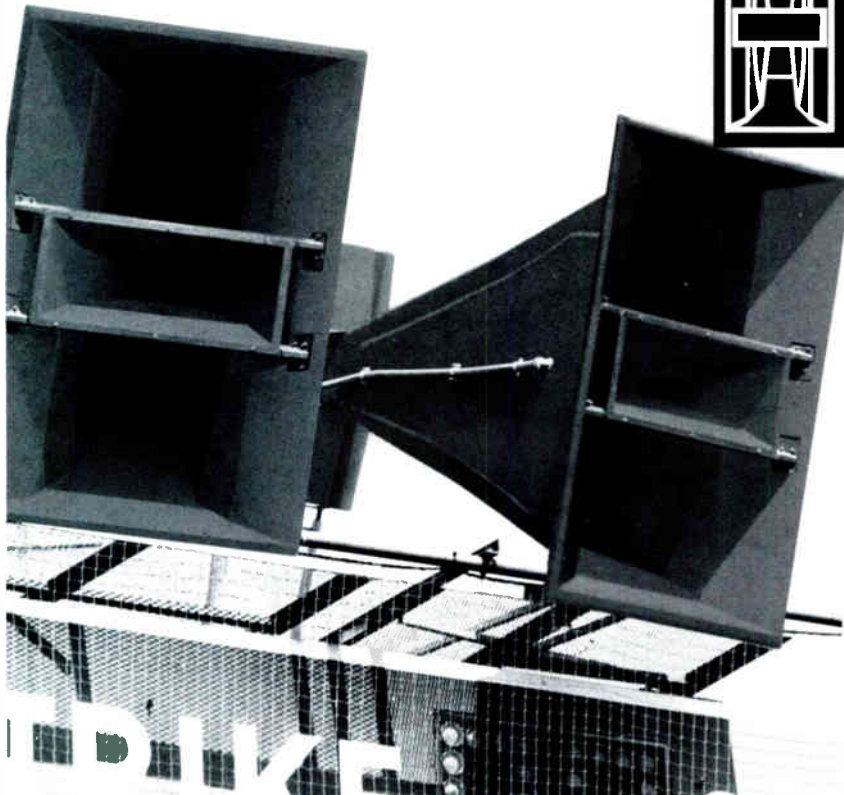


always hear the orchestra cues. As a result, a small stage monitor system was installed consisting of eight JBL SLT-1 speakers ringing the floor of the stage

The shotgun mics are tucked into the space between the stage and the first row of audience seats.

and set up in two zones. The first four speakers were set on one delay time and the next four on another delay time. The net effect is that anyone in the audience sitting close to these stage monitors can't hear them because the speaker is pointing away from them, the sound from the orchestra arrives slightly before

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the articulation of the speaker is heard, and the articulation is pointed toward the actor.

In between the stage monitors are eight short shotgun mics: AKG 451s with hypercardioid CK3 capsules. Overhead shotgun mics could not be used because of ambient audience and house



noise due to the configuration of the theater. The shotgun mics are tucked into the space between the stage and the first row of audience seats. The only drawback is the occasional kick from a theatergoer exiting across the stage floor after the show is over. There is also a Sanken COS-11 suspended over the center of the stage to capture what the AKGs might miss.

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Photo by Richard Laird

The pit provided quite a logistical challenge for Fox and Perla.

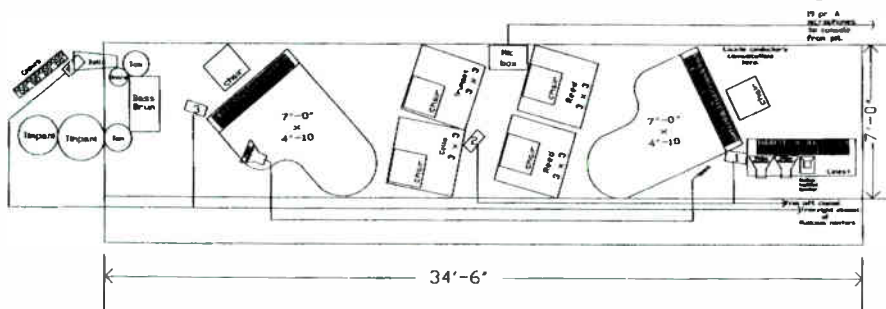
the top seven rows of the audience. They too, are on a time delay so that sound from the stage meets up with them at the same time. In addition, there are four flat-panel speakers spread out two to each side of the theater on the walls. They provide pseudo-ambience for vocals, orchestra and sound effects.

Over 30 sound effects have been created for this production. The most

Musician's Monitors and Conductor's Video Monitors

□ This represents the size and direction of the the musicians monitors.

▽ This represents the video monitors so the conductor can see the stage.



Drawn with new piano size.
7'-0"
x
4'-10"

Top View
To Scale

ANNA KARENINA
Directed By Ted Mann
Music By Daniel Levine

Fox & Perla
Design
for
CIRCLE IN
THE SQUARE

August 18, 1992

complex cue is a conversation that takes place in the woods during a quail hunt. As the actors walk through the forest the birds are chirping around them. In the theater, it feels like the audience is in the middle of the forest too. Suddenly, the birds flutter up (with sound coming from the stage monitors), the actors pause, raise their shotguns toward the ceiling and gunshots erupt from the Apogee A2s. In order for this to be synchronous, all sounds come from a S100 with 32 megs of RAM, played on an Alesis sequencer.

I had an opportunity to see the theater layout for myself and hear Gene Perla run through some sound effects checks during preview rehearsals. It was exciting to watch and listen as this production team was fine tuning the show, even as it was going into previews. ■

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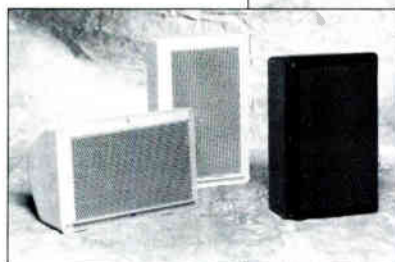
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September 1992 63

SOUND QUALITY, PART FOUR: SOUND QUALITY PROJECTS MOTIVATION, INTENT AND SCOPE

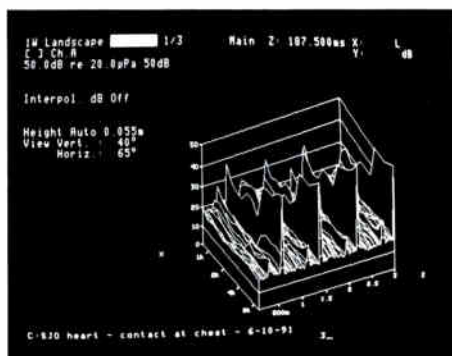
By Steven J. Orfield

In Part three of this series, the concept of sound quality diagnostic testing and computerized modelling analysis was examined. The concept underlying Part three was that technical acoustical and vibrational diagnosis is essential once sound quality standards are in place even on a preliminary basis.

While the listener constitutes the beginning and the end of the sound quality analysis chain, measurement constitutes a very significant, complex and expensive portion of the ongoing analysis.

In Part four, we will discuss the motivation of the corporate researcher in using sound quality analysis, and some project applications of sound quality analysis. While the results of many of these projects are considered to be confidential corporate research, a general narrative on the problems, scope and process is useful in understanding how the typical corporate research project proceeds. Some of these projects are underway at this time, and therefore,

Steven J. Orfield is the President of Orfield Associates Inc. in Minneapolis, Minnesota.



Sound Quality - Heart Valve Measurement.

the final benefit of these projects is unknown. Some projects have been undertaken by Orfield Associates and some are published in the literature without identifying consulting/engineering teams.

Of specific interest in this process is the corporate dynamic which is generating interest within the respective firm,

MUCH OF THE MOTIVATION TO BEGIN THESE PROJECTS IS FOUND ORIGINATING IN EUROPEAN AND ASIAN DEVELOPMENTS.

and so, the relationship between research and marketing departments will be discussed in some detail. This foundational interest may be driven by such concerns as competition, legislation, product complaints or by market research. Much of the motivation to begin

these projects is found originating in European and Asian developments, the former being based on the origination of sound quality in Europe and the often strict noise legislation there, and the latter being based on Asian sensitivity to noise (due in part to the limited size of living environments) and to the particular propensity, on the part of the Japanese, toward very finely focused product design, the “elegance” of which is the constant subject of the international industrial design community.

It is important to understand that sound quality is an issue which is dealt with remedially in existing products and via initial design and modelling in new products. While the former is generally an added cost, the latter is often accomplished at some engineering cost but little or no product cost. Thus, the speed with which any competitive industry “cycles” product change, particularly with regard to new generations of product development, directly affects the implementation of sound quality to that industry. (Once one significant manufacturer implements effective sound quality work in his product design, it is highly likely that the competitive manufacturers will have sound quality implemented in their next introduced and competitive model.) It is also important, from the standpoint of understanding the entry of sound quality into any field, to remember one of the fundamental rules of budgeting innovation. The first firm to introduce an innovative feature generally recoups its investment very quickly, as there is little competition; as competition comes on stream, this firm

is often able to reduce product cost because it has already recovered its investment in initial sales.

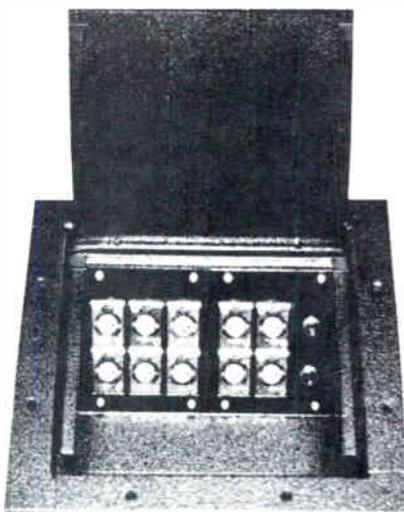
SOUND QUALITY MOTIVATION — THE CORPORATE DYNAMIC

There is often a great gulf in understanding between the engineering research staff of a given corporation and its marketing and market research staff; a brief look at this situation can quickly elucidate much of the motivation behind the sound quality movement. The engineering staff, which is generally very capable with regard to acoustics and vibration, has a history of working with marketing in the identification and removal of sound problems which generate complaints. Thus, the marketing staff of a large auto maker may be responding to numerous client complaints or to an article in an auto magazine regarding the negative aspects of sound quality. An interesting case is the following review in the November 1990 *Car and Driver* regarding the Saturn automobile (this example was used in a recent Sound Quality Analysis seminar by Gordon Ebbitt of Bruel and Kjaer):

Everything about the car prepares you for a pleasant driving experience. And then you start the engine. The power plant is in a word, noisy. We're referring not simply to decibels—at a 70 mph cruise the Saturn is only about as loud as a Civic four-door we tested—but sound quality. As the revs climb past 4000 rpm a chorus of Osterizers begins to play. By the 6500 rpm red line, the engine sounds intense enough to liquefy New York City.

If the auto maker accepts as valid the above critique, the marketing staff will note this as an imperative change. A meeting will be held with the R&D staff, and the acoustical personnel will then proceed to "eliminate" the problem. An effective fix will result in a change in consumer behavior (*i.e.*, the discontinuance of the complaint), and the problem will thus be resolved. Interestingly, there will be no "evidence" of this solution except on a historical basis; in real time, consumers will

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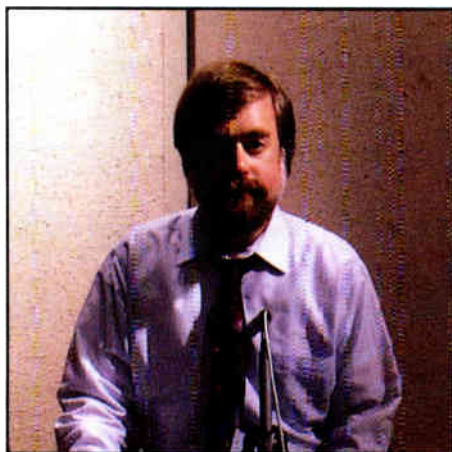
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not respond to the absence of this problem.

This is the crux of most past acoustic product engineering. As these same engineers and marketing managers enter into the advanced sound quality field, one of the crucial differences is that they are starting to emphasize the "positive" attributes of product acoustics, such as "high quality," "powerful," "smooth," "expensive." The distinction here is that after the engineering work, there is clear evidence for the consumer; if the sound quality work has been well executed, the consumer will hear it, notice it and be able to describe in common language his or her characterization of it. Thus, the distinction between the traditional corporate product "noise control" and a full sound quality effort is partially the distinction between the absence of nega-



Sound Quality - Heart Valve Testing

tive acoustical attributes and the presence of positive ones.

PROJECTS — AUDIO QUALITY

A number of years ago, Orfield Associates was involved with the evaluation and design of "drive-thru" intercoms for the restaurant industry. The problem,

which most of us are too well familiar with, is the consistently awful sound of these products.

On the one hand, customers and comedians are constantly referring to the lack of intelligibility of these systems. On the other hand, these same parties make repeated reference to the quality of the sound, usually by performing imitations of the nature of the sound to characterize the background noise, the harshness and roughness of the sound, as well as the lack of clarity. Thus, the problem had the two dimensions of a typical sound quality problem, the need for "noise control" and the need for quality control.

If this had been a typical noise control problem, it would have been defined and resolved in the engineering department. On the contrary, the problem was con-

SOUNDSPHERE SPEAKERS LOOK & SOUND CHOSEN BY CUB FOODS STORE CHAIN

While Soundsphere Loudspeakers have been utilized in Cub Foods stores in Eden Prairie, Cottage Grove, Bloomington and Plymouth, Minnesota, the most recent installation has been at the newest 120,000 sq. ft. store in Apple Valley. Twenty-five Soundsphere #110A speakers with transformers tapped at 75 watts were installed to gain quality music and voice page.

Craig Streich, the Store Manager, takes advantage of the music quality and added efficiency of clear voice page when reassigning workers to various tasks in the expansive store.

Scott Miller, Manager of Pro Sound at Muzak of Minneapolis, notes that the Cub Foods executives selected parchment-colored #110 Soundspheres to meld with the ceiling color and felt that the shape and color were highly compatible with the contemporary interior design esthetic.

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MASTERS & SLAVES
Linking of multiple SR6000s in master/slave configurations made a breeze.

PEDIGREE
TAC has an acknowledged track record in the design and manufacture of the most concert theatres and theatre desks anywhere from Sydney Opera House to the Colosseum. TAC's reputation for excellence in the audio reinforcement field is well known.

FACILITIES
With many more features than can be listed here, SR6000 offers a considerable step forward in SR console design concepts and defines a new horizon for the technology.

TOTAL CONTROL
SR6000's output system has been designed to allow maximum flexibility in configuration of output stages. Each input can separately address 8VCA/Mute groups and 8 audio subgroups, all of which are overlapping. The main stereo output and the 10 x 8 output matrix allow multiple speaker arrays to be controlled with ease, while the VCA Master gives overall control of all 10 main outputs.

SPLIT-AUXILIARY SYSTEM
SR6000's revolutionary auxiliary system allows the 6 solid buses to be split between left and right sides of the console, giving the engineer 16 auxiliary paths for large, effects-heavy mixes.

COMPACT SIZE
The compact design is only 1.2m wide for 40 inputs, stereo effects returns and all output returns. Robust steel construction, coupled with side lift bars and concealed air space under the console allow SR6000 to be raised and transported easily at the same knowledge that all circuitry is fully protected from external impact.

TAC



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*Sound
Quality - Medical
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sidered to be a market-based problem which could potentially influence customers to stay away from the particular restaurant due to communications difficulty and to errors. Since the client base of this industry is broad both in age, in communications skills and literacy, this problem had to be defined in terms of a population demographic which characterized all significant population groups.

As a result of joint interest between engineering and marketing, consumer behavior observation studies were completed to elicit problems caused by or enhanced by the communications system, and the limits of the system were then clarified in terms of consumer response. Jury testing and objective intelligibility testing were performed, and a performance specification was developed dealing with both objective intelligibility criteria and subjective quality criteria. All criteria were developed based not on percentage performance increases but rather on significant benefit analysis (*i.e.*, Are each of the product improvements a significant benefit for the consumer based on jury testing?).

The result of this process was the design of a new generation of drive-thru audio systems which was tested repeatedly during design and prototyping, and the final version of this product met or exceeded all performance criteria.

**PROJECTS — MEDICAL
DEVICE QUALITY**

Orfield Associates has been working for about a year with a medical device supplier who provides products for use

in a home bedroom application in the United States and worldwide. As their products began to be offered in Japan, acoustical comments began to come back from their Japanese distributor. This gentleman explained that the Japanese made versions of the product were far quieter, and were thus more acceptable for use in the small Japanese living space.

Having been retained to measure the American product, our immediate goal was to reduce the noise levels; as we began to investigate, it became quickly apparent that the noise levels of the competitive products were very similar and that this was not the issue. The American product had a sound quality problem of a whining fan noise, and had the manufacturer simply listened to the complaint by his distributor and decreased the noise level in dBA (A-weighted decibels), he would have met the criteria and failed to solve the problem at the same time.

This manufacturer has now performed a number of jury tests of his products, and we are now beginning to run sound quality calculational software analysis of the products to establish an objective base of measurement information which has a high degree of correlation with the subjective jury responses to the product's acoustical performance.

**PROJECTS — MEDICAL
IMPLANT DEVICE QUALITY**

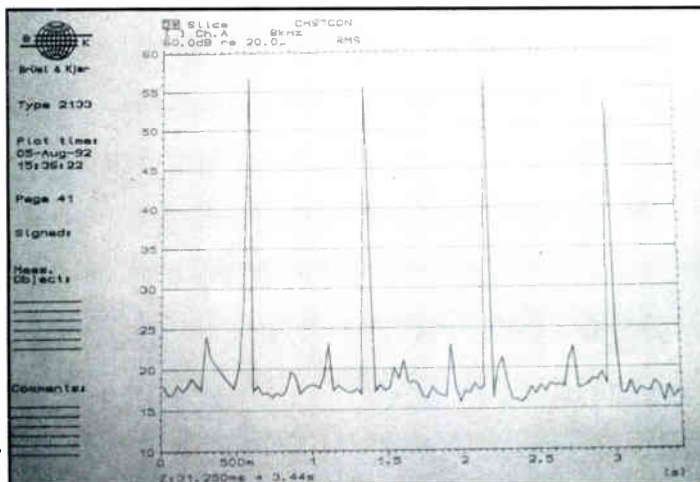
A personal experience has introduced our firm to a new area of interest highly related to sound quality. When I was in my twenties, I found out that I was born

with a defective heart valve; at the time, I was classified 4F by the military during the Vietnam war, due to my probable need for an artificial heart valve later in life. Two years ago, this need became a reality with the implantation of a mechanical heart valve. Past discussion of heart valves had suggested that noise might be an important issue in terms of annoyance; having picked a valve which was anecdotally reported to be quieter than others, the significance of noise quickly became a central issue. During normal daytime activity, there was a modest perception of the noise of valve closure, but at bedtime, there was a very clear signal-to-noise and sound quality problem with the valve.

In order to begin to quantify this, a measurement procedure based on both near field miking and on vibrational

measurement of valve levels was employed. Additionally, a classical auditory threshold experiment was performed in our acoustical laboratory to quantify the perception on the valve. The experiment, an active listening threshold test, employed pink noise as a background signal. The noise level was slowly increased from about 40 dBA until the perception

of the valve noise was doubtful, with the outer ear covered to simulate closure during sleep and uncovered to simulate open listening. The resultant level for full masking was 81 dBA under closure and 42 dBA under an opening listening condition, suggesting very little problem for normal daytime listening but a significant one during nighttime at-



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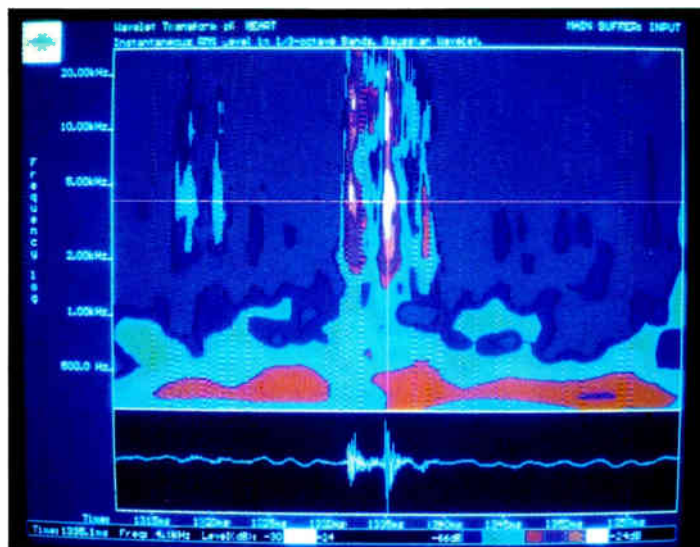
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tempts to sleep. (A review of the medical journals confirms this view.)

Using the normal SQ paradigm considering other factors which will affect the interpretation of the noise, both acoustical and non-acoustical issues came into play. On the level of analytical Sound Quality, the valve was rated high on the sharpness scale, as the impulse was very strong in the high frequencies. On the loudness scale, the valve was also significant, as the signal had a very high signal-to-noise ratio in many of the higher frequencies. (It was narrow-band in nature.)

Considering the expectation set in use by a valve patient, a problem began to clarify. In listening to an implanted valve, a feedback loop is set up between the expectation of hearing the valve as associated with proper heart function and the actual heart pulse rate function. As the valve seems to sound inappropriate or different, due to such common heart functions as overbeats and skipped beats, the resultant listening response is an increase in heart rate due to anxiety. As the heart valve begins to sound faster, this same feedback loop again recurs.

This puts the valve patient in a peculiar position similar to listening to a stethoscope constantly as the environment becomes quiet. Thus, the subject in the case of heart valves is essentially in a biofeedback loop and must learn not to respond to unusual heart valve sounds or changing pulse rates, as this tends to produce a self-generated anxiety and increases in heart rate. Having met with

a number of major manufacturers of heart valves, I find there is much denial of this problem, with such off-handed medical discussion of noise as being insignificant when compared with proper valve mechanical function. With this in mind, it has been interesting to prepare a live simulation of this sound in our Acoustic Simulation Room. The responses of heart valve company executives, upon hearing the actual sound of wearing their product, is quite telling. Finally, it is interesting to note that with regard to mechanical sounds produced by this product, it is often true that louder sounds suggest greater stress on the product; quieter products, conversely, tend to have fewer mechanical problems. It is important to remember that noise is often a symptom of structural stress and increased probability toward failure.

SUMMARY

It is clear from the preceding that there is a movement in manufacturing to begin to consider the residual quality of the sound of a product, both from the standpoint of affect (*i.e.*, pleasantness) and from the standpoint of appropriateness and secondary effects. While this movement is being established in Germany and in Japan, it is our hope that the Sound Quality Working Group will assist in making the United States a more focused and effective player in this revolution.

In our next article, we will discuss a specific analytical tool, Sound Quality analysis software. ■

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World Radio History

CONFERENCE REPORT

(Continued from page 25)

suggestions on how to avoid this.

While the Test and Measurement Conference brought to light much of the current work on the topic, it was apparent that further research was needed.

Bob Thurmond (G.R. Thurmond and Associates), in his paper, "Measurement and Perception of Quality in Sound Systems," listed some areas of research he feels are needed in determining what is meant by a quality sound system.

He writes: "Additional information is clearly needed in a number of areas, such as: . . . how the loudness of reinforced speech and music can be pre-

ADDITIONAL INFORMATION IS CLEARLY NEEDED IN A NUMBER OF AREAS.

dicted in terms of SPL, frequency response, room characteristics, distortion, directivity, and other factors; . . . what factors contribute, and in what proportions, to the perceived timbre of a sound system; . . . how to measure the frequency response of a sound system so that meaningful information on its perceived timbre is obtained; what types and levels of distortion might be acceptable or even desirable; whether other performance tests can render specific intelligibility tests unnecessary."

PROCEEDINGS AVAILABLE

While this has been a sampling of only some of the papers presented at the Test and Measurement Conference, a complete set is included in the "Proceedings of the 11th International AES Conference," which is available from the AES.

"We were very strong in this conference on getting manuscripts for all of the papers," Richard Cabot explains. "In fact, the rule was that papers for which manuscripts were not submitted in time for printing were deleted from the program. The reason behind that was if someone couldn't make the conference, they could buy the proceedings later and still get most of the information that transpired."

The conference ended with facilities tours of Biamp, Tektronix, and Audio Precision. ■

ACOUSTIC ANALYZERS

(Continued from page 30)

1/2, 1/3, 1/6 and even 1/12 octave band measurements in real time. You can adjust your equalizer efficiently in the RTA mode, and then switch over to the TEF mode to calibrate delay lines, measure intelligibly, etc. The Hyperception Acoustic software is now a hardware/software option. I have not had any extended "hands-on" experience with the latest software release for the TEF 20 and I am looking forward to working with it.

FANCY STUFF

When I go to a car show I like to look at the real fancy stuff, not the workhorse products. I am the same way with test gear. So we will take a look at a few fancy analyzers. I have dropped into Meyer Sound's SIM school (they are just around the corner from me), checked out one of their installations at the San Francisco

I became so attached to the system that I adopted it for most of my lab and field work.

Opera House and I will be playing with one of their units shortly. The main idea of the Meyer analyzer is that you can observe the frequency response of the sound system using music as the test signal source.

Bruel & Kjaer (recently taken over by a German firm) has introduced the 2012 — sort of a super fast/super expensive TDS TEF-like system for the lab that has been in Steve Orfield's hands for over a year and we will get Steve's two cents on this lab machine.

Audio Precision's Dual Domain enhancement for their Precision One now includes an MLS capability for speaker testing, Scantek's 820 combines both computer capabilities yet is a standalone instrument, and no doubt a number of other test systems will get a going over in this series. Since this last batch of analyzers is so expensive we will not get too carried away with in-depth evaluation of these units.

I have to go now, as I have to fire up an LMS analyzer for next month's review. ■

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World Radio History

New Ancha Office; Peavey at Batman Attraction

Ancha Opens Dallas Office

Ancha Electronics, Inc. has formally announced the opening of its Dallas office. The company, whose main office is in Rolling Meadows, Illinois, also maintains satellite operations in Norcross, Georgia and Tampa, Florida. To head up the new office, Paul F. Morrow has joined Ancha and assumed the position of engineering manager. Morrow's background includes time with the U.S. Air Force, seven years as project engineer with Altec Lansing, LTV Advanced Technology Center, and an acoustic consultant with Joiner, Pelton, Rose, Inc. and The Joiner-Rose Group. His most recent position was as manager of quality assurance with AMX Corporation. Robert Ancha, company president, said, "Opening our fourth office is really a customer driven decision. We have received many favorable remarks for our work at the Greer Garson Theater at Southern Methodist University. . . We look forward to our system installation at the new J.C. Penney World Headquarters. . . We anticipate an ever increasing market available to us."

Soundelux Florida Does Batman Attractions

Soundelux Florida has designed and installed the sound system for all four Batman attractions which recently opened in Six Flags theme parks across the nation. Four more new Batman attractions are expected to be installed during the next year. Peavey equipment was used for the current installations. The customized sound effects, created by Soundelux, were mixed on an AMR Production Series console. At the attractions, the signal is equalized by Architectural Acoustics CEQ-28s and 28Rs and processed for distribution to the amplifiers by CEX-4L multipurpose crossovers. The attractions' amplifiers consist of CS800s and CS1200s, as well as Architectural Acoustics IPS 800s and IPA 300s.



Left to right: John Miceli, Tony Miceli, Soundelux Florida.

Since most of the speakers are outdoors, Soundelux chose the Architectural Acoustics PR Series of speakers. PR603's are mainly used in the "queue" lines and other support areas. The main design engineer for Soundelux, Jeff Bobbin, had specially designed fiberglass subwoofers built to house Peavey 18 inch Black Widow speakers to provide massive low end. John Miceli of Soundelux noted that, "The sound installation industry is very competitive right now and budgets are smaller than even several years ago. We at Soundelux continue to deliver the highest quality, while looking for superior alternatives to offer even more for less."

Crown Installations

Crown International has reported on several installations and sales. The new performing arts center at the Milton Academy in Milton, Massachusetts features an audio system powered entirely by Crown Com-Tech amplifiers. The center has two balconies and seating for 400. Two movable risers are located on the main level in front of the stage and can be used for audience seating, raised to extend the stage, or lowered to accommodate a pit orchestra. D&B Sound of Salem, Massachusetts performed the installation, using a total of five Com-Tech amps housed in racks in the main control booth at the front of the first balcony level. Four Bose 802 speakers are set up

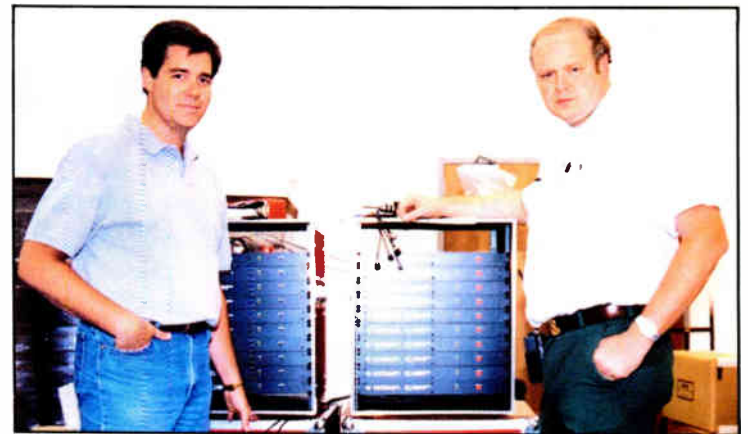
in stereo pairs on each side of the stage proscenium. Four Electro-Voice speakers are available for additional reinforcement. D&B also installed speaker jacks backstage. The system also includes a full technical intercom system and video loop through panels located throughout the building.

The New Rhema Bible Church in Broken Arrow, Oklahoma features Crown IQ System 2000 com-

puter control software and 18 Crown CM-30 supercardioid condenser choir microphones in the 4,500 seat sanctuary. The IQ System, using the IQ 3.1 version software for Macintosh, allows individual control of level, on/off and polarity of each Crown Com-Tech amplifier, providing power to a three-cluster JBL main speaker system. An AMX controller allows control of all of the IQ functions

from a touch screen. The system was designed and installed by Ford Audio's Tulsa, Oklahoma office, with consultation from Rhema Sound Engineer Cliff Paden. Ford Audio vice president Bryan Burdick served as project manager. Westlake Audio has sold five Crown Macro-Reference amplifiers to Todd AO/Glen Glenn Studios, the post production facility in Hollywood. The amps are used in Stage A, driving JBL theater speaker systems installed left, right and center, as well as boom speaker systems for 70mm shows.

Crown's IQ System 2000 software and CM-230 microphones were used at the Republican National Convention. Burns Audio supplied audio equipment and technical support as the sound contractor for the convention. Each state delegation was allotted one customized Crown CM-230 tridundant microphone. The IQ software allows only one microphone to be turned on at once.



Left to right: Mark Ockenfels of Burns Audio, Dr. Clay Barclay of Crown planning for the Republican National Convention.

puter control software and 18 Crown CM-30 supercardioid condenser choir microphones in the 4,500 seat sanctuary. The IQ System, using the IQ 3.1 version software for Macintosh, allows individual control of level, on/off and polarity of each Crown Com-Tech amplifier, providing power to a three-cluster JBL main speaker system. An AMX controller allows control of all of the IQ functions

Ramsa at Olympics

Ramsa has announced that during the Barcelona Olympics NBC used over 300 pieces of Ramsa equipment, including amplifiers, speakers and mixers at the Barcelona broadcast facility. Three Ramsa WR-S8616 mixing consoles mixed audio for each of the three pay-per-view Triplecast channels provided by Radio Television

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Olimpica '92 (RTO). RTO, a division of the local Olympic organizing committee that provided coverage for international broadcasters, additionally used 83 Ramsa mixers, Ramsa amplifiers and monitors.

TOA in Atlanta

TOA Electronics' new office in Norcross, Georgia is being directed by general manager Jonathan Parker. Given his new responsibilities, Parker has relinquished his post as TOA's manager of Professional Music & Entertainment products, and relocated to Atlanta from TOA's corporate headquarters in South San Francisco. The new facility provides dealers, consultants, and reps with full support and ordering services for all TOA products, and

houses its own demo room. Richard Krochmal, TOA director of audio products, said the new office is part of long-term plans designed to expand TOA's commitment to the U.S. market. Joining Parker in



Left to right: Ken Jorgensen, Jonathan Parker of TOA.

Georgia are customer service supervisor and applications coordinator Ken Jorgenson, communication systems eastern regional sales manager Bob Hager, assistant to the president — marketing Kazuo Musa, and two customer service representatives. The address of the new office is Spalding Woods Office Park, 3850 Holcomb Bridge Road, Suite 145, Norcross, Georgia 30092. 800-733-7088.

Clair Brothers Equipment in Use

Clair Brothers Audio Systems has announced that NBS, the regional sound company in Charleston, South Carolina which provides sound for festivals and concerts, has taken delivery of a Clair Brothers P-4 Piston system consisting of eight P-4 speaker enclosures. According to Mac Johnson, NBS principal, the benefits included "a small arrayable package, intelligibility and a straight-forward system that didn't require a dedicated processor."



Left to right: Mac Johnson, Chris Clanton, Paul Delcioppo set up P-4 Pistons in Charleston.

In other news from Clair Brothers, Merv Griffin's Resorts International of Atlantic City has renovated the sound system in the Rendezvous Lounge, adding a Clair system engineered and installed by Island Audio of Merrit Island, Florida. Hans Kennon, director of marketing for Island and formerly director of entertainment for the Trump Castle, selected Clair loudspeaker systems for the house and

monitor system. According to Island principal Carlos Gonzalas, "Merv Griffin is very particular about sound and believes in providing the absolute best quality for his guests." Clear line of sight was a major consideration in the installation; the 300 seats all needed an unobstructed view. Island Audio specializes in designing audio systems for resorts and "high profile venues." The company possesses a level two license, allowing it to be bonded on jobs of up to \$1,000,000.

Arrowhead Stadium Renovation

Arrowhead Stadium, home of the Kansas City Chiefs, has completed a major renovation of its sound system. Progressive Electronics of Grand View, Missouri was the sound contractor for the \$350,000 upgrade to the 78,000 seat stadium. QSC Audio reports that QSC EX series amplifiers were used. Craig Metzler of Progressive Electronics said, "We were awarded the contract for this job in May of this year, and our completion date was July 17, so this was one tight schedule." A total of 68 amplifiers were installed, including 21 EX 4000s, nine EX 1600s, 21 EX 800s and 17 Model 1100s. The main cluster consisted of Electro-Voice and Community loudspeakers, controlled by an IED system. Acoustical Design was responsible for the sound system design.

In other news, QSC Audio Products has announced that the model EX 4000 and EX 2500 amplifiers have received certification from the Canadian Standards Association. "The CSA certification expands the application potential of these products in public buildings throughout Canada," said Harold Keeling, safety compliance engineer at QSC. "The importance of these safety agency approvals is recognized by QSC, and we are committed to meeting their requirements both domestically and abroad with all of our products."

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REP NEWS

Shure Award to Cordial/Riley

Shure Brothers has named Cordial/Riley Marketing its Sales Representative of the Year. Based in Clarkston, Michigan, and covering Shure's Michigan territory, Cordial/Riley was granted the award based on "superior sales performance, outstanding customer service, and consistent communication with the factory."



Left to right: Al Hershner, Shure; Glen Cordial, Cordial/Riley principal; S.N. Shure and Bob Gilbert of Shure; John Riley, Cordial/Riley principal; James Kogen and Jeff Brownstein, Shure.

TOA Top Reps

Three rep firms have been named "Representatives of the Year" by TOA Electronics, Inc. Seattle-based Vector, Inc. was named for best performance in sales of TOA's Engineered Sound products. C.B. Electronic Marketing of Arvada, Colorado was named for highest sales on behalf of TOA Commercial Sound products. And LSM Associates of Rochester, New York was named for sales of Professional Music & Entertainment products.



Left to right: Jeff Pallin, TOA; Chuck and Larry Bickford of CB Electronic Marketing.

Grundorf Appointments

Grundorf Corporation has announced the addition of two firms to its sales force. Jamm Distributing will handle all Grundorf products in Indiana, Kentucky, Michigan, Minnesota, the Dakotas and western Wisconsin. Champion Sales, with its pro division headed up with Pat Lee, will be responsible for Texas, Oklahoma, Louisiana and Arkansas. John Amstadter, owner of Jamm, said, "We are proud to be able to represent such a quality line as Grundorf offers. Grundorf says the addition of these firms is part of a "continuing growth by the Council Bluffs, Iowa manufacturer of speakers and cases to widen its distribution base throughout the United States."

American Fibertek Names Reps

American Fibertek has appointed three manufacturers representative firms for its fiberoptic product line. R&D Sales Associates, Malden, Massachusetts, services Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island and Vermont. R.W. Kunz & Associates, Prairie Village, Kansas, covers Iowa, Nebraska, Missouri and Kansas. And 1 Volt Associates Inc. of Silver Spring, Maryland, covers North Carolina and South Carolina.

Allsop Hires Repco

The Allsop Consumer Electronics Division has announced the addition of Repco Sales Inc. of Illinois to its Consumer Electronics manufacturers representative sales force. Repco is responsible for northern Illinois, Lake County, Indiana, and eastern Wisconsin.

Wohler in Africa

Studer Revox South Africa Pty Ltd. of Johannesburg has been appointed to represent the Wohler Technologies product line throughout the southern part of the African continent.

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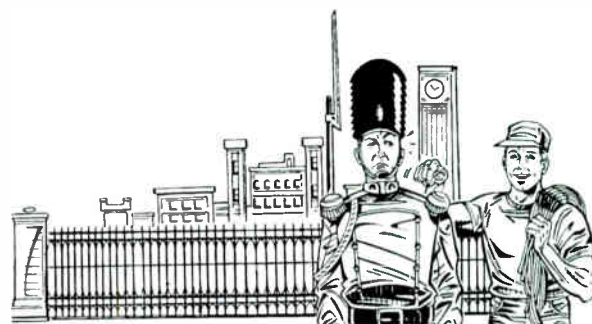
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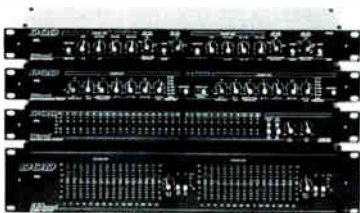
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PRODUCTS

DOD EQs; Infinity Subs

By Steve Jacobs



DOD Series II products.

Rack Products

The DOD Series II rack-mountable line includes products for applications ranging from musicians to commercial installations. The line features five equalizers, including the 231 seriesII that offers two separate 31-band EQs while occupying two rack units. Each band has its own low-cut and bypass switches with LED indicators.

The 830seriesII offers two channels of 15-band, 2/3-octave equalization and features electronically switched low-cut and bypass controls with LED indicators. The 430seriesII EQ has two channels of 12 dB boost and cut in a one rack space unit.

The line also offers the RTAseriesII realtime analyzer. The unit displays 31 bands in a vertical row of five LEDs with a choice of 4 dB or 12 dB windows that are switch selectable. A built-in pink noise generator and calibrated microphone with a 40-foot cable are included.

Circle 6 on Reader Response Card

Powered Subs

Infinity has introduced two powered subwoofers, the SSW-212 and the SSW-210. Aimed at multimedia and home theater installations the company cites placement versatility and visual appeal as being

Steve Jacobs is the Associate Editor of Sound & Communications magazine.

among the benefits of the subs.

The low frequency response of the SSW-212 and SSW-210 is to 25 Hz and 30 Hz respectively. A pair of IMG (Injection Molded Graphite) drivers (12-inch pairs for the 212, 10-inch pairs for the 210) are acoustically coupled. Voice coils



are designed for low throw, high-current handling. Power ratings for the subs are 300 and 250 watts for the 212 and 210, respectively.

Circle 7 on Reader Response Card

Adds to CAD

Mark IV Audio has introduced two computer sound system software packages, AcoustaQWIK and AcoustaROOM, as part of its AcoustaCADD line of sound system design assistance software.

AcoustaQWIK is a standalone software package that provides the fundamental functions for loudspeaker systems design. The program guides users through processes of selection and placement of loudspeakers.

AcoustaROOM is an add-on room model creating software package for AcoustaCADD. Like AcoustaQWIK, room models are created from pre-designed templates. AcoustaROOM has eighteen templates for typical auditoriums, performing arts centers and houses of worship.

Circle 8 on Reader Response Card



SAORI Upgrades

TOA Electronics has added three modules to its SAORI digital signal processor. The three modules are built to be used in existing SAORI mainframes. The IS-110AD is an 18-bit, two channel analog-to-digital converter, the IS-110DA is a 20-bit digital-to-analog converter and the IS-110TM is a timing module.

The new modules are designed to expand the 32-bit device's analog-to-digital and digital-to-analog dynamic range by 10 dB, while improving the signal-to-noise ratio, as well.

Circle 9 on Reader Response Card

Residential CCTV

ChannelPlus has introduced the model 7101 in-wall camera. Designed for indoor or outdoor resi-



dential applications the camera features an adjustable horizontal and vertical viewing angle that provides a 110-degree viewing area. The design is meant to be unobtrusive so that it appears to be a light or a

detector.

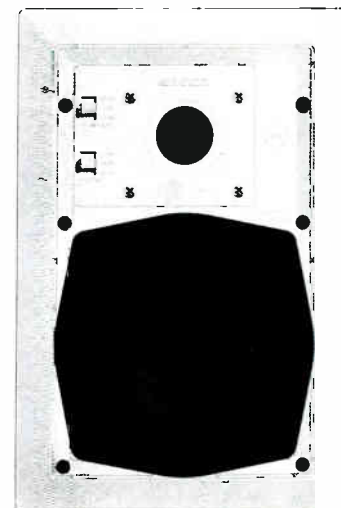
The camera is meant for use with a ChannelPlus modulator. The two provide an image and video distribution system. The camera can be viewed on unprogrammed UHF channels at TVs in the house. When used with other ChannelPlus products it can be part of a home automation system.

Circle 10 on Reader Response Card

Rectangular In-Wall Speaker

Sonance has introduced the S3500 two-way rectangular speaker that incorporates some of the features first developed for the round Sonance S3R.

The S3500 incorporates a pivoting tweeter with a neodymium magnet to permit placement flexibility and optimum output. A three-



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World Radio History

way switch on the tweeter faceplate allows the listener to adjust treble output over a 6 dB range. A second three-way switch can adjust the woofer's impedance and increases the bass as the impedance is lowered.

The basic Sonance look is kept while changing the footprint. The width of the speaker is 8 1/8 inches.

Circle 11 on Reader Response Card



Extending Subwoofers

The VBS412 has been added to Community's VBS series of subwoofers, which is designed to extend the low frequency performance of Community's RS Series and N-Series loudspeakers.

The VBS412 is electronically

controlled and contains four ferrofluid-cooled cast frame 12-inch drivers. It is rated at 2000 watts and produces bass to 35 Hz.

Circle 12 on Reader Response Card



Video Scan Converter

The RGB/Videolink 1600U video scan converter has added an RS-232 port to control functions from a computer. The RGB/Videolink 1600U transforms high resolution computer graphics to television format, allowing connection to video projectors, teleconferencing systems and composite monitors as well as recording on video tape machines.

The 1600U automatically synchronizes to all computer displays with horizontal scan rates from 20-90 kHz. A direct interface to video projectors and other display equipment accepts signals up to 32 kHz.

Circle 13 on Reader Response Card

DJ and Club Products

Gem Sound has added power amplifiers and an electronic crossover to its product line targeted to the club sound and mobile DJ markets. The PA650 and PA800 are two continuous-duty power amplifiers designed for non-stop use.

The PA650 is designed for continuous, high-level sound amplification and features thermal and output protection circuitry. The unit has 300 watts continuous output power at 4 ohms. The PA800 contains chassis-mounted heat sinks and fan cooling, and is rack mountable.

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Tour Guide System

Vega has introduced its Tour Guide System for situations where a roaming speaker must be heard by several listeners. Applications include museums, language translation in theme parks, remote monitoring of mix outputs in film production, or stage monitoring.

The Vega Tour Guide System consists of a Vega T-16 bodypack transmitter and a Vega PL-2 micro-miniature receiver. Receivers can be added depending on requirements and applications. The PL-2 receiver is a two-channel design that can receive either of two separate transmissions. The T-16 bodypack transmitter accepts lavalier or headset microphones.

Circle 14 on Reader Response Card



Tach Alarm

The Tach Alarm from Control Resources, Inc. is designed to protect sensitive electronics by monitoring cooling fan speeds and generating Pass-Fail signals. Tach Alarms are compatible with AC and DC air movers that provide tachometer (Hall Effect) pulses. The alarm outputs are compatible with logic circuits and with LEDs.

Circle 16 on Reader Response Card

LITERATURE

Contact East and Brady Information

Test Equipment, Tools and Supplies

A 48-page supplement to the general catalog has been released by Contact East. The supplement features test instruments and tools for engineers, managers, technicians and hobbyists. Features are products from brand-name manufacturers for testing, repairing and assembling electronic equipment.

Product highlights include: DMMs, EPROM programmers, power supplies, adhesives tool kits and portable digital scopes.

Circle 1 on Reader Response Card



Brady Resource Guide

A new standard set forth by the Telecommunications Industry Association (TIA) entitled, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings" establishes guidelines for installers and facility administrators involved with the telecommunication infrastructure. Part of this standard addresses the need for labeling telecommunications components. The Industrial Products Division of Brady USA, Inc. has developed the "Guide to the New TIA-606 Standard for Labeling Telecommunications Components" that details the labeling requirements for compliance with the standard.

Circle 2 on Reader Response Card

Intro to Fiber Optics

Video networks in homes and hospitals are examples of fiber-optic technology illustrated in

Corning Incorporated's booklet, "Fiber Facts."

The booklet provides a non-technical overview of the subject, including a brief history of optical communications and an explanation of the functions and capabilities of optical fiber. "Fiber Facts" also looks at what's ahead in the field of lightwave communications.

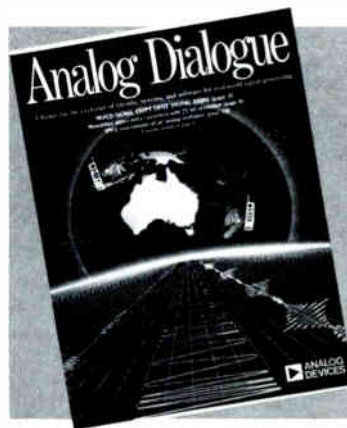
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Digital Scope Applications

LeCroy Corporation has published Application Note (ITI013B) entitled "Benefits of Digital Oscilloscopes in Communications," providing ten different applications using LeCroy's 9400, 9300 and 7200 series oscilloscopes.

Applications included are: Bus testing, Phase Shift Keying, and Constellation Display of PSK waveforms.

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Circuits, Systems and Software

Analog Dialogue is a quarterly technical journal on circuits, systems and software for signal processing. Highlighted in Volume 26, Number 1 are a pair of monolithic I/O chips providing critical functions for digital mobile radio for both TIA and GSM communications. The AD7001 and AD7002 are featured in the tutorial, "If Stages Are Going Digital for both Analog and Digital Signals."

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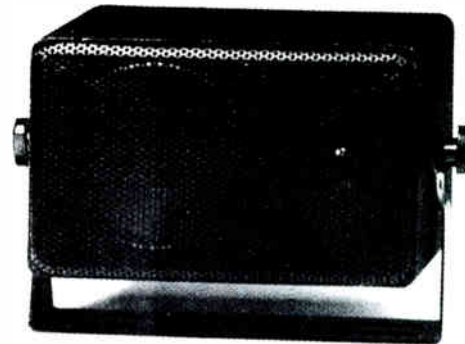
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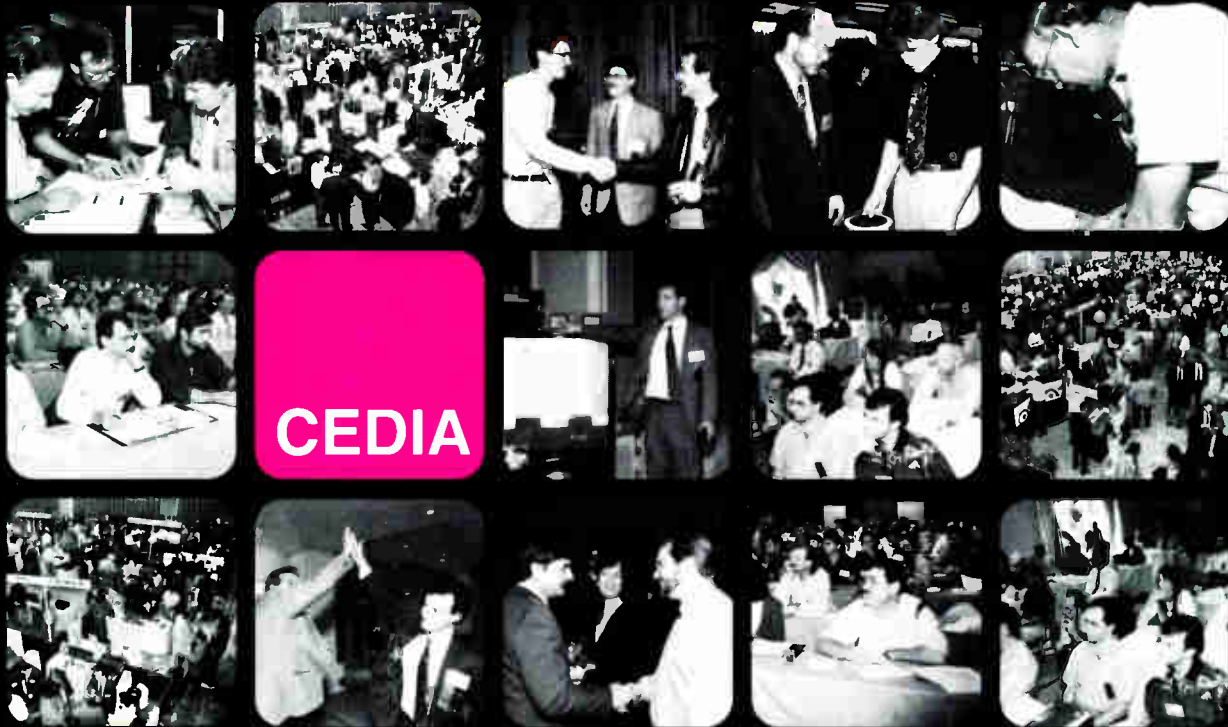
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PEOPLE

Ford for TOA; Ferrell Named

TOA Names Manager

TOA Electronics has appointed Bill Ford to the newly-created position of Marketing Manager, Digital Mixing Systems. Formerly TOA's Western Regional Sales Manager, Ford has had 15 years of pro audio experience in management, sales and recording to the position.



Ford

In his new capacity, Ford is responsible for directing the marketing and sales of TOA DSP-based digital mixing products in the U.S. Additionally, he is working with TOA personnel in the U.S. and Japan to develop new uses for DSP technology.

QSC Promotes Ferrell

QSC Audio Products has promoted Barry Ferrell to the position of Product Manager. Ferrell is responsible for providing technical development of new products and support of sales and marketing.

Sales at AMX

AMX Corporation has appointed Victor Hobbs as national sales manager. In this position, Hobbs supervises sales teams responsible for providing products and services to AMX's customers in the U.S.

Hobbs has more than 28 years of experience in the audio/visual industry with companies such as Electrosonic and his own Sound Logic.



Hobbs

Anderson at Meyer

MeyerSound has announced the appointment of Jamie Anderson to the newly created position of SIM operations manager. Anderson is responsible for the overall coordination of the department. He is additionally serving as a customer liaison in product support and customer service.

Previously, Anderson held a position at the University of Southern California, where he taught the "Theater Electrics" program.

Infocomm Appoints Gillen

Infocomm International announced that Kevin Gillen, president of Gillen Interactive Group, Inc. of Laytonsville, Maryland will manage Infocomm International's Multimedia Conference.

Gillen recently helped the International Television Association create a multimedia/interactive operation lab for ITVA's '92 convention. Gillen has been program manager for the Washington, DC chapter of the International Interactive Communications Society since 1986, and is a founding board member.

Warren at Electro-Voice

Minnie Warren has been named human resources manager at Electro-Voice, inc. In this position, Warren is responsible for the direction and administration of human resources activities and policies within the company. She is also active in employee relations issues.

Warren had served as an International Labor Union Representative.



Warren

Corporate Sales

David A. Curran has been promoted to the position of Director of Corporate Sales by Best Power Technology Sales Corporation. Curran formerly served as Best's National Accounts Manager for the South Central region.



Curran

In his new position, Curran is

responsible for strengthening Best's national reseller program and field sales.

President of Gates

Kim B. Edwards has been named president of Gates Energy Products, Inc. Edwards, who most recently served as vice president and general manager of Gates Energy Products/Consumer Business Division, replaces Robert H. Shiley who will retire on November 1 of this year.

Edwards has also held the position of vice president of marketing for Gates Energy Products

CALENDAR

Upcoming Events

OCTOBER

Audio Engineering Society (AES): San Francisco, California. Contact: (212) 661-2355. October 1-4.

Infosystem: Thessaloniki, Greece. Contact: 031-23 92 21. October 1-5.

Fiberoptic Splicing and Termination Workshop: Washington, D.C. Contact: (508) 347-7133. October 5-9.

Scan Tech: Anaheim, California. Contact: (412) 963-8588. October 6-8.

Custom Electronic Design & Installation Association (CEDIA): Dallas, Texas. Contact: (800) CEDIA-30. October 7-11.

Fiberoptic Splicing and Termination Workshop: Dallas, Texas. Contact: (508) 347-7133. October 12-16.

Int'l Business Music Association (IBMA): Ponte Vedra Beach, Florida. Contact: (816) 444-3500. October 14-17.

Instruments Society of America (ISA): Houston, Texas. Contact: (919) 549-8411. October 18-23.

NOVEMBER

International DJ Expo: Chicago, Illinois. Contact: (516) 767-2500. November 9-12.

SMPTE: Toronto, Ontario, Canada. Contact: (914) 761-1100. November 10-14.

COMDEX/Fall: Las Vegas, Nevada. Contact: (617) 449-6600. November 16-20.

Design Engineering Show: Anaheim, California. Contact: (203) 352-8372. November 19-21.

Networking '92: Kortrijk, Belgium. Contact: (617) 235-8095. November 24-26.

JANUARY 1993

Consumer Electronics Show: Las Vegas, Nevada. Contact: (202) 457-4919. January 7-10.

National Association of Music Merchants (NAMM): Anaheim, California. Contact: (619) 438-8001. January 15-18.

Infocomm: New Orleans, Louisiana. Contact: (703) 273-7200. January 11-17.

Imaging Conference and Exposition (IMEX): Miami, Florida. Contact: (617) 487-7934. January 21-23.

FEBRUARY

Image World: San Jose, California. Contact: (800) 800-5474. February 1-5.

ISC West: Anaheim, California. Contact: (708) 390-2462. February 16-18.

MARCH

InterMedia: San Jose, California. Contact: (203) 352-8297. March 30-April 1.

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FREE INFORMATION

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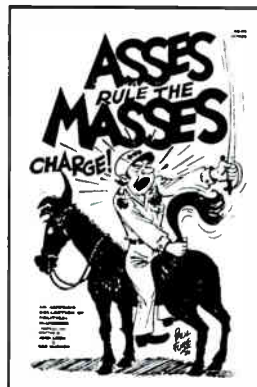
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	FIRST PLACE	SECOND PLACE	THIRD PLACE
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Horns	JBL	ELECTRO-VOICE	ATLAS/SOUNDOLIER
Drivers	JBL	ELECTRO-VOICE	PEAVEY
Subwoofers	JBL	ELECTRO-VOICE	PEAVEY
Speaker Systems	JBL	ELECTRO-VOICE	PEAVEY
Delays	YAMAHA	AUDIO/DIGITAL	KLARK-TEKNIK
Equalizers	PEAVEY	RANE	KLARK-TEKNIK
Microphones	SHURE	ELECTRO-VOICE	CROWN, ASTATIC*
Wireless Microphones	TELEX	SHURE	NADY
Mixers	YAMAHA	SOUNDCRAFT	PEAVEY
Power Conditioners	BEST POWER	JUICE GOOSE	FURMAN
	TECHNOLOGIES		
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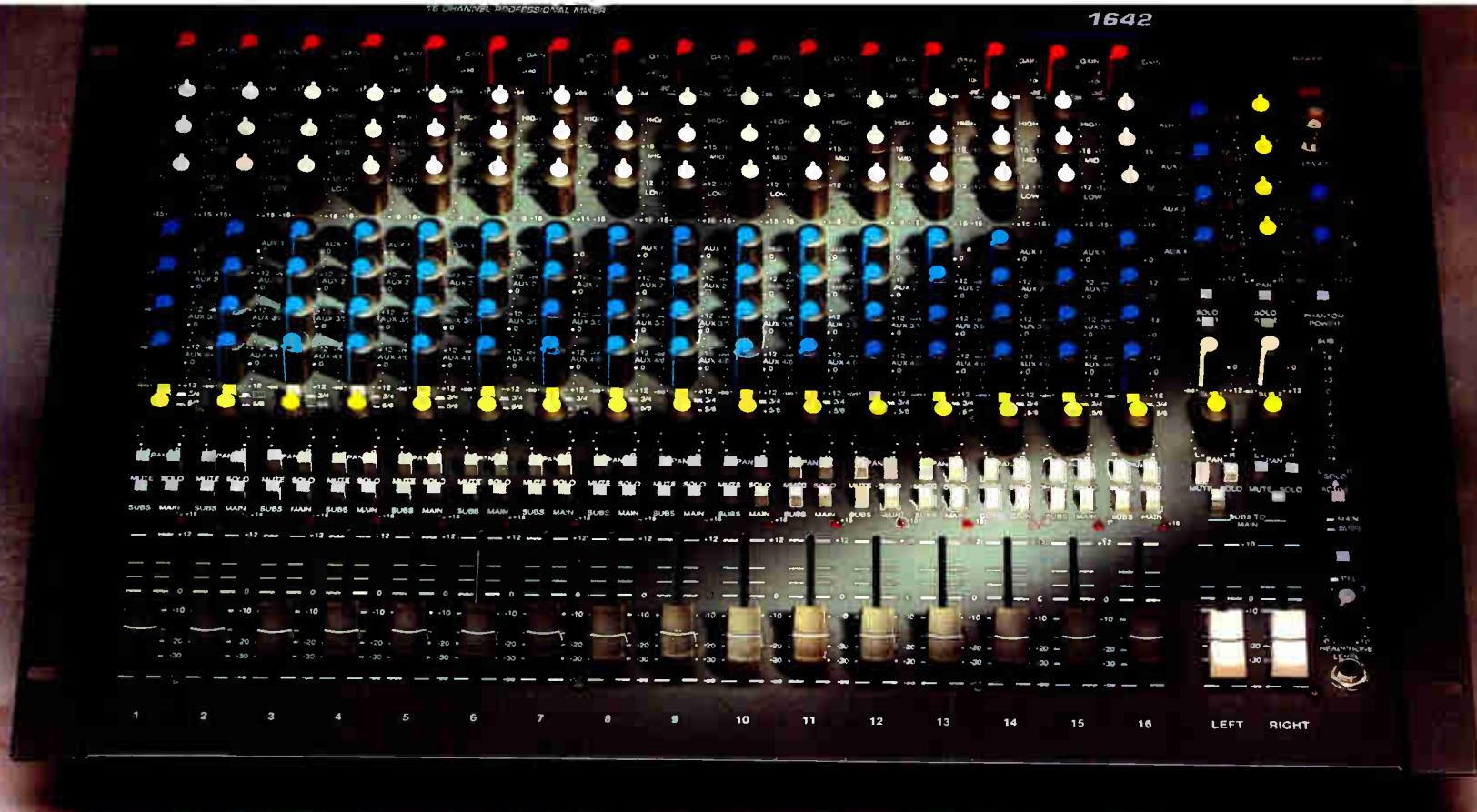
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	TECHNOLOGIES		
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SURVEY METHODOLOGY

1. The sampling pool for the survey consists of sound and communications contractors from Sound & Communications' subscription list. Only contractors within the United States and Canada are called.
2. In a telephone survey, contractors/installers selected at random are asked to identify what brand they used for various products in installations completed in the past six months and those in progress. A different type of installation is highlighted each month.
3. On completion of the survey, results are tabulated and the product brands are ranked on a scale from one to three, with number one having the most votes. Separate rankings are made for installations occurring in the past six months and for those in progress.
4. An asterisk (*) denotes a tie for that ranking.



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DELTA SR: THE PERFORMER

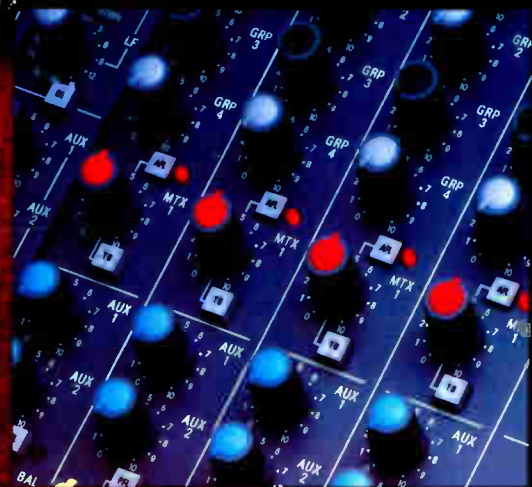
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