SOUND & COMMUNICATIONS

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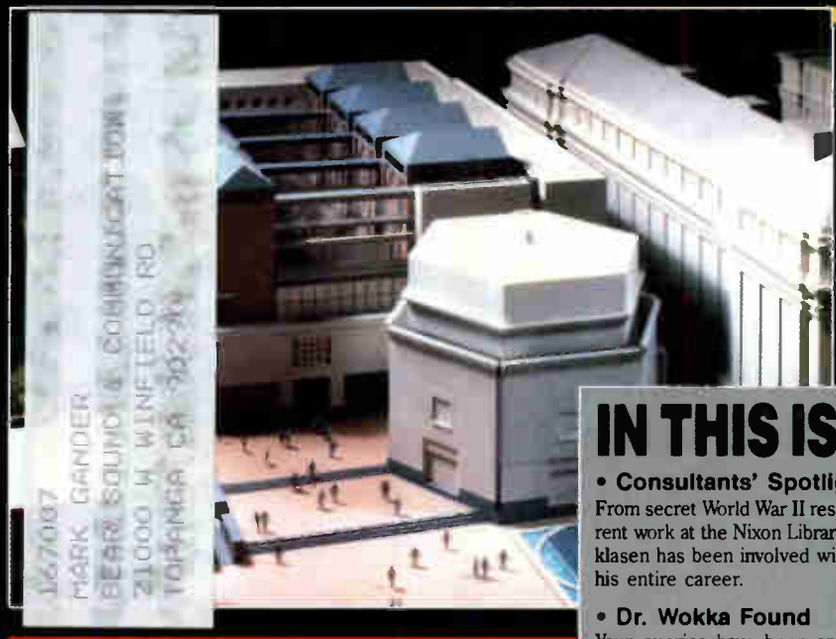

ATTRACTIONS AND MUSEUMS

Are there hard times in leisure-time jobs? Enough people are keeping busy at theme parks, museums, libraries and the like to keep these venues' reputations for sexy sources of good business. **31**

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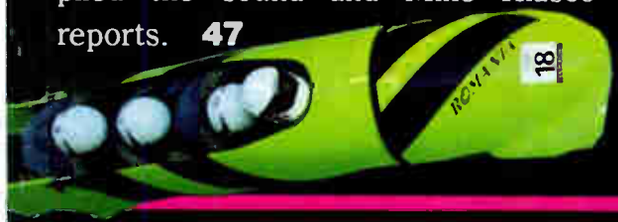
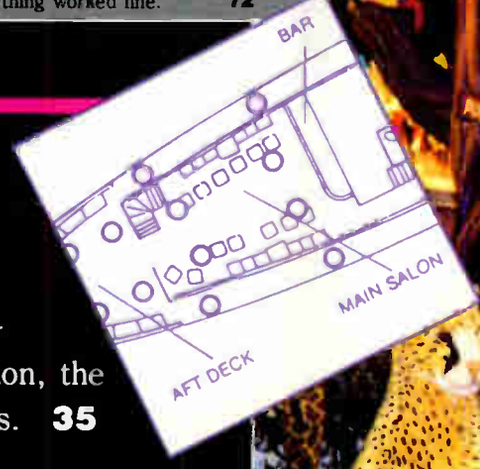
THEME PARK COMPLEXITIES

The show must go on. Minimally skilled personnel, passing vandals, and an environment of make believe are demanding some of the most sophisticated hardware — and software — in the business. What's being used? **64**

SUPPLYING THE OLYMPICS

For the third time in five years, Sound & Communications covers the Olympics. What was seen — and heard — in Albertville? Bose Corporation supplied the sound and Mike Klasco reports. **47**





MARINE WORLD

Dolphins, tigers, and killer whales all need to be heard, intelligibly, at Marine World/Africa USA. With seven arenas, background music, and its own recording operation, the park's audio system is extensive and serious. **35**

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◇Did we forget to mention we're giving away a free Duracell Alkaline battery with the purchase of a Concert Series II System? Offer expires October 1, 1992.
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LETTER FROM THE EDITOR

The Importance of Conventions

When a friend of mine set off for the Candy Convention, we treated it as a joke, and thought she must be having a lot more fun in her work than the rest of us. In truth, aside from the fact that she gained five pounds (her new product samples were edible), her experience wasn't that different. The Candy Convention, like any convention, has a series of parameters that benefit an industry.

From a philosophical standpoint, a convention is a necessity. Whether one is an astronomer or an acoustician, the act of convening acts as an anchor to individual endeavors geographically dispersed. The convention serves a series of purposes.

Basically – and here we're dealing with opinion – there is no market without a convention. That's part of the reason conventions appear, disappear and suffer sea changes as a market develops, crests and changes with the times. If a convention doesn't change with the market, it disappears (and we've all seen some of that).

At the candy convention, my friend sampled new products, talked shop (or shoppe), walked her feet off, and stocked up for the big selling season (Halloween). She networked, heard of new merchandising ideas, attended seminars, and did some deals.

We're fortunate in the next month to have two conventions that are in tune with the times. We're about to take off for NSCA Expo '92, sponsored of course by the National Sound and Communications Association. Expo devotes a great deal of its energy to seminar programs, certification programs, and learning experiences. With the addition of the exhibitors, the Contractors Caper sponsored by manufacturers reps, the West Penn party sponsored of course by West Penn, the NSCA Expo fulfills, I think, the function of a central organizing entity to an industry. As one would expect in a vital industry, new exhibitors will show at this NSCA (Hughes, Clair Brothers, Colloseum). Established lines gain new distribution (Wharfedale at Optim Audio). And one can get a sense of the totality of a market. We'll be at NSCA in Anaheim close to the time you read this, and we'll report on it in the following months. We'll also report on it of course on NSCA-TV News, our television news program produced and transmitted in Anaheim.

Shortly after NSCA, also on the west coast, DJ Expo is being held at the Sheraton Universal in Los Angeles. This convention too offers an anchor to a diverse industry, fulfilling needs of participants from Club DJs to club sound designers. The dates of DJ Expo are May 4 through 7, and features seminars, exhibits, and special events. DJ Expo, as many of you know, is sponsored by DJ Times magazine and produced by its publisher, Testa Communications, which also publishes Sound & Communications Magazine.

We'll see you at both conventions.
Happy networking.
Best regards,

Judy Morrison

Judith Morrison
Editor in Chief

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FROM MICS TO SPEAKERS

Photo-Guy Boudia

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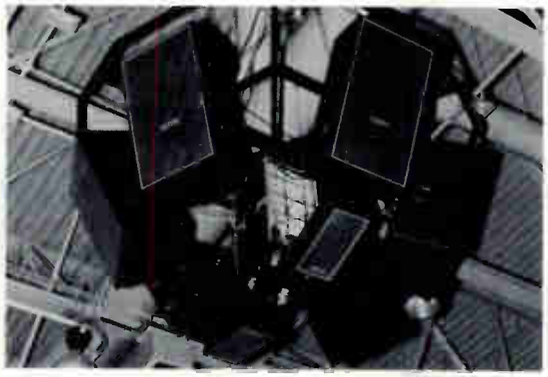
The Kingdome



"I was able to enjoy a number of performance benefits by locating the amplifiers in the center of the cluster. That positioning would not have been possible without the control and monitoring afforded by the Crown IQ system."
Greg Stielstra
Mavri Incorporated
System Designer, Kellogg Arena

"The IQ 2000 system was easy to install. The performance is rock solid and dependable. It has added new dimensions and flexibility to our audio system since we can tailor the system to each audience and artist. We even use it for energy management. The system has more than justified its cost."
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Las Vegas Hilton Showroom
Head Audio Engineer
System Designer

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FEATURES

DEPARTMENTS

Behind Every Virtuoso, There's Years Of Practice.

Europa

Virtuosity takes practice. And almost two decades of practice have gone into producing the definitive front-of-house console: Soundcraft's *Europa*. The best circuit designs, like our patented padless mic amp and active pan pot. Balanced sends, returns, inserts; fully-parametric EQ and a noise gate on every module. The list goes on.

But the secret of *Europa* isn't just ours — it's yours. We asked professionals working in every area of live sound what they wanted in an FOH console. And we designed *Europa* with you in mind.

It's designed to withstand the rigors of the road. The frame is immensely strong, built to prevent twisting. Handles run the length of the console to make it easy to lift. Multiway connectors are recessed to reduce strain, mounted to resist damage.

The smallest detail has been scrutinized. The knobs, for example, combining "grippability" with style so ingeniously, we patented them too. No dual concentric controls on the entire console — you won't tweak the wrong thing. All switches are illuminated or associated with LEDs.

Europa combines superb design and audio quality with value for money. Without compromise. A full eight groups plus mono and stereo buses, twelve aux sends, matrix sections with external inputs for additional submixes and eight stereo inputs are standard. Full VCA facilities with non-destructive soloing and multiple assignment. You can even continue a soundcheck while playing a CD to the audience. And fade the entire console on one fader. If you've always wanted something on a live sound console, it's probably on the *Europa*. You asked for it; we put it there.

Now you need to listen to *Europa*. Try it out. Experience a level of sound quality that you'd usually associate with a digital studio. Hear why *Europa* is in a class of its own — virtuoso class.

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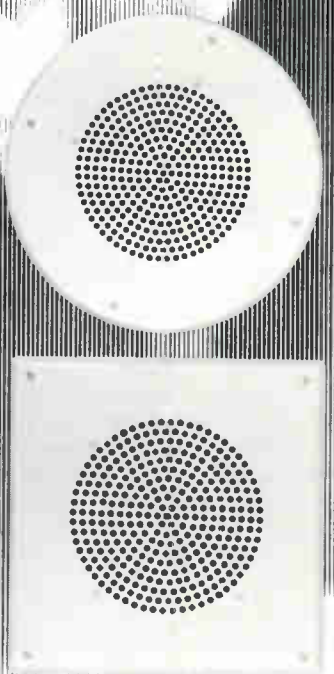
The security secret of these new vandal-proof baffles is the potent combination of high tensile strength 14 ga. carbon steel, plus a durable interior steel screen to give the speaker further protection, and security socket screws for mounting. The white powdered epoxy finish is virtually chip-proof and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

STEEL ON STEEL DESIGN PROTECTS LOUDSPEAKER INSTALLATIONS



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NEWSLETTER

QSC FORMS NEW DIVISION

QSC Audio Products has formed a new division, Sonetic Laboratories, to manufacture a line of standard feature, low cost power amplifiers "as a departure from QSC's more sophisticated power amplifiers." The division is being launched with three models, all of which feature complementary circuits, clipping indicators, active balanced inputs, one-quarter inch RTS and barrier strip input connectors. One model features passive cooling; the other two use a two-speed fan for cooling.

AIPHONE ADDS TO GOVERNMENT SERVICES

Aiphone Corp. has promoted Diana Potts to the newly created position of government coordinator, responsible for all Aiphone installations involving government facilities. Jun Matsumoto, president of Aiphone, said, "The security restrictions usually applied to government facilities will present us with many new challenges, as well as opportunities for expanding product technology." Potts was previously manager of customer care for Aiphone.

CROSSCOM AWARDS CONTRACTORS

CrossCom National has presented awards to several contractors. Michael Bates of Comtech Business Systems in Dallas has been named "Contractor of the Year." John Thomas and Todd Cole of Network Media Services in Austin have won the "Minuteman Award" given to the contractor who as the "highest percentage of achieved goals in the emergency and standard service categories combined." Howard Salter of Universal Communications in Houston has been named "New Contractor of the Year." Cheryl Sturr of Desert Telephone Systems in Phoenix won the "Superman Award" given to the contractor with the lowest average response time on emergency and standard calls combined.

PRICE REDUCTION

Yamaha has reduced the suggested retail price of the YPDR601 Professional Disc Recorder, from $20,000 to $13,980. The YPDR601, introduced in August of 1991, features a full function remote control, and allows partially-recorded discs to be played in any CD player.

DIGITAL MOVIE THEATER SYSTEM INTRODUCED

ARC International Corporation has announced that Ballantyne of Omaha, its wholly owned subsidiary, is introducing the Strong DLS6 Digital LaserSound System, a complete system using a 12-inch laser disc encoded with six discrete channels of digital sound, with up to eight channels for special applications. Cinema Laser Technology, a division of Ballantyne, will encode the original sound track of the motion picture on a 12-inch disc. By optically reading a SMPTE time code track placed on the film, outside of the sprocket holes, the DLS6 will automatically synchronize the movie's laserdisc audio with the projected film image. The existing analog soundtrack remains on the print. The complete system retails for "under $10,000."

RBDS STANDARD

The Electronic Industries Association's Consumer Electronics Group has announced that it is proceeding with the development of a standard for the Radio Broadcast Data System. The RBDS standard was developed under the auspices of the National Radio Systems Committee, a technical committee sponsored jointly by EIA and the National Association of Broadcasters. However, NAB has adopted a policy statement saying that it will support RBDS for both AM and FM rather than FM only.

ALLEN & HEALTH CONSOLE SHIPPED

DOD Electronics. the U.S. distributor of the Allen & Heath line of mixing consoles, has announced the first shipment of the new GS-3 mixing console in the United States. The console is an "ultra-compact" pro audio mixing console featuring a full on-board MIDI mute automation system based on the V4 plus system.

NEWSLETTER

PORTLAND INSTRUMENT LICENSED BY HME

HM Electronics, Inc. has announced that the 700 series Professional Cabled Intercom products will now be manufactured and distributed by Portland Instrument Corporation under an exclusive license agreement. According to HME, Portland Instruments adds the HME 700 to its family of ROH and Port-A-Com products. HME continues its direct distribution of its wireless intercoms and microphones.

SHOWBIZ EXPO

The Ninth Annual ShowBiz Expo '92, to be held at the Los Angeles Convention Center June 20 through June 22, will have as its theme, "Creativity Directs Technology." The show is expected to have over 300 exhibitors including manufacturers of cameras, lenses, lighting, and sound equipment.

CARL C. ICAHN KEYNOTES EDS

Carl C. Icahn, chairman of TWA, will be the keynote speaker for the 1992 Electronic Distribution Show and Conference at the Las Vegas Hilton on May 4 at 4 PM. Icahn's address is expected to cover business survival in today's economy, and electronics industry interests and relationships with the world of aviation.

ANALOG DEVICES UNVEILS MODEL

Analog Devices, Inc. has introduced a "road map that could dramatically accelerate the use of sound, voice, image and communications capabilities in personal computers and electronic equipment." The new model, called Signal Computing, defines an open systems structure for third-party software that the company expects to "significantly lower the delivered cost of signal processing technologies, thereby enabling manufacturers to incorporate new media and communications capabilities in their products." In its simplest form, according to the company, a specific algorithm solution such as CD-quality sound compression, is embedded with a compatible signal port device and signal processor into a PC.

TOA OPENS ATLANTA OFFICE

TOA is opening an office in Atlanta, to be headed by Jonathan Parker. The office will provide sales and technical support, plus headquarters for southeastern intercom sales.

HAZAMA NAMED PRESIDENT OF JVC

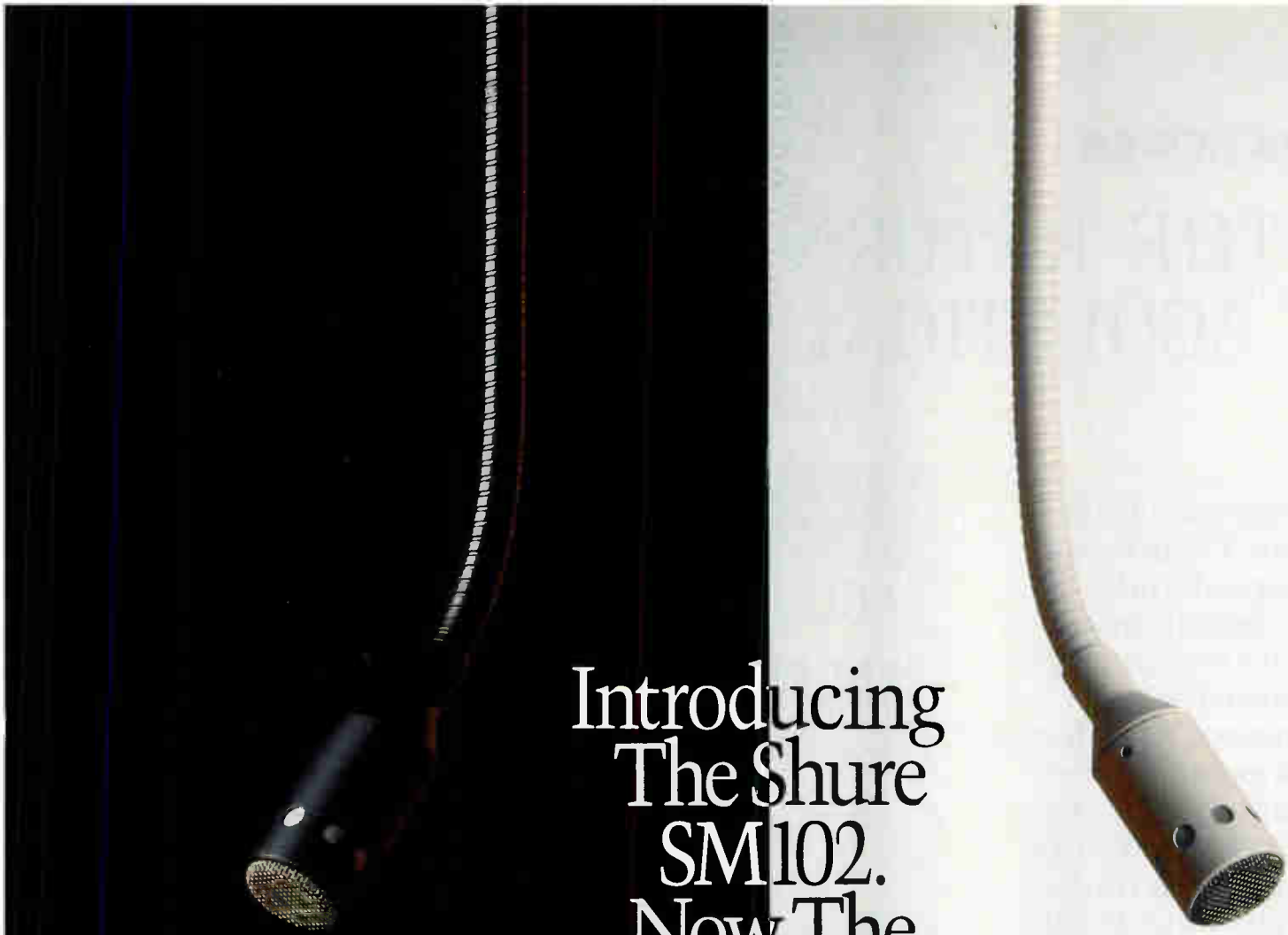
Hajime Hazama has been named president of US JVC Corp. and JVC Company of America. Hazama had been president of JVC Limited, based in London, for six years. His responsibilities now include overseeing operations of JVC Company of America, JVC Professional Products, Manufacturing Company, Service & Engineering, Information Products, and JVC Laboratory of America, which are all divisions under the umbrella of US JVC Corp. He also serves as president of JVC Company of America. Hazama replaces Hiroshi Sano, who returns to Japan as managing director, member of the board, and general manager of the Consumer Marketing Division for Victor Company of Japan.

UHF LICENSING

The Federal Communications Committee has removed the ban on the licensing of UHF wireless microphone systems above 530 MHz. Vega, which had petitioned the FCC asking for the change, said, "The FCC action significantly opens up the UHF band and will help eliminate any potential overcrowding problems which could have occurred. According to Vega, removal of the UHF restriction now means that broadcasters and producers can easily license Vega's UHF systems over their full frequency range of 494 to 695 MHz." Gary Stanfill, Vega president, said, "The is will insure availability of interference free wireless microphone frequencies in the future."

CEDAR INSTALLED

EMI, the U.K. record company, has installed the CEDAR Restoration and Production System at Abbey Road Studios. CEDAR, which stands for Computer Enhanced Digital Audio Restoration, removes noise via a menu driven system, and runs in real time. Other installations of the system include Tape One Studios, Charly Records, and Channel 4 Television.



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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.

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

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BOOK REVIEW

THE RETURN OF A CLASSIC: ACOUSTICAL ENGINEERING

By Neil A. Shaw

Dr. Harry F. Olson was the Director of Acoustical and Electromechanical Research of the RCA laboratories at Princeton, New Jersey and was later Vice President of the Lab. He was a giant force during the explosive growth of electronic sound that followed the addition of sound to motion pictures and a major player in the intense competition between RCA and Bell Labs that saw immense sums poured into research and development of electroacoustic technology.

Dr. Olson has written many books, among them Musical Engineering (1952), Dynamical Analogies (1943), and the classic series — Elements of Acoustical Engineering, First Edition (1940), Elements of Acoustical Engineering, Second Edition (1947), and Acoustical Engineering (1957)

(known in the industry as "The Holy Grail").[1] Except for a Dover Publications reprint of Musical Engineering retitled Music, Physics and Engineering (1967), those of us in the industry who have wanted a copy of Dr. Olson's books, especially Acoustical Engineering, found it necessary to frequent the back aisles of used bookstores in search of a worn copy of the original D. Van Nostrand editions. In many respects, this experience seemed much like the fruitless searches of Jason in his epic journeys for the Golden Fleece.

No longer must we search in vain, for an excellent facsimile reprint edition has been published [Acoustical Engineering, by Harry F. Olson; Professional Audio Journals, Inc., Philadelphia, Pennsylvania; $49.95]. This sumptuous volume, an exact copy of the original, is, in many physical properties, superior to the original. The paper is a heavy acid free type and the binding is superior to many texts that cost two to three times that of this edition.

In this facsimile edition of the 1957 original, for which I understand a mint copy of the D. Van Nostrand edition was used to make the plates, Dr. Olson in 16 chapters systematically takes us from the basics of acoustics through electroacoustic transducer's and systems, measurements, architectural acoustics, speech, music and hearing, underwater sound and ultrasonics.

Of special interest to persons involved with audio are the chapters concerning Acoustical Radiating Systems (chapter 2), Direct Radiator Loudspeakers (chapter 6) and Horn Loudspeakers (chapter 7). A thorough reading of these chapters can give a reader a firm understanding of the basic phenomena of horns and direct radiators. From these chapters, one can readily discern when a "new" transducer's advancement is real or, shall we say, just a gleam in the marketing department's ear. The wealth of information contained here is practically indescribable. These chapters are the heart of the book and although they may have been supplemented by others and other books, these chapters and the cornucopia they contain have never been supplanted.

There are chapters on Microphones (chapter 8) and Measurements (chapter 10). Acoustical Engineering also provides excellent coverage, although at times seemingly dated, on Architectural Acoustics and the Collection of Sound (chapter 11) and on Speech, Music and Hearing (chapter 12). Dr. Olson, in his section on the "Collection Of Sound," is referring to "sound collecting systems," *i.e.*, studios in broadcast stations, scoring and re-

Neil A. Shaw is a Senior Associate with Paul S. Veneklasen and Associates, consultants in acoustics and audio/visual systems, Santa Monica, California.

cording studios, and their like. In his discussion of speech, music and hearing, Dr. Olson presents the absolute limits and performance characteristics of the human hearing system and its response to music and speech. The information presented here has not changed appreciably since its publication, and is of considerable use today. These basic limits and parameters of the human auditory system can not be exceeded. Suggestions to the contrary by some "evangelists" in our industry seem to be based more on "faith" than on fact.

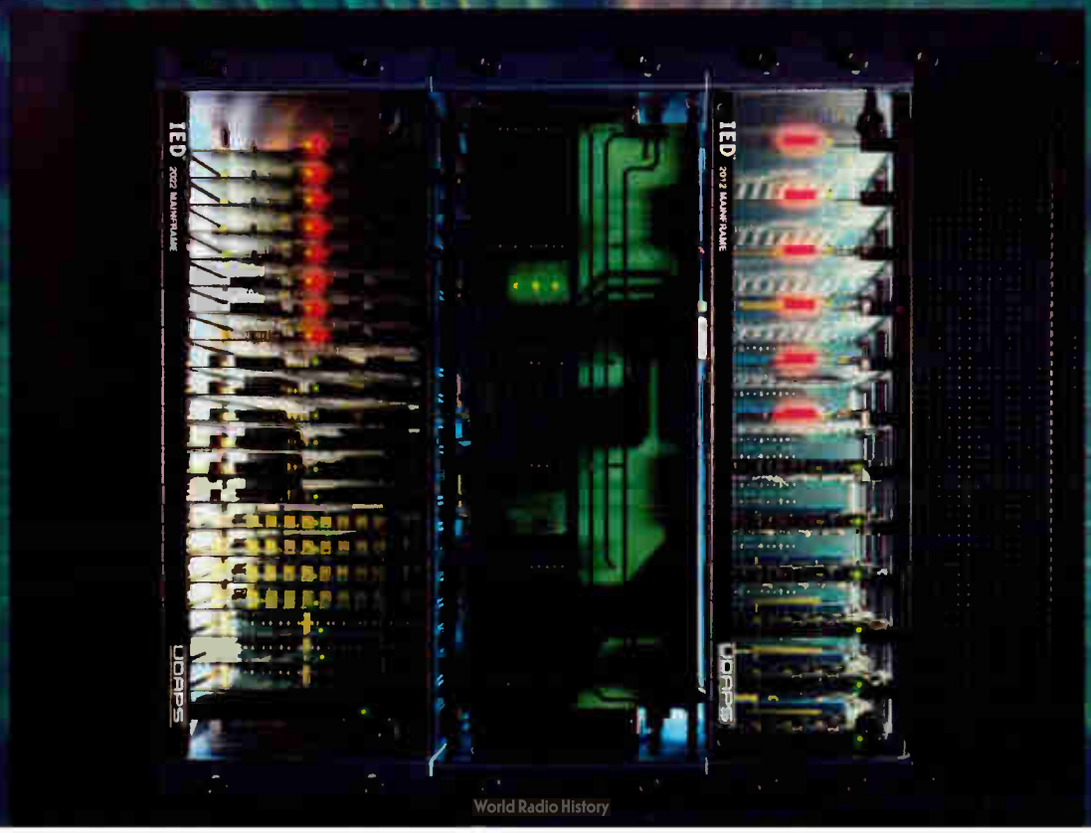
Also of great interest to practitioners is the chapter on Dynamical Analogies (chapter 4). Here, Dr. Olson summarizes the use of "analogies when it is desired to compare an unknown system to one that is better known." The mathematical representation of the known system, and the visualization thereof, enables one to extend the line of reasoning into unexplored fields.

This classic text, now that it is again readily available at a modest cost, deserves a place in the ready reference library of all who consider themselves serious students of audio, sound and communication.

[Editor's Note: *Acoustical Engineering* features an introduction by Jesse Klapholz, editor of Professional Audio Journals; an updated biography of Olson; and a bibliography of selected articles Olson published between 1957 and 1980. *Acoustical Engineering* is available from Professional Audio Journals, Post Office Box 31718, Philadelphia, Pennsylvania 19147-7718; (215) 465-1975. Cost is $49.95 plus $4 shipping and handling ($8 international).] ■

[1] The Holy Grail," as applied to Acoustical Engineering, is attributed to Arthurian knights Mr. Mark R. Gander and Mr. John R. Eargle. When contacted about this, both credit the other, while both acknowledge disseminating the appellation.

A Revolutionary State of Mind



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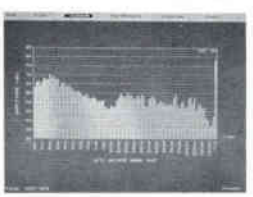

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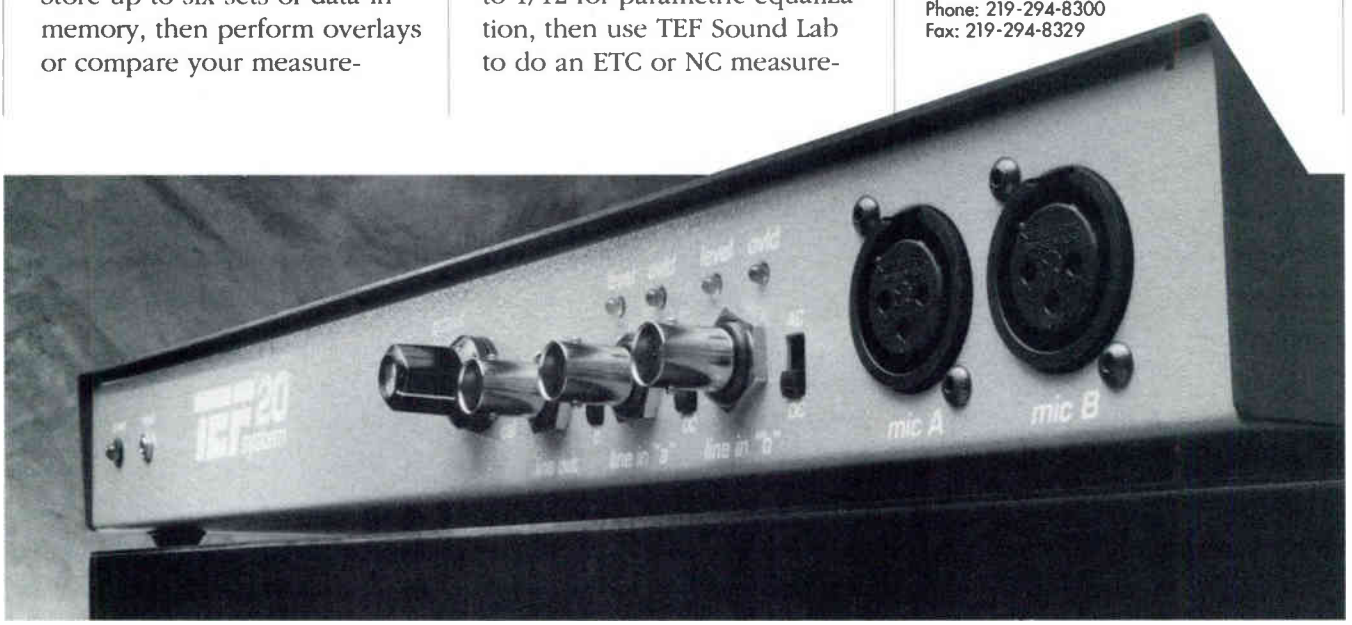

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Processing Loudspeakers, Part III

Beyond the Turnkey Approach

BY DANIEL SWEENEY and MIKE KLASCO

In the previous installments of this series we discussed the history of the processing loudspeaker as a recognizable component category, the major design approaches prevailing today, and the product offerings that are currently available. In this final segment we'll examine an emergent category where highly versatile configurable processors are designed to extend the approach universally. Additionally we'll also make mention of an expanded directions to processing such as the amplifier-speaker interface including active parameter synthesis and future possibilities such as predistortion and adaptive filtering.

The Yamaha D2040 digital crossover/system controller.

THE BIRTH OF THE SUPER PROCESSOR

Historically processing speakers have been turnkey systems with dedicated electronics, and, in some instances, transducers and enclosures which cannot feasibly stand alone. In such designs the processor is virtually integral even though it is not actually physically built into the speaker system. Most processed systems used professionally today are still built around dedicated electronics, but a number of companies currently offer so-called universal processors for use with a wide variety of different speaker systems.

Universal processors are hardly a stable, standardized product category at this time, and the relatively few products which could be deemed universal take a number of forms, both in terms of internal circuitry and basic layout, but most share a broad, general approach to system control.

Universal processors tend to approach universality both in terms of the variety of speaker systems they can effectively control and in the sheer number of their basic processing capabilities — and in fact these two forms of versatility are interrelated. Many such processors include provisions for frequency division, limiting, equalization, and time delay all in the same module, and generally a multitude of options are offered within each processing function.

The processor itself may take the form of a single rack mount black box — the usual form of the DSP systems discussed below. Analog systems such as the Symetrix are more likely to take the form of a card and mainframe system. A few companies, most notably BGW, take integration much further and include the processor cards within the power amplifier.

THE DSP PROCESSOR/ CONTROLLER — A UNIVERSE IN A BOX

DSP has been the technology of the future for the past ten years and to some extent it still is. The huge majority of signal processors used in professional audio are still analog and analog is unlikely to be superseded any time soon. But in the still embryonic category of the

Daniel Sweeney is a freelance writer in the Los Angeles area. Mike Klasco is the Technical Editor of Sound & Communications.

universal loudspeaker processor/controller DSP, is already the norm and analog circuitry the exception.

Digital hardware naturally lends itself to a large variety of diverse applications simply because filter parameters and level setting may be established in software, and the same digital circuits may thereby be made to perform a multitude of tasks including several simultaneously. And because filter functions are synthesized, the processor can be programmed to execute almost any function or combination of functions up to the limit of total processing power.

Moreover, individual settings can be stored permanently in memory or preprogrammed. The user can select whatever program is appropriate with no fear of component drift or unauthorized knob twiddling by technicians or musicians.

Another advantage of digital processors is almost infinitely variable time delay. Analog circuits using all pass filters can practically achieve only a few milliseconds of delay at most. A digital delay, because it holds the signal in memory, can delay it any length of time, and in Yamaha's processors; the C20 and D2040, delays of over a second are possible, allowing installation in distributed systems or remote clusters without the need for an additional delay line.

Still another plus for DSP lies in the possibility of synthesizing filter characteristics which aren't really feasible in the analog domain. Digital finite impulse response filters (FIRs) will provide effectively infinite filter slopes, and the outputs of such filters may be easily time aligned with digital delay lines.

An even more intriguing possibility inherent in DSP is adaptive predistortion whereby the processor diagnoses the nonlinearities inherent in the speaker system arising from basic system operating parameters and the characteristics of individual drivers, and then predistorts the input signal to correct for such nonlinearities. A related strategy would involve equalizing the speaker system to individual room acoustics automatically by FFT or TEF analysis of direct output as well as room response, with compensatory equalization then applied automatically by the processor.

Adaptive predistortion and automatic room equalization have yet to be offered in any commercial system, but equipment designed to perform both strategies is under development. For example, Sound Technology's RTA-4000 analyzer, reviewed a few months ago in Sound & Communications, provides an RRC (room response curve) mode which determines

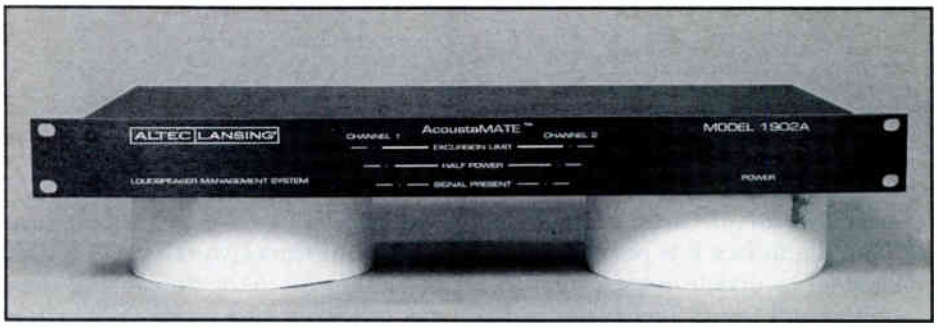
the response curve from the music. Using the serial interface it is possible for the RTA-4000 to update a programmable equalizer and Sound Technology is discussing this with a number of equalizer manufacturer. Almost five years ago TOA presented an AES paper on a self-equalizing speaker, but has yet to bring this technology to market. Eclipse, a division of Fujitsu Ten, a giant Japanese auto sound firm, introduced a true adaptive self-equalizing system for cars at the CES last January. This is the real thing, down to the digital parametric equal all. Perhaps someday our pro-sound technology will catch up to the sound systems our customers listen to in their cars when they travel to our installations!

Current universal processors using DSP perform frequency division, limiting/compression, equalization, and time alignment. The range of user choices within each processing function is already quite extensive. The TOA SAORI is perhaps the most elaborate of these new processor units, and includes a third octave equalizer with selectable filter Q, four notch filters with selectable Qs and center frequencies, a special constant directivity horn equalization setting, and a four channel electronic crossover with selectable slopes, filter Qs, and frequencies. The SAORI also provides two separate time delay functions, one for aligning drivers within an individual speaker system, and another for delaying the outputs of entire speaker clusters. The SAORI is often used in conjunction with computer control.

A more modest digital design is the Peavey PC4-XL which is basically a four-way electronic crossover, but includes limiting, multiple delay taps, parametric equalization with shelving high and low pass filters, and horn equalization. The unit is provided with memory for up to fifty settings, and access code protection.

JBL's ES52000 digital controller combines the functions of two way dual channel or two, three or four way single channel crossover, equalization, time delay and protection limiting. The ES52000 offers infinite slopes (50 to 100 dB per octave) on the crossover, and artifact-free digital limiting. Loudspeaker system settings are contained in a factory programmed ROM integrated circuit, so a technician must install a new ROM if previously unsupported speakers are to be used with the ES52000.

Yamaha makes two digital processors, the D2040 and the C20. The C20 is a further development of Yamaha's DDL3 technology. Based on proprietary DSP chips and converters, the C20 is a single rack space, single channel processor that



The Altec Lansing model 1902A AcoustaMATE.

was first offered for use with the YST Sound Reinforcement Series. Three sets of outputs, for subs, bass and mid/high, each have user-defined crossover points, and limiter/compressor parameters. The user may select 6, 12, 18, or 24 dB per octave slopes, filter characteristics (Butterworth, Bessel, Linkwitz-Riley, etc.) and asymmetrical crossovers are supported. Specific settings for many different venues can be called up with the push of a button. Compensation for bass build-up in clustered arrays and high frequency air absorption are optionally selectable. Three different levels of user access are provided by a rear panel switch.

The D2040 is a four-way, two channel electronic crossover with separate limiting, equalization, and delay for each channel. The D2040 supports the AES/EBU for computer controlled applications.

Adamson claims two digital processors also, the DSPX 4000 and the ARCX 4000. The DSPX 4000 is an electronic crossover/equalizer using infinite crossover slopes and minimum phase equalizer filters. It also includes a digital spectrum analyzer for comparing the input spectrum to that of the acoustical output as measured in the actual listening space. Adaptive room correction may then be applied via the ARCX 4000, a device which is still under development at the time of this writing.

White entered the universal processor field with the introduction of their DSP 5000 parametric equalizer/digital delay line/electronic crossover at New York AES last October. The DSP 5000 is a single channel four-way system. Six, 12, 18, and 24 dB/octave slopes are supported in the crossover, as well as filter characteristic (Butterworth, Bessel, or Linkwitz-Riley). Up to 13 bands of parametric equalization, are available with adjustable center frequencies of 20 Hz to 20,000 Hz.

ANALOG PROCESSORS

Altec Lansing is just now putting the finishing touches on its AcoustaMATE 1902A Loudspeaker Management System. AcoustaMATE is a dual channel universal processor system. It can be used with any loudspeaker system for which a plug-on personality module has been developed. By the way, I refuse to get into the semantics of processors and controllers — this is worse than arguing on how many angels can dance on the head of a pin, but is more like how many angels are wearing tap shoes versus army boots. In any case, AcoustaMATE differs from the typical processor in that it is used either with speaker systems with passive crossovers or in conjunction with an electronic crossover. The purpose of AcoustaMATE is to enhance the sound quality through "exciter" processing. The intent is to make sounder, fuller and bigger through low- and high-frequency enhancement circuits, in effect simulating the effect of a two-way system sounding like a four-way system. At the high frequency end, the upper harmonoc content of the input signal is extracted amplified and added back to the original (along with some group delay). A similar process takes place at the low end. Since these circuits are mostly static in nature, there are no audible side-effects such as pumping or breathing.

Aside from the exciter processing, a sophisticated over-excursion limiter is incorporated. The limiting and enhancement parameters for a given speaker system are contained on its personality module. A three LED display indicates signal presence, half power and excursion limiting. An amplifier sense input is used to monitor the amplifiers output signal. Once the personality module is installed, the system is completely plug'n play, with no setup required.

Brooke Siren Systems FDS360 is a stereo two way or mono 3/4 way processor. Crossover slopes of 12, 18, or 24 dB per octave are user selected, all with Linkwitz-Riley characteristic. While the FDS360 has integral limiting functions, the time delay and equalization operations must be from external processors and patched into the FDS360. The FDS360 provides for polarity and phase correction, which aides acoustic summation in the crossover region and a cost-effective alternative to outboard delay circuitry in an analog processor.

Symetrix makes what is probably the most versatile analog universal processor, the 524E electronic crossover. The 524E is card based system which in basic form offers four outputs, and can be configured as two-way stereo or four-way mono. Each channel has separate limiting. Cards can be ordered with built-in equalization, and extensive custom options are available from the company.

BGW's SPA series amplifiers offer extensively optioned analog processing units, but theirs are contained within a complete rack mount system which also includes power amplification. Processing encompasses analog time delay via all pass filters, parametric equalization, and subsonic filters. Processing circuitry is contained on small plug-in modules, separately configurable via jumpers, and front panel controllable.

Dynacord makes analog processor-amplifier combinations. Dynacord systems don't include equalization or frequency division, but they do provide, thermal sensing and speaker protection, limiting, and an unusual form of bypassable predistortion. In order to overcome the inertial characteristics of woofers and to achieve a better matching between the acceleration characteristics of woofers and mid and high frequency drivers, Dynacord processing amplifiers steepen the leading edge of low frequency wave forms and dynamically equalize the woofer. Something similar occurs in motional feedback systems where the woofer is included within the total feedback loop, but Dynacord's predistortion is based on typical woofer characteristics and not upon the output of a comparator.

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ACTIVE PARAMETER SYNTHESIS AND OTHER TECHNIQUES TO CONTROL THE AMPLIFIER-SPEAKER INTERFACE

Any use of low frequency equalization, variable damping, or low frequency filtering could be said to achieve active synthesis of low frequency loudspeaker system parameters, but the term "active parameter synthesis" more properly refers to utilizing electrical analogs of mass and compliance to realize a larger apparent cabinet size, thereby increasing bass extension. When UREI begun to manufacture power amplifiers in the mid 1980s, compensation circuitry was used to enhance the interface between the amplifier and speaker, including the speaker wire effects.

The UREI 6500 featured a patented Conductor Compensation which was claimed to eliminate the problems originating in speaker wiring by including the speaker leads in the main feedback loop of the amplifier. Conductor Compensation senses the effect of cables upon the signal, across the speaker terminals, and feeds this information through a second pair of wires back to the amplifier. The result was enhanced damping factor seen by the speaker. This added another pair of wires, and mixing up the polarity or the sense wires with the main wires could lead to an unhappy ending for the amplifier. While "sense" and "return" wires are commonplace with many processing speakers these days, six or seven years ago the pro sound world was not ready for this and UREI eventually dropped the Conductor Compensation scheme.

Crown developed its Delta-Omega amplifier which attempted to provide user-selected control over amplifier damping in the mid 1980s, but eventually came to the conclusion that this sort of interface optimized was too critical to be left to the control of the end-user. PAS has used a variation of amplifier source impedance compensation in their T.O.C. processing for a number of years.

A very different approach to amplifier-speaker interface is taken by Bag End with the ELF system. Devised by Ed Long (the originator of Time Alignment), ELF makes use of the predictable phase and frequency response characteristic of a sealed box speaker system operating below resonance. The ELF-1 Low Frequency Integrator provides equalization, frequency dividing, time offset, and system limiting protection. The ELF EL-18 series 18-inch subwoofers are specially designed for ELF operation. Extremely extended deep bass is provided, but the woofer must have high excursion capability.

A very sophisticated implementation of active parameter synthesis was worked out by Audio Pro during the late seventies and marketed as the ACE bass system. The ACE bass is a vented powered speaker system with an undersized box driven by a negative impedance amplifier through a precisely tuned conjugate network. More recently Yamaha has further developed this approach. The Y20 is a single rack space amplifier interface that can be used with any professional amplifier to optimize its output impedance. Yamaha's two professional YST subs use single and double eighteens respectively and are capable of very high output levels. Box size is reduced over that of competing designs of comparable output using nonassisted alignments, and transient response is said to be superior to that of conventional vented alignments predominating in pro applications.

TOWARD THE FUTURE

Processing strategies are likely to become increasingly common in the years to come. Where now the benefits of processing almost inevitably exact a price in terms of artifacts of one sort or another, the processed systems of the future will be endowed with all manner of adaptive functions for maintaining consistent loudspeaker behavior even when protective operating modes are invoked. Adaptive room equalization will come into its own, and the cost effective simulation of specific ambient sound fields will become

(Continued on page 131)

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Putting It in Writing

A Review of Guide Specifications

BY JAMES K. WOOD

I am sometimes asked, "What can be more of a chore than writing a guide specification?" My answer is, "Trying to read and interpret a bad one." Considering the important role that specifications play in our industry, it is worthwhile reviewing the objectives and procedures used in preparing them.

Although guide specifications spelling out the requirements and objectives for a specific undertaking may be issued by one of a number of sources, *e.g.*, engineers, contractors, manufacturers and even end users, the content of the specification will include input from most of the parties affected by it. The user's desires, the designer's experience, the contractor's expertise, and the expected level of equipment performance will all be reflected when the document and associated drawings are tabled for bids. Three basic components, present throughout, will ensure the success of a bid specification: clarity, consistency and continuity.

The first thing the preparer must do is decide on a format which will include these. The most accepted format in the engineering profession is the CSI (Construction Specifications Institute) 3-Part Format. In it, tasking is broken down into 16 Divisions encompassing general requirements and the major trades, with subdivisions describing specific units of work. Most of the specifications involving sound and signalling systems are found under Division 16-Electrical, simply because most of this equipment has wires attached to it. Occasionally, and often more appropriately, they may be found under Division 10-Specialties, where greater attention may be brought to such things as acoustical parameters.

Organization of the specification is extremely important to assure an unambiguous interpretation.

Each section, or subdivision, of the complete project specification is assigned a 5-digit number, beginning with the two digits of the Division allocation. The section is divided into three parts: Part 1, General; Part 2, Products; and Part 3, Execution. Organization of the specification is extremely important to assure an unambiguous interpretation of the owner's intent, and fairness to all qualified bidders. Three lower levels of text organization are permitted in each part; *viz.*, Part 1 General, 1.1 ARTICLE, 1.1.1 Paragraph, 1.1.1.1 Subparagraph. Major articles may include items such as Scope, System Description, etc., with subsequent paragraphs clarifying intent and responsibilities. Having exhausted the three numerical sub- designations, lower case alphabetical designators followed by a parenthesis in the format ("a)") may be used. Don't deviate however. Once a system has been adopted, maintain it throughout the specification.

Pay careful attention to grammatical construction. At great risk to my own credibility, I urge you to eschew obfuscation. In other words, make all statements clear and concise. One of the most overworked words in the specwriting business is "shall." If you mean to have someone do something, simply tell him to do it. Since the contractor is the principal required by contract to perform the work, it is not necessary to keep repeating "the Contractor shall" throughout. "Install loudspeakers... Adjust system levels...Instruct personnel in operation...etc.," are clear enough statements. Avoid the use of weak nouns such as "make determination of" when the use of a strong verb such as *determine* says it better and takes up less space.

James K. Wood heads up Audio-Video Facilities Management of Rumford, Rhode Island.

One further caution on the use of the overused "shall": its use implies direction, which is the prerogative of the owner or agent, who pays the bill. If certain materials or services are to be provided by the owner, the correct terminology is: "the Owner will provide such and such." Make every reasonable effort to keep your sentences short, reducing repetition and minimizing the use of prepositional phrases such as "front of the speaker" when "speaker front" will suffice.

Multiple requirements such as standard amplifier specifications should be listed alphabetically, in lower case, followed by a period, not in a long continuous sentence. This permits the person reviewing the specification to more readily spot items of significant interest or importance. Avoid open-ended requirements such as "as necessary," "satisfactory to," etc. The contractor performing the work cannot be expected to predict what job conditions may be encountered which are out of the ordinary and is entitled to advance warning if such exist. Spelling out those conditions in advance will avoid the need for subsequent extras or variances. Indeterminate words and phrases such as "suitable," "neatly," "workman-like manner," etc., must not be used.

The owner assumes that the contractor will perform his work in a professional fashion and has the option of not paying for it if he doesn't. It is not the responsibility of the owner to judge the competence of workmen. This is the responsibility of the contractor and is assumed subject only to specific qualifying statements included in the contract such as "installer shall be certified by the manufacturer to install (name of equipment) as evidenced by a certificate or letter issued by the manufacturer stating that the installer is so qualified." The use of underlining or boldface within a specification is incorrect. An item calling for such special attention is worth a more detailed explanation.

Do not duplicate information contained on the drawings in the document. The adage "one picture is worth a thousand words" definitely applies to engineering projects. Most bidders go immediately to the drawings to determine how much physical work is involved and to obtain equipment counts, then refer to the details in the written spec for details of compliance.

Drawings must include the physi-

cal location of all equipment to be installed, including reflected ceiling plans, mounting angles, etc., to avoid lighting and other obstacles furnished by other trades.

Each symbol must be clearly identifiable and distinguishable from others on the drawings. Provide details of items requiring particular attention, such as unique connectors, but don't overdo it. Fancy representations of equipment look good on presentations, but contribute little to the functional value of job layouts.

Escape phrases such as "unless otherwise specified" are another no-no and are an abrogation of responsibility on the part of the specifier. Who knows how or where an alternate course of action will be specified? The bid specification at hand is a static item and the price will be calculated accordingly.

One exception to the shortening rule is the use of pronouns. Avoid them. In the interest of clarity, it is better to use the full word or phrase to which you are referring.

The use of numbers can be the most confusing aspect of a specification, so choose your method of stating them and stick to it. Numbers under 10 should be spelled out. Figures 10 and greater should be expressed numerically. It is not necessary to follow a spelled-out number with the same number in parentheses. Use fractions or decimals, but not both, throughout. Fractions should not be hyphenated, e.g., use "1½ inches," not "1-½ inches." Floating hyphens cause problems at the end of sentences and with many word- processing programs. A hyphen should only be used at the end of a number when the number is part of an adjective such as "½-inch radius."

The three part specification is intended to state the desired outcome of the applicable section of the project, the equipment to be used and the means employed to accomplish it. It will include certain guarantees as to performance and procedures involved in bidding the project and may include provisions for training and ongoing maintenance.

The specification should commence with a cover page containing a "banner" at the top with important contact information contained in a block below. The banner consists of a block of information with the name of the owner or issuing authority of the specification on the left, and the project number, with the specification date below, on the right. The project name and a brief description may be entered below, followed by the name of the authority for which the spec has been prepared, as well as the names of those personally responsible for preparation and approval of the documents, revisions and all applicable dates. This may be followed by a distribution statement authorizing limited or general release.

The cover page is followed by a table of contents, with the banner at the top, containing the Section number and title, listing by Part all Articles, paragraphs and subparagraphs by title. It is not necessary to include page numbers.

EXAMPLE

TABLE OF CONTENTS
SECTION 16761
SOUND REINFORCEMENT SYSTEM
PART 1 — GENERAL
1.1 SUMMARY
1.2 DEFINITIONS
1.3 SUBMITTALS
1.3.1 Manufacturer's Catalog Data
1.3.2 Samples.....etc.

Beginning with the body of Part 1 of the specification, all pages should be numbered at the bottom, including

the Section number, *e.g.*, 16761-1.

The PART 1 — GENERAL portion of the spec should include a summary, also called scope, spelling out the overall objectives and a description of the system. It will also contain the general references with regard to equipment availability, associated drawings and manuals, guarantees, equipment performance, installation (not execution), submittals and other required data. Reference to any special conditions relevant to the job site, use of customer owned materials, etc., may also be made with clarification in the applicable portion of the continuing specification. A line-item list of manufacturer's catalog sheets of all major items of equipment to be installed should be included to assist potential bidders.

PART 2 — PRODUCTS will include the individual specifications of all major items of equipment to be used on the project, plus any requiring special attention, e.g., gold-plated connectors. The product specification must include the significant performance parameters contributing to the desired project outcome and all important physical information necessary to enable installation.

"Boiler-plate" specifications are widely available from manufacturers. Bear in mind, however, that they often contain redundant information which does not contribute materially to the specification, and are apparent as such. It is best to use these as a guide and rely on your own knowledge of a particular product and the owner's requirements when you prepare the specification. Above all, be concise! The use of language intended to exclude other suppliers of equipment of equal merit, for whatever reason, can, and often does, backfire, and is not to the benefit of the owner.

PART 3 — EXECUTION, the concluding portion of the document, specifically directs the contractor how to carry out the project to the satisfac-

(Continued on page 131)

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Attractions: How Attractive?

Doing Business with Theme Parks, Museums and Other Leisure-Time Venues

BY MARIA M. CONFORTI

Knowing what to expect from the theme park/attraction industry can keep a contractor off the roller coaster of rocky business, and heavy into the fun and games of a full work roster.

"The construction business in general, and the theme park business, are both coming out of the recession. There is life in the old boy," says Will Parry, president of SPL of Columbia, Maryland. Parry started the construction department at Maryland Sound, and his theme park work there included Universal Studios in Florida, MECA's Sanrio theme park in Japan, Walt Disney's Pleasure Island, subcontractor work on the MGM Studio Tour for the Walt Disney World Company, and more. He says SPL is currently in contract negotiations with "the same suspects." There is interest both in improving upon existing rides and attractions, and building new rides and attractions, Parry notes, adding that SPL expects a significant part of its 1992 income from the theme park business.

"I see theme parks and entertainment in general as a growth area," says Dave Marsh of Pelton Marsh Kinsella. His company did the $2.1 million job at the brand-new Fiesta, Texas (San Antonio). The 200-acre site boasts areas devoted to Hispania, plus '50s rock-and-roll and '20s gangster nostalgia, and more. "There appears to be a lot of competition among the theme parks to provide a greater thrill at attractions and to increase attendance, and that has resulted in a lot of activity in that area."

A lot of the same equipment that was used a year or two ago is being updated.

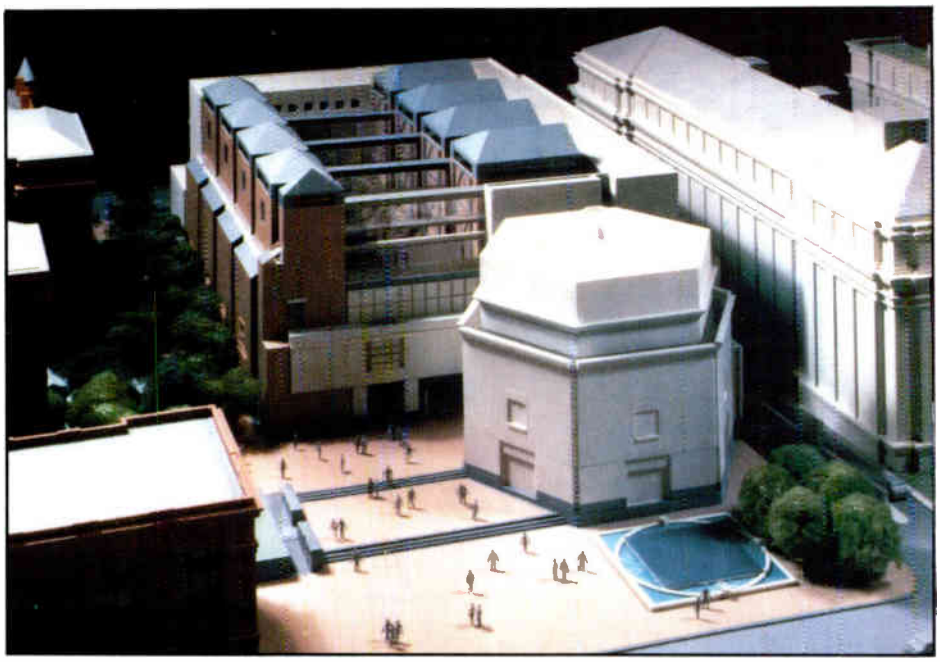
"We seem to be doing real well, we're staying busy on a regular basis," says Doug Macuch, sales, RCI Systems. The Rockville, Maryland-based firm is at work on the Holocaust Museum. The museum's exhibits will include, among other things, interactive multimedia locators that will allow viewers to key in names of those involved in the Holocaust, and to track down facts and pictures.

Business slowed down somewhat initially due to the recession, Macuch reports, "but now it seems to be that people are looking for real value. We probably don't get some of the jobs that people are looking for a real bargain on, because we don't necessarily offer the 'Cheap Charlie'- type of systems."

"I think it's going to become more of a fun thing for some of us out there, as the term 'virtual reality' [popularizes] and simulation systems become more cost-competitive," ventures Steve Emspak of New York City's Shen, Milson & Wilke. His firm completed the new Reagan Public Library.

"The basic philosophy in the entertainment business — whether it's theme parks or entertainment facilities or theaters or arenas — is to use the highest quality equipment, because it interpolates the artists' performance," Parry states. "There tends to be a more realistic view on spending the dollars on the right equipment in the entertainment business. Therefore, the finest equipment is used on a regular basis. Oftentimes, it's the same equipment being used over and over again because it becomes a de facto standard of the industry, and the equipment's reliable and provides the performance that everyone's interested in. So a lot of the same equipment that was used a

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



Model of the United States Holocaust Memorial Museum to be installed by RCI Systems.

year or two ago is being updated, [through] new models or whatever, and is still being used in these jobs."

"There is a continuing trend toward automation," Parry states. "We install a larger and larger number of computer- controlled sound systems each year. That's been true for both the sporting market and the theme park entertainment business. For the theme park business, [the systems] are almost 100 percent automated. There's more of that and less manual control."

"There's a definite interest in box-type systems [for loudspeakers]," says Marsh. "It's a human tendency to take something that sounds good and say 'I like the way this sounds, I want to build a whole cluster out of it.' What they're overlooking is, when you get those boxes together [in a park install], how well they interact with each other, whether you can truly depend on the sound to be better in that situation or not, it's not a black-and-white situation. It really should be evaluated on the basis of a lot of considerations: weather-proofing, hardware for hanging, liability, the overall cost, [and] maybe artist acceptance."

"A lot of museums are tending to look toward high-technology solutions," Emspak states. "Interactive multimedia is very present; muse-

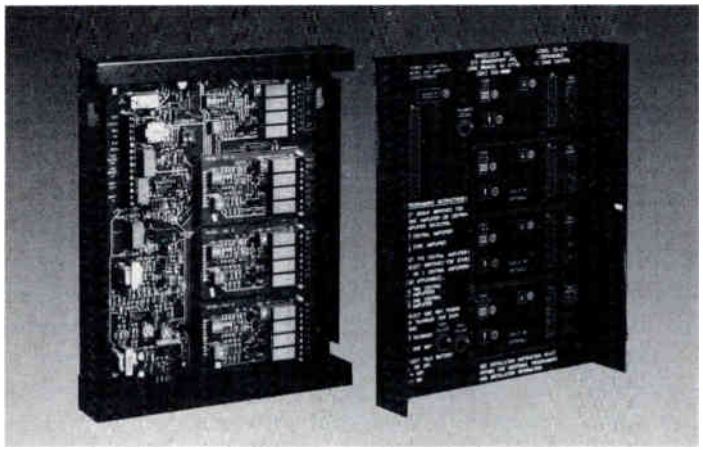
ums have always been pretty progressive in that area anyway, and that certainly isn't going to slow down."

"Usually museums are rather tightfisted," reports RCI president Jay Kingery. "The interactive part of it, though, is being developed quite aggressively." Clients enjoy being on the cutting edge of the technology, Kingery says. "Of course," he adds, "by the time you actually get it installed, you are no longer leading, [the technology] changes so quickly . . . Looking at it from a management point of view, as it becomes more and more high-tech, you have to have more and more high-tech individuals. That is increasingly hard to find . . . I think it's going to put a whole new burden on the [museums] to put in place this technical management level."

On the other hand, because theme parks typically use part-time and/or seasonal help, their automated systems must be inherently easier to operate. "[Park employees] just walk in and press the *start* button, and their responsibility is to be a host to the customer, not to be a technical person," Parry says, "as opposed to a theater environment, where you have a theater sound engineer or lighting technician or whatever . . . So it benefits the owner, because he has reduced labor costs and has the same quality show."

"People are more discerning about what they're getting," Macuch says. "The advent of multimedia has [resulted in] a much more complex selection process, and we're finding people are very value-conscious. Everything is being scrutinized and looked at under a microscope. . . . If you're not doing expert installations and a high-end product, you've got trouble.

It's easy to get stars in your eyes as theme park and museum technology becomes more and more sophisticated. Just make sure to keep at least one of those starry eyes on the bottom line. "You have to make money every month in the contracting business," Parry says. "You cannot afford to lose money any month. Even if you make $1, you still have to make money every month. In the contracting business, the margins are too small to put yourself in a loss situation. So monitor your cash and your income position on a weekly basis, and make sure every single month that you're going to make money, even if it's only $1." ■



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Theme Parks and Elephants

Unique Problems at Marine World Call for Vigilance and Innovation

BY PAMELA MICHAEL

Thirty miles northeast of San Francisco, just a few giraffe strides inland from San Francisco Bay, is a 160-acre, unique combination oceanarium and wildlife park — Marine World/Africa USA. The sprawling complex includes a 55-acre lake, an extensive system of pools and water channels (including one pool with a million gallon capacity), facilities for education, wildlife rehabilitation, breeding and research, and seven major show arenas (with stadia of up to 3,000 seats), each with its own sound system. Marine World/Africa USA is home to a wide variety of creatures from land, sea and air, taken care of by a staff of 300 during the winter months, when the park is open five days a week. In the summer months, seasonal workers swell the work force to 1,200.

Built on the site of a former golf course, the lushly landscaped park offers lots of interaction with exotic, and in some cases endangered, wildlife. Visitors can kiss a killer whale, feed a giraffe, meet a tiger cub or sea lion, ride an elephant. The park also provides the public with a chance to talk to trainers and researchers after each performance or demonstration; questions are solicited, various animal behaviors discussed, close contact with many gentle-trained animals encouraged. The park's Tiger Island, in fact, is a habitat for hand-raising Bengal tigers. A unique feature is the presence of trainers at all times, playing, swimming, relaxing with the cats. This is the only display of its kind in the United States.

Pamela Michael is a freelance writer located in the Bay Area of California.

Money was raised to install seven new sound systems for show arenas.

The complex is special in another way, too. It is the only such park in the country owned by a non-profit foundation. Formerly a for-profit corporation owned by ABC-TV and then Resorts International, the organization was transformed to a non-profit education and research facility through the efforts of Michael Demetrios, who joined the company in 1974 as Vice President and General Manager. (Demetrios is now President.) In the mid-eighties, when their home of 22 years on a piece of prime real estate on the shores of San Francisco Bay had to be relinquished to developers, a decision was made to restructure as a non-profit, and to build a brand new facility 50 miles away.

The time frame involved in the move was a bit more critical and problematic than most businesses face — animals cannot be stored like office furniture until their quarters are ready. The new park broke ground in May of 1985. On September 29, the old park closed. In a move that at the time received much praise and attention as a triumph of logistics and cooperation, all Marine World/Africa USA's animals, equipment, and personnel were moved to the new site in about five weeks — whales, tigers, birds, boats, reptiles, records, and much, much more.

One thing that was left behind for the most part, however, was audio equipment. Money was raised to install seven new sound systems for show arenas, plus a park-wide background music system and backstage paging. Some old work-

Darryl W. Bush—Marine World Africa USA

Aerial view of Marine World.

horses, though, like the Pioneer RT 909 open reel tape deck that had operated eight or nine hours a day for many trouble-free years, were brought along—too reliable, too "familiar" to leave behind. The RT 909 is currently being used for music search in the park production studio in Vallejo. Park sound engineers also decided to continue using their old ITC SP and WP tape cart decks in the new park.

For the elaborate, fast-paced shows the staff produces and engineers, the broadcast cartridge medium can't be beat for cueing, according to Chief Sound Engineer Dave Miller, who showed us around the park. When asked if they had considered switching over to a digicart system, Miller replied, "Boy, don't I wish! I see them in the catalog and just drool." The park is upgrading to the Delta Series, however; "bullet-proof," Miller called them. Miller and a team of eight or nine young people, all trained in-house, produce hundreds of carts a year in a tiny production studio with a home made, Styrofoam sound booth. "Someone thought that because Styrofoam does such a good job insulating heat and cold that it would make a good sound insulation, too" Miller explained, "the problem was finding good Styrofoam glue." The booth does provide good dead sound, apparently, but is pretty acoustically transparent, requiring total silence in the area when in use. Another problem is heat. "Turn on the lamp and you can't get anyone to sit in there for very long."

The power wasn't on yet at the site, so the engineers used a generator, trundling out in the cold at midnight.

Because sound is so integral to the performance in a theme park production, the staff works hard to match appropriate music to different animal behaviors. Music is used to accentuate certain behaviors. In the killer whale show, for instance, when the whales "breech" (rise out of the water), the music is surging and powerful. More fluid or discreet behaviors are enhanced by more subdued, or dreamy music. All park shows have music and sound effects, some with 70 or

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One of the most remarkable aspects of the sound setup at the park is the audio technician training program. Dave Miller, who taught high school students to produce radio programs as part of the Catholic Media Ministry before he came to Marine World, seems to have a special gift for teaching engineering skills to kids with no prior experience. Many Miller-trained sound engineers have gone on to jobs in film, radio and production. Miller describes the job of engineering a show as requiring both radio and theater techniques, with the cues of theater and the gain-riding of radio.

The level of professionalism and dedication of the production staff at the park is evident at every turn. One piece of park history that illustrates this attitude is the story of the first carts produced for the grand opening of the new Vallejo facility. The power wasn't on yet at the site, so the engineers used a generator, trundling out in the cold at midnight and such to pour in more gasoline. They worked all night, non-stop for several days, producing the 400 carts needed for the opening six shows. To their horror, the finished carts had a lot of wow and flutter in them — the capstan motors of the cart machines were designed to lock onto the line frequency (which was all over the place), so the carts could not be used. A new generator was brought in and the entire midnight-oil ordeal had to be repeated — all the carts remixed. P.S.: The shows went on as scheduled, with all the carts necessary.

Conditions are no longer quite as primitive at the park, but neither are they state of the art, in most cases. "As a non-profit, we have to really stretch each dollar as far as possible," Dave Miller confided. Some of the costs of mounting each show are offset by corporate sponsors, and equipment is often sold to the park at a bargain basement price by radio stations or studios that are upgrading. Background music for the public areas of the park are supplied, pre-mixed, by a local radio station.

Music and effects for shows are mixed on a Tascam N520. "Finally, we have enough channels for all the sound sources and signal processing we need," Miller said. Other production studio equipment includes Yamaha and Technics CD players, an Onkyo cassette deck, JBL 4311 monitors, an Otari 8 track MX5050, a 2-track MX 5050, TEAC 2000R for music search, Sennheiser MD441U mic, Yamaha SBX 90, and two Technics SP13 turntables (also brought from the old studio). Miller indicated that they use the turntables very little these days; a growing CD library heralds the phase-out of

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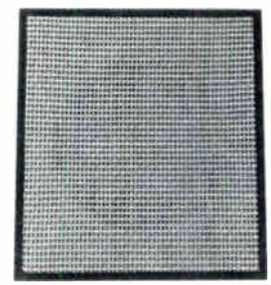


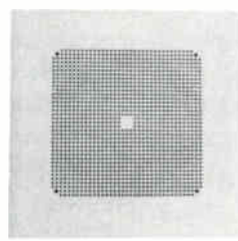


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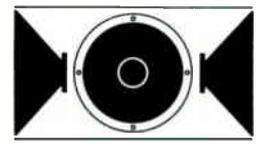
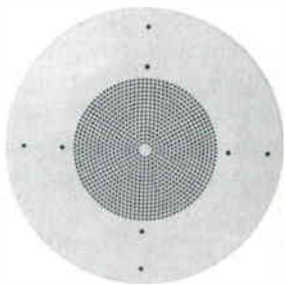


Darryl W. Bush—Marine World Africa USA

Birds need sound reinforcement too! Pictured here are two tweeters.

vinyl.

Many of the various shows at Marine World/Africa USA call for a big music system, heavy sound reinforcement. Budget constraints during construction demanded a high quality compromise, with good speech intelligibility and music fidelity adequate for pop music productions, essentially a speech articulation system. Pro Media, of El Sobrante, California, did the sound installation for the park when it was built. Miles of cable were laid (direct burial, not in conduit) for the park-wide background music system, which utilizes Bose 102 speakers, most mounted on redwood pedestals. Although the cable trenches were dug in advance by the landscape contractor, Pro Media President Drew Serb says installing the background system was the most difficult aspect of the job. As Serb put it, "There was so much landscaping to work around, and so many miles of cable, plus substations (to hold the transformers that change the voltage from 210 to 70 volts) throughout the park, hidden in planter boxes, or buried under sidewalks. We have terminal cans buried in the bushes." The park had some rust problems with the Bose speaker grilles initially, but Bose sent a rep to the park and all the speaker grilles were replaced with stainless steel at no cost. The biggest problem with the speakers now, Marine World's Dave Miller said is theft. "Even though they're 70 volt and can't be used at home and even though they're locked in redwood pedestals or up high, we still lose a few a year."

The park has 13 inputs and 18 different zones, some of them switchable, which enables the staff to create a separate sound system in any of a variety of picnic areas. School or corporate groups can have full sound for announcing awards or activities, or playing background music. In addition, the park has five complete portable sound systems for use by visiting groups, much of it equipment scavenged from their old facility.

The heart of the park-wide sound system is a tiny rack room which holds the Bose 102 controllers and QSC 1700 amps

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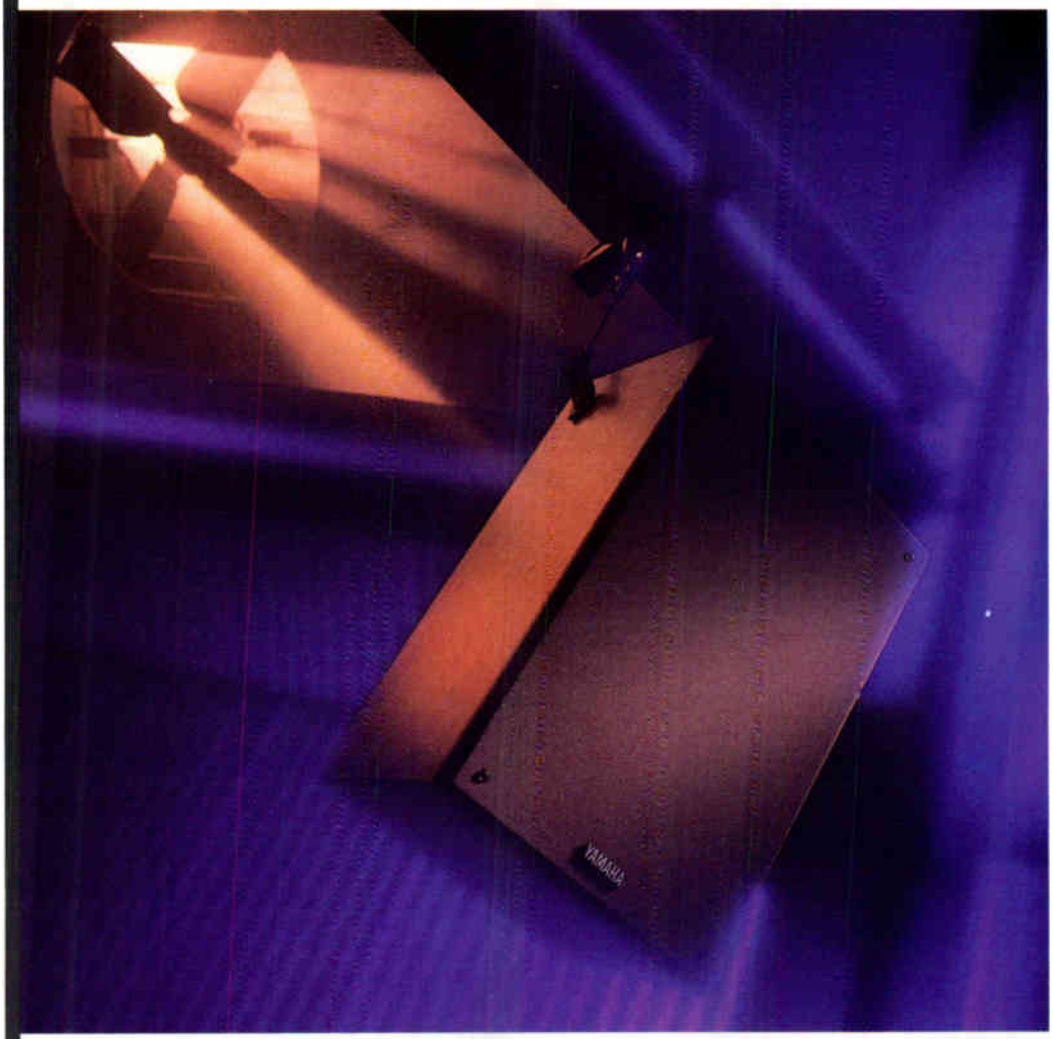

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that have been running 24 hours a day since 1986 (with no failures!) The staff has emergency paging capability from the rack room, the front gate and the information booth. The system is also used for an employee "morning show" that is broadcast throughout the entire park each day before it opens to boost everyone's spirits.

The main show arenas make extensive use of cordless mics, an absolute necessity when dealing with animals and water shows. Most arenas use Swinteks, with some TOA's and Telex in use, as well. Dave Miller swears by the Swinteks: "I don't know of any other microphone you can drop in salt water, pull out, rinse in fresh water, dry off, and it's still going!" The proximity to water in many of the show areas is a big problem, particularly in the marine mammal areas (the whale, dolphin, sea lion shows, and the like). "Salt water destroys equipment real fast," Miller said. "We have to be very careful."

Another big problem has been finding enough frequencies for the cordless mics. "RF heaven" sound man Miller calls the area. "We had some problems in our Bird Theater some time back," he remembers. "The mics kept cutting out. We couldn't figure it out until I happened to notice a schedule change that had two shows in close proximity at the same time." The staff has to pay close attention to proximity to prevent frequency problems with cordless mics and to prevent sound spillage from one arena to another. Sound contractor Drew Serb cited sound spillage as one of the factors Pro Media had to take into account in their installation. Working with the landscape designers and the architects, the solution they came up with used hills and buildings as sound barriers, and very directional loudspeakers. The issue of interference with the surrounding community was less of a problem when the park was initially constructed; the area was not built up, there were few neighbors, only a few houses on a hill across the lake.

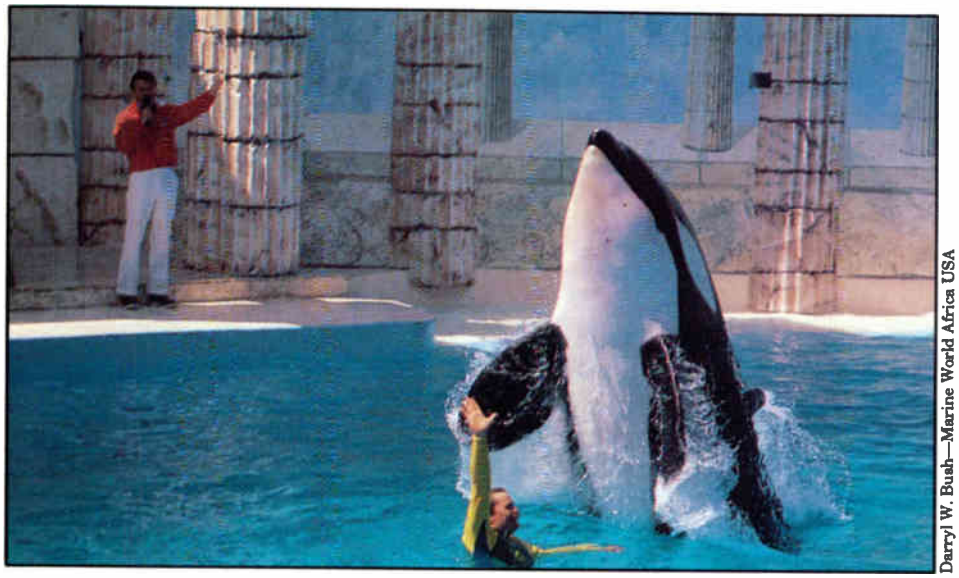
Now the park is served by its own freeway exit and there is a Holiday Inn next door. Pro Media tried to anticipate future growth in their installation, says Serb, and were careful to focus the loudspeakers at a very low angle in the stadium directly across from the nearby houses. Neighbors have been supportive, generally, and Marine World strives to be a good neighbor. The lake, used for the Water Ski and Boat show, also serves the community as a flood control facility, waterfowl sanctuary, and municipal fishing spot. Still, these shows push a lot of sound, and some of it inevitably escapes. The park staff takes occasional sound

level checks to make sure they are in compliance with local noise ordinance regulations.

Marine World/Africa USA had a chance to reconfigure a main sound-release source in 1991, when they opened their newest amphitheater, the 3,000 seat Showcase Theater. Showcase is actually a remodel of an older stadium. The new arena is covered with an awning and is the only show in the park to employ digital technology — a computerized light system and digital board. The stage is 90 feet x 36 feet and rises four feet above the front aisle, and is constructed of double layer plywood covered with indoor/outdoor carpeting. There are two banks of Bose 802 speakers (16 in all), a total 4,000 watts, stacked in pairs across the front, with a set of six delays half way up. In the spacious sound booth (right in the middle of the stadium, unlike all the other setups in the park), a Yamaha 2404 board is employed, affording greater capability and allowing the park to use the arena as a night time venue for concerts and the like.

Showcase Theater will feature the Chinese Acrobats in the summer season; currently a show entitled "The Magic of Animals," an illusion show, is being presented. The illusions require the performer to have both hands free, so the staff has been experimenting with a lavalier Swintek in a head boom, as well as the standard handheld Swintek mic. Because the lavalier is not really designed for sound reinforcement — it's more for TV work and such — the setup took a lot of tweaking with audio analyzers to get the sound distributed evenly and loud enough for people to get the impact of the music but not be knocked out of their seats.

Black Boxes Inc. of San Francisco did the installation on the new Showcase Theater, having done the original installation when the facility was completely open air. BBI laid out the new system with Bose Modeler, used the DRA MLSSA acoustic analyzer to set up the delays, and EQ'd the system with pink noise. The site presents a good argument for a distributed system like Bose, according to Mark Roos, BBI owner. "There's a big problem with echo off the concrete seats which present a high vertical face," he says. "If the delays are too hot, the sound bounces off the empty seats, so great care must be taken with level settings." The houses on the hilltop above the amphitheater dictated that BBI aim everything down low. "It's not cool to set up at one end and blast," said Roos. "The delay is quite an issue." BBI opted not to include ducking switches for delays in this job.



Darryl W. Bush—Marine World Africa USA

The Killer Whale and Dolphin Show is the park's #1 attraction.

The park staff is very proud of this arena, with sound technicians vying for engineering slots. It is indeed a "showcase" for the most elaborate productions yet mounted at the park. New attractions are added every few years, as fund raising allows. The first walk-through butterfly habitat in the United States opened in 1988, Elephant Encounter in 1990, Showcase earlier this year, and in May, Shark Experience, a $5 million undertaking, the largest capital improvement since the park opened in Vallejo.

The Killer Whale and Dolphin Show, though, is still the park's #1 attraction. The partially-shaded 3,000-seat stadium has four pools and five swim-through channels totaling nearly two million gallons that house two killer whales and five Atlantic bottlenose dolphins. There are 16 underwater viewing windows in both the whale and dolphin pre-show pools, where visitors can watch the animals practicing their powerful jumps and other spectacular behaviors from below.

With the exception of research areas, where programs like Project Circe, a dolphin communication study, are conducted, the pools at the park are not wired for underwater sound. Above water the trainer/announcers use Swintec cordless mics. The stadium operates with a center cluster of E-V speakers, although we've been told a satellite system is being considered because the overhead awning has a lot of bounce. The concrete bunker-style sound booth up in the stands is equipped with a Yamaha 508 mixer and a rack for processing equipment: one QSC 1700, two 1200's, E-V crossover and a QSC 1080 amp for the monitor speaker, a JBL 4406. Bose 102's are used as monitors backstage down below.

Watching Katie Mize, a young woman trained on the job, engineer the show, was an impressive demonstration of grace, attention, and enthusiasm. Using a three-slot ITC cart deck on her left and a one-slot rapid cue deck on her right, she changed carts probably 50 or 60 times during the show, with lightning-fast agility. The shows are scripted, of course, (although Katie was working from

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memory!) but animals don't always do what they're supposed to at the right moment, so Katie has to be very attuned to what is happening in the pool. If the Yaka, one of the killer whales, decides not to make a jump on a particular pass, Katie has to be sure not to surge the music level up until the whale breaks the surface of the water. The communication between the sound booth and the stage/pool area is two-way, as well. Aside from intercom capability, a flashing red light mounted on the front of the booth alerts the show announcer when the animals are at the water gate, ready to begin the show. With a flick of a switch the gate is lifted and the whales swim into the performance pool.

Most of the park's show areas, like the Whale and Dolphin Show, use a center cluster arrangement of speakers, but two — Jungle Theater and the Ski and Boat Show — use Meyer UP1As. The Ski Show is a high-energy extravaganza and the staff tends to drive the speakers a little harder. According to sound engineer Dave Miller, the UP1As (mounted on poles and pointed up at the bleachers) have held up very well. Before installation in 1986, Pro Media treated the speaker cones with a protectant, sealed the boxes with a 3M compound, and replaced all the connectors with flexible conduit. To date, only one has had to be replaced.

The show itself presents some difficulties, soundwise. Rather than a semi or full circle configuration, the Ski Show bleachers are stretched out along the shore of Lake Chabot. Getting sound to all areas can be a problem, as can wind, a factor in all the show areas. Each stadium is ringed by banners or flags that can flap up quite a ruckus in a stiff breeze.

If the delays are too hot, the sound bounces off the empty seats.

As with the flags, the acoustical problems at Marine World/Africa USA are often unconventional or unique. Dave Miller recounted a mic problem with a TOA cordless in the Elephant Encounter production. This performance uses a smaller theater and has no sound booth, just a box backstage to hold the equipment. "Problem was, the sound kept cutting out." Apparently, any time the trainer got between the receiver antenna and the elephant, they lost signal. "What we discovered," Miller explained," is that RF does not travel very well through an elephant." Another acoustical mystery solved. ■

Direct from the French Alps

The Sound of the Winter Olympic Games

BY MIKE KLASCO

The 16th Winter Olympic Games were held for 16 days in the French Alps, in and around the town of Albertville, France. This is the third time the Alps have hosted the Winter Games: previous events were in Chamonix in 1924 and Grenoble in 1968. For the 1992 Games, the Olympic area was spread out over the Three Valleys area, which resulted in incredible logistical problems. A total of 35 sound systems was used at the Games, ranging from fixed installations, portable systems for outdoor events, and in support of the opening and closing ceremonies. The sound system for the Olympics required over 3,000 hours of design, installation and operation time.

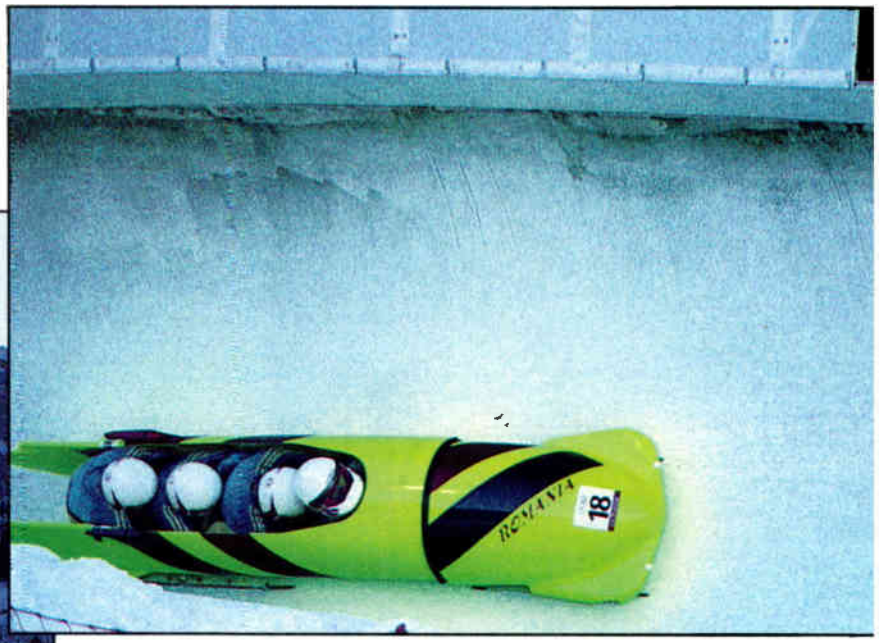
In 1989 Bose France was named the official supplier for the 1992 games. Work on the sound system design began two-and-a-half-years ago as the venues were being planned and constructed. The engineering group consisted of U.S., French and Canadian engineers. Bruce Myers, Bose's senior applications engineer, led the design effort. Dominique Marphay, Technical Manager, headed up the French group with Serge Damenex as Assistant Technical Manager and Didier Mayeux as his Technical Assistant.

One innovation introduced at Calgary to Olympic downhill events was that skiers could now easily hear their times called out. Jesse Klapholz, Sound & Communications' technical editor at the time, expressed his surprise at how seamlessly central clusters of Bose 802s worked, how cold his feet were in the snow, and how well the audio was managed. For the 1992 Winter Games I have to concur with Jesse's observations on all counts.

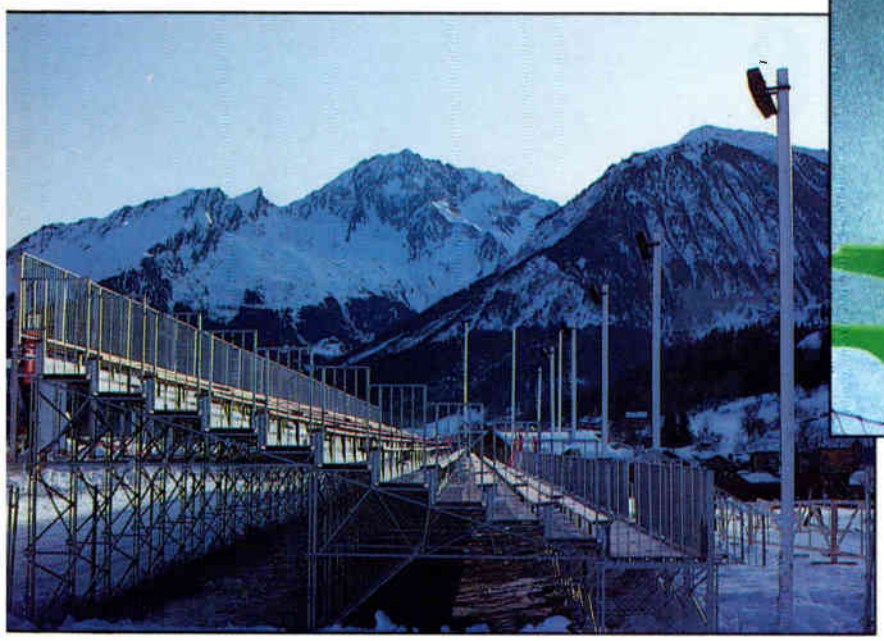
Calgary as a job was a lot more straightforward than Albertville. The Olympics has expanded so much that all the events this year had to be held at sites spread over a 100 mile area. Andy Smaga, general manager of Bose France, stated that the Olympics differed from conventional outdoor events in two ways: duration and distance. Staging as many as 25 different events a day for 16 days can be a staffing and scheduling nightmare. Actual operation of the sound systems was handled by Bose France personnel, local independent sound contractors and Bose crews from around the world. Smaga also stated that "most people don't notice a public address or sound reinforcement system unless it is faulty or distorted. Especially in the last few years, consumers' expectations for sound systems are much higher than they used to be. With high quality stereos in homes and cars, with the perfection of Compact Discs, people don't accept poor quality anymore. A good sound system is like a clean window, it lets what's natural come through and it is itself invisible. We want people to hear the Games, enjoy the music and performances, and not think about the sound systems."

Part of the reason Bose has pursued supplying the sound systems for the Winter Olympic Games is presumably that most of the venues show off the strong points of the unconventional low Q (wide coverage) products that Bose manufactures. Most Bose pro speakers are lightweight, rugged, and weather resistant. Both the Bose 802 and the 402 use an array of small full-range drivers in conjunction with equalization that results in decent sound reproduction free from horn throat distortion, albeit with more limited projection than you would obtain from a horn system. It is no surprise that most of the venues were configured as distributed sound systems, although a few used a cen-

Mike Klasco is the Technical Editor of Sound & Communications.



The Romanian bobsled team supported by a Bose 402.



Bose 402s in the VIP bleachers at the Corcheval Nordic Combined.

tral cluster array along with distributed subsystems on delay lines. All the facilities I visited had uniform, clear, intelligible sound that was aesthetically pleasing, achieved decent sound levels and was free from feedback. Yet for all the careful, almost artful design effort, I could not understand exactly half the announcements, although Bruce Myers patiently explained to me that this was because they were in French.

SOUND SYSTEMS AT THE ALBERTVILLE GAMES

The sound systems at the Games were the most extensive in the history of the Winter Olympics. The statistics are: 310,000 watts of power, 15 kilometers of cable, 150 microphones, 1,000 speakers (comprising a mix of Bose 802 full range, 402s, 102s, 302 bass speakers, Acoustic Wave Cannons and Bose Acoustimass Pro powered systems). Some of the sound systems were for permanent installation, although a few of these would be reconfigured after the events, while others were leased just for the Games and were disassembled immediately after.

COMPUTER AIDED DESIGN

Projects as complex as the Olympics with intrinsic *drop-dead* scheduling are ideal candidates for help from computers. Computer-aided-design, computer-aided-test, and computer-control were evident in all aspects of the Games.

COJO, the French Olympic organizing committee, used *Catia*, a French developed integrated solid modeling CAD program that ran on an IBM mainframe computer for many diverse aspects, from layout of the event facilities, to course maps, TV camera locations and even seating ticket generation. Venues took painstaking planning. COJO first decided on the provisional installations, including bulkheads and rows of seats. The second step involved setting up cabling for the power, computer networks, and media. The space was then divided up, allocating it to the various Olympic functions. Accreditation zones were then set up to ensure security. 3-D questions were then addressed, such as where to place TV cameras and scoreboards. Of course, anything left after all this was available to the sound designers!

Sound system simulations were, of course, run on Bose's Modeler 4.0 software. Bose introduced Modeler, its Macintosh based computer program for sound system design, in 1986. The program allows comprehensive performance predictions to be made based on a computerized model of the sound system and room. I first reviewed Modeler 2.0 in 1989 and found it lacking in some key elements. But when I reviewed Modeler 3.0 last year I was able to recommend it highly — and concluded that in a number of ways it was the best of the software programs. Modeler 4.0, released last July, has significant improvements over the version I last reviewed, and a further expanded release is scheduled for July '92.

One interesting aspect of sound system design for the Games was accommodating the typically high ambient noise levels for the events. The combination of wind noise, crowd noise and sports equipment noise resulted in noise levels of 80-85 dBA. Sound systems were typically required to operate at 100 dB levels at the seating with a target uniformity of ±1.5 dB.

But computer-aided-design simulations are not the only consideration

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for sound system layout. Dominique Marphay, the Bose project manager for the Olympics, explained that the design of each system involved athletes in each sport. While distributed sound systems provide even, nonlocalizable sound reproduction, they won't work for figure skaters. "Skaters actually need to be able to pinpoint loudspeakers as they do their rapid double and triple spins," Marphay said, "It helps them keep count!".

And freestyle skiers need even sound coverage down the slopes — in order to perform properly, their music must be uniform in coverage all the way down.

A few installations required the speakers to be carried to their positions by one person on skis. Conversely, easy access was also a problem; in one venue the Bose 802 kept disappearing and had to be constantly replaced. Bruce Myers attempted to catch the culprit by placing an 802 controller (the matching equalizer for the speaker) in a bear trap, but to no avail.

As a dress rehearsal for the Winter Olympics, the sound systems were used during numerous test events including the World Cup Skiing and World Championship Skating

SO HOW DID IT ALL SOUND . . .

Actually, I only got to see (and hear) a few venues during the time I spent at the Olympics. One of the venues I had a chance to look over was the Albertville Ice Rink (the French called this building "Halle De Glace" — Hall Of Ice). This facility used an external "erector-set" framework functioning as flying buttresses to avoid the use of interior supports. The midband reverb time was 3.5 seconds and all surfaces were hard. Ambient noise, including crowd noise, was about 85 dB and the required sound level was about 100 dB. Total capacity of the facility was 9,200. For the ice skating "playing field," a central cluster of 12 Bose 802s was used, plus an additional 802 facing downward. The Bose 802s were supplemented in the low-end by a pair of Bose Cannons. The delay zone speakers consisted of 31 Bose 802s and these covered the audience seating. A Yamaha DDL 3 delay line was used. All of this was powered by Carver 450 watt stereo amplifiers. The coverage was uniform and seamless, and the delay speakers contributed intelligibility

without being localized. Intelligibility was good, in spite of the 3.5 second reverb time. The only criticism I have is the use of an enclosed booth for the mixer operator, as the sound levels varied noticeably throughout the skating events, and this was strictly operator error.

Another venue I had a chance to check out was the La Plagne bobsled Luge. This was an outdoor bobsled run that accommodated over 8,000 people. Bose used 33 model 402 line array (column) speakers inventively built into the bobsled run. The speakers were flush mounted on the flat face of the top edge of the run. The sound level and intelligibility were fine.

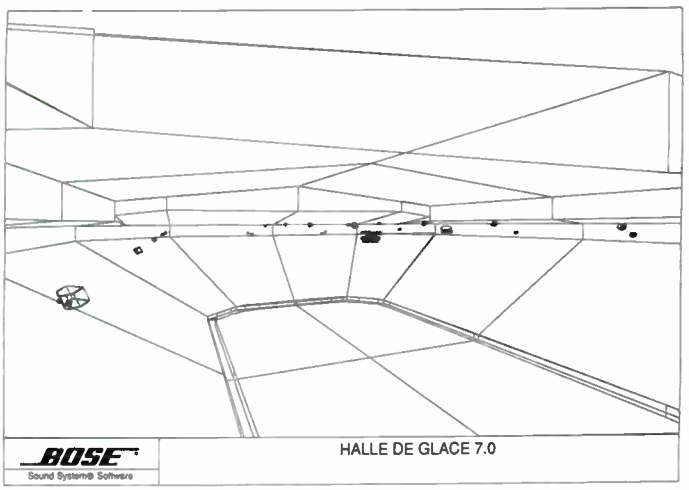
In Albertville, at the Olympic Village where the venues were clustered, a Mitsubishi Diamond Vision III was set up. Picture quality was quite good and so was the sound. For the opening and closing ceremonies of the Games, high performance concert speakers were supplied by U.S. Sound under subcontract from Bose.

OTHER OLYMPICS

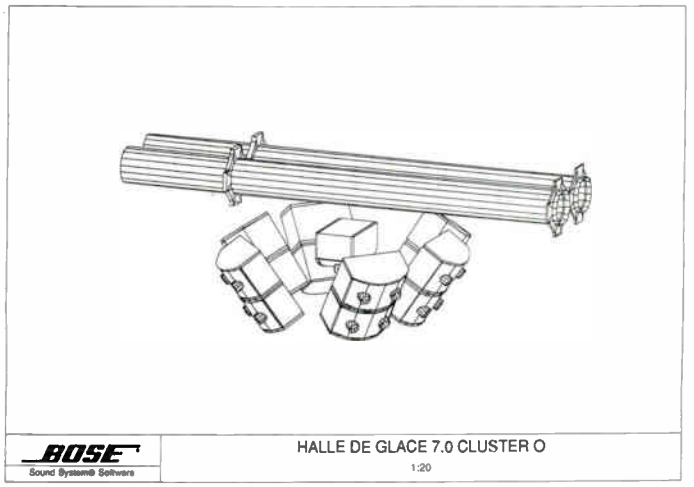
I really looked forward to this trip as I have not been to Europe for 15 years, nor have I ever been to a Winter Olympics. Most of my travels take me to the Orient, and during a few of these adventures I prepared the computer models and tested the sound systems for the 1986 Asian Games and the 1988 Summer Olympic Games, both in Seoul Korea.

I started work on the sound systems for the Korean facilities in 1985. The Seoul Olympic Committee knew that Ramsa/Matsushita used computer modeling for the sound systems for the 1984 Los Angeles Olympics and that TOA had used a computer modeling program for the 1985 Universiade in Kobe, Japan.

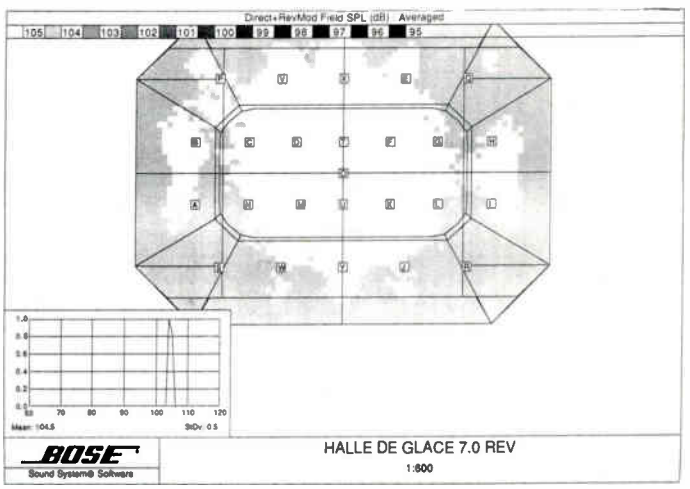
For the 1984 Olympics in Los Angeles, Matsushita was a sponsor and had donated the audio equipment for the main stadium as well as a few other facilities. Opening and closing ceremonies were by Best Sound, and Stanal Sound had supplied sound for a number of events in the Olympic Village. Matsushita had modeled the main stadium extensively on a high power mainframe computer. State-of-the-art techniques were used, cutting edge even by today's standards. Speaker directivity was measured using an automated lazy susan (a large turntable with the speaker on top), with a computer controlled mea-



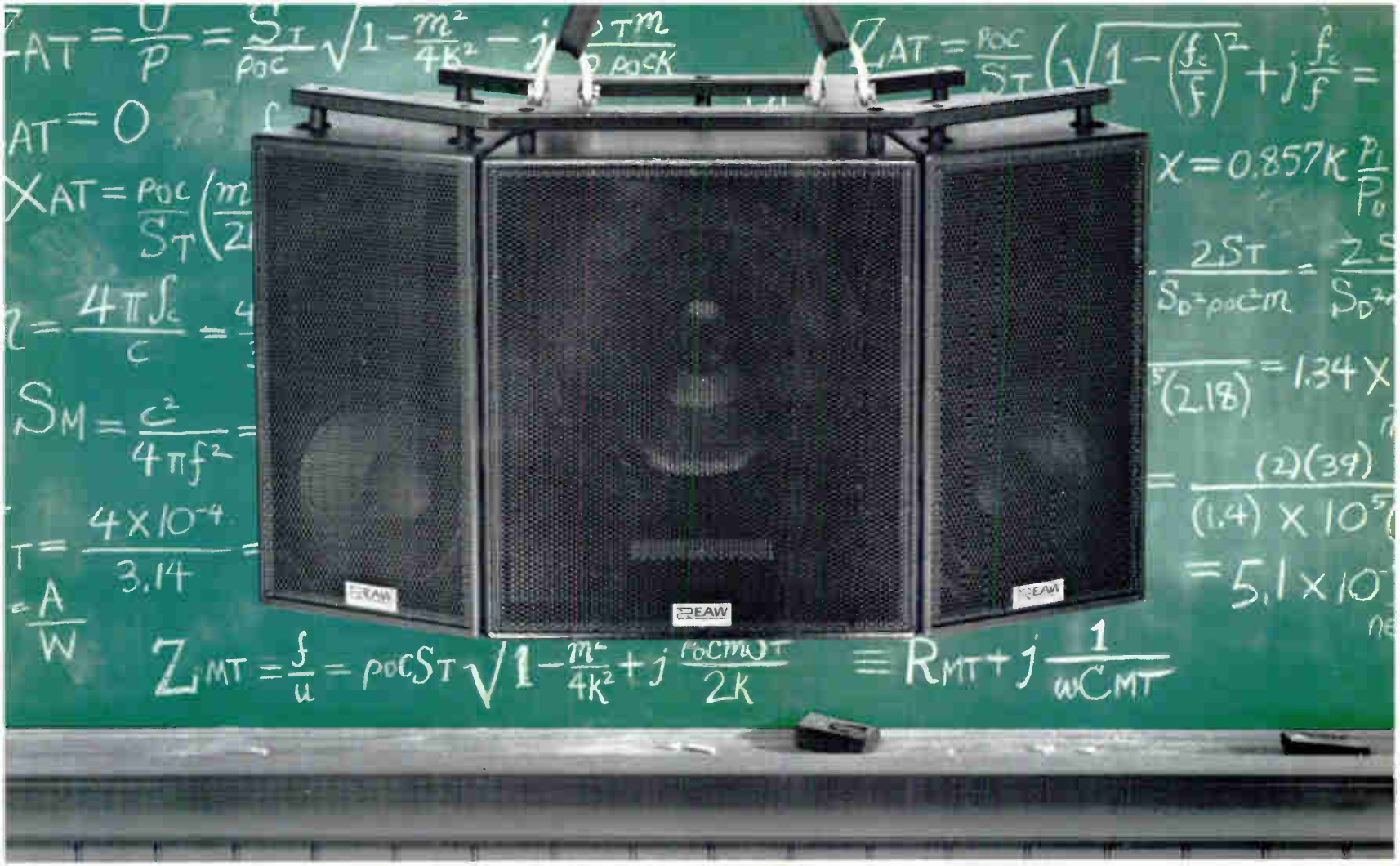
Model of the Halle de Glace.



Cluster O at the Halle de Glace.



Clusters at the Halle de Glace.



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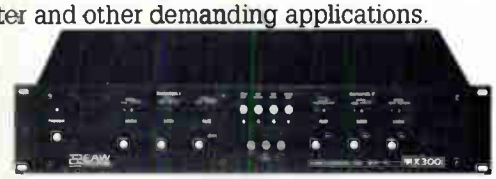
The KF300 Series includes a variety of hardware configurations and powering options, such as the horizontal AS300 enclosure, designed for distributed systems. Each version delivers coherent output, controlled directivity and wide full power bandwidth in concert sound fill coverage, theatrical systems, dance clubs, corporate theater and other demanding applications.



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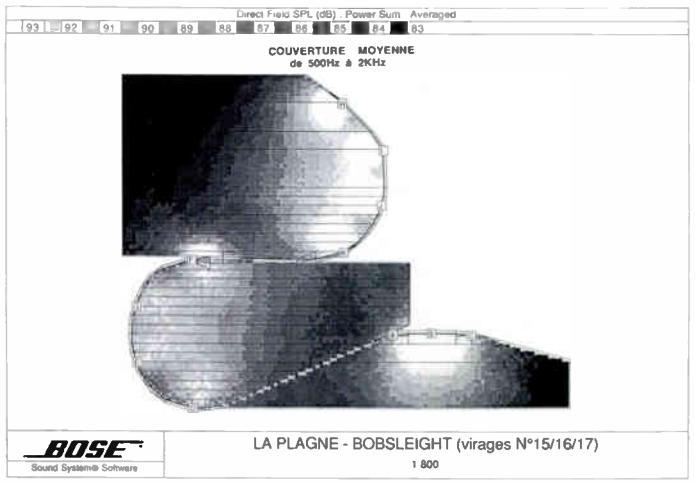
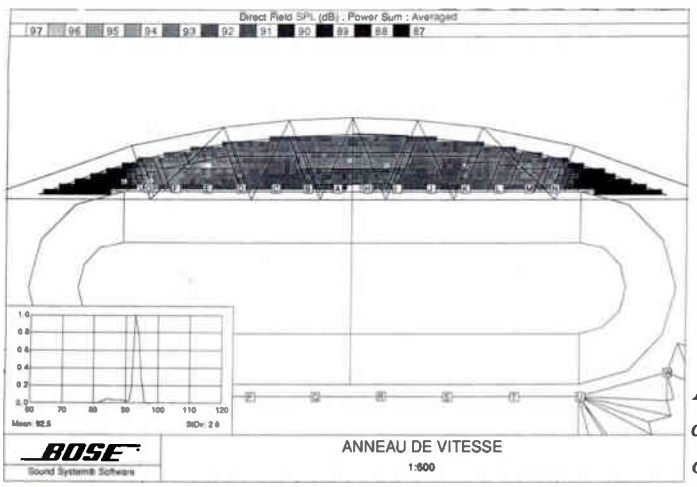
La Plagne — Bobsled coverage.





Anneau de Vitesse — coverage.

suring instrument acquiring the data, and this was entered into the program. Ray tracing computer modeling simulated the reflections of the sound system. Even more impressive, the resulting performance was auralized so that the sound quality could be audibly auditioned before the sound system was installed. Line (Bessel) arrays of horns were used to achieve the required directivity (sort of column speakers composed of large format horns). Yet for all this fancy technology, various rude surprises cropped up when the sound system was finally used.

TOA was the Official Supplier for the Universiade ("The Olympics Of Youth") in 1985, and took a more conservative approach using a "decentralized" sound system. TOA supplied the sound system for the opening and closing ceremonies as well as the sound systems in the athlete's village. TOA developed its own computer program for simulations of sound pressure levels. The program has evolved over the years and last year TOA began moving in the direction of preparing this program so it

could eventually be made available to sound contractors and acoustical consultants in the U.S. Presently TOA is planning to introduce its computer program but no official release date has yet been determined.

Back in 1985 my choices were limited. I had seen a demonstration in Korea of Fuji Sound's program which boasted ray tracing, but this ran on a powerful computer that I did not have access to. Porting this program to the personal computer and refining it for sound contractors was only a gleam in Altec's eye at the time. Years later this program evolved into Acousta-CADD, but this did not help me back then. Tom Birkle was working on Bose Modeler at the time, and I talked to Tom at the time, but he was not even able to tell me who was sponsoring his work, let alone provide me with a working copy. And the first cut of Modeler was a far less sophisticated program; the last seven years of development really shows in Modeler 4.0.

Six years ago, *Sound & Communications* had the exclusive story on the sound systems for the 1988 Summer Olympic games in Seoul Korea in the January and February 1987 issues.

The facilities included a truly Olympic sized stadium that held 110,000 people and was so large that baseball and football games were held simultaneously. Five sports arenas were also built; for cycling, fencing, tennis, weight lifting, and dance.

Central clusters were used for all the sports areas except tennis, as this was an open structure and the international tennis organization was very sensitive to sight lines, so a distributed system was used. The main stadium was also a distributed system due to its enormity. Ramsa had attempted a single cluster built adjacent to the score board on the periphery of the Los Angeles main stadium for the 1984 Games, but for all the fancy engineering, the computer modeling and auralization, the Bessel

The Les Saisies cross country area with Bose 402s.

View of Les Saisies cross country area.

horn configuration, the results were marginal. For the 1988 Summer Olympics, the sound contractor, Je-il Electronics, and I did not intend to fall into these traps, and all the designs were conservative and did not "push the envelope."

Since the Seoul Games, I have come across a sound system that could have been successfully used at the Seoul main stadium as a main cluster system, and this was Cliff Henricksen's U.S. Sound system which was used for the opening and closing ceremonies at the Albertville Games. *Sound & Communications* will be bringing you the inside story on what Cliff has been up to for the past few years. (By the way, it can now be told that Cliff wrote the popular Dr. Wokka series for *Sound & Communications,* and this series will be returning to these pages.)

Bose has earned "Official Supplier" status for both the 1988 and 1992 Winter Games and proudly points to this title being awarded on merit. I do not dispute this. Ramsa did "donate" their equipment and services for the Los Angeles Games. TOA was an "Official Supplier" to the Universiade Games, and the 1988 Summer Olympic projects in Seoul were strictly business for Sammi Sound Technology (Standford Acoustics in the U.S.) and Je-il Electronics, the Korean pro sound firms that manufactured and installed the audio systems.

BROADCAST

Broadcasting the Olympic Games is a major undertaking. CBS had a technical staff of 400 people at the games. The broadcast center was developed jointly by CBS and Sony Communications Systems. The facility is modular and will be taken apart and used again by CBS at the 1994 Winter Olympics in Norway. Most of the facility was actually prebuilt at Sony Communications in Sunnyvale California and shipped to the Olympic site as modules.

The optimum location for TV cameras was determined even before the venues were built, as COJO staff was able to use 3-D CAD modeling software to simulate the view that would be seen by the cameras. The integrated CAD system allowed modifications to proceed smoothly. Changing the position of TV cameras can easily knock out a block of seats. To determine the impact of such action, COJO used a perspective command that generated a wireframe model of the areas the cameras would cover. This made sure that there would be real seats for the spectators and perfect views for the TV audience.

The handheld wireless mics and hidden body-pack transmitters used by Charles Kuralt, Harry Smith, Paula Zahn and other CBS commentators were designed and manufactured by Lectrosonics. Sound & Communications readers probably know Lectrosonics best for their sophisticated boardroom and teleconferencing equipment, such as their automatic mic mixers and logic controlled amplifiers, as well as their excellent amplified lecterns. Miniature receivers, also made by Lectrosonics, were mounted on the video cameras to pick up the sound from the transmitters and the sound was then recorded on the video tape for rebroadcasting.

Symetrix SX204 headphone amplifiers were used for audio monitoring and intercom systems by CBS.

From the aspect of the sound system interface with the broadcast, most of the effort was spent in keeping the reinforced audio out of the broadcaster's mics. This was accomplished and all the broadcasts I heard sounded quite clean, more than I can say for the picture quality.

EURO HDTV 92

The Olympic Games boasted its own high definition TV channel which was presented by the EC (European Community) and the local TV station. Thomson, the giant French electron-

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ics conglomerate (perhaps you have heard of their U.S. consumer electronics division: RCA?), was behind the effort.

I am sorry to say that the results were not impressive. At first glance the wide screen was sexy (16 x 9 aspect ratio compared to 4 x 3 for standard TV), but the picture quality was miserable. Just about every video signal processing anomaly I have ever seen was present: jumpy scan doubling motion artifacts, fuzzy definition (over 1000 lines was claimed, but I have seen clearer pictures from receivers with less than half this resolution), and significant strobing on scenes with heavy white content. Definitely not ready for prime time!

How much of the funky performance was due to the broadcast linkup rather than the receiver is beyond me. In the Japanese engineering press the poor quality has been blamed on the early generation HDTV cameras. In any case, the system, called ProScan, will be marketed in the U.S. by RCA before the end of this year. While the set I saw in France was being fed a "high definition" signal, the ProScan receivers will be sold as HDTV-ready. The sets will include a connector for a high-definiton adaptor, but improved definition enhancement circuitry is built into the set. This IDTV Improved Definition TeleVision processing consists of scan doubling which will yield 1050 lines for the U.S. NTSC system. I think the scan doubling was the cause of at least some of the problems — it apparently lacked the sophistication of the Faroudja and the Frox systems. Any time a contrasting edge moved, especially horizontal lines, but diagonals also, the leading edge would jitter noticeably.

The receiver was located in the lounge at the Club Med resort where I was staying during the Games (A technical editor's life is tough!) and I took the opportunity to look over the manuals that were left under the receiver. Additional controls are provided to zoom a standard broadcast so it is shifted to the left of the screen and to use the right side of the screen for picture in picture (using a second TV tuner built into the set). The RCA receiver price range is targeted at $4,000 to $5,000 retail. Guesses on the cost of an HDTV tape recorder (or at least one that can cope with a 16 x 9 aspect ratio) are at $2,000 to $3,000.

The Japanese have their own HDTV system, "MUSE," but pricing has been around $35,000. Recent price reduc-

tions have brought a few sets down to $28,000. Just last week Sanyo introduced a 34-inch (same size as the RCA) with a list price of $8,000, intended for the Japanese market. The cost reduction is based on the application of using very large scale integrated circuitry chip sets which greatly reduce parts count and adjustments, as well as the anticipated increase in production quantities, which is set for 3,000 units per month.

Broadcasting of HDTV or 16 x 9 aspect ratio pictures is still up in the air (pun intended), and there is much discussion that programs may not be broadcast at all, but instead transmitted on a nationwide fiberoptic network.

All in all, the efforts at packaging improved definition TV into a wide aspect ratio format is an exciting development, but will not meet customer acceptance if the engineers have cut corners on the scan doubling and other subsystems in order to meet the price points required by the marketing department.

It is no surprise that most of the venues were configured as distributed sound systems, although a few used a central cluster array along with distributed subsystems on delay lines.

CONCLUSION

All-in-all Bose can point to a real success story. Everything sounded fine and worked well, the broadcast people were happy that the reinforced sound was kept under control, and both the athletes and spectators were certainly impressed with the results. In an upcoming issue, we'll discuss the unique and innovative sound system developed by U.S. Sound that was used at the opening and closing ceremonies. ■

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FROM ALBERTVILLE:

Surprising Find on the Olympic Heights: Dr. Wokka

Editor's Note: Longtime readers of Sound & Communications have repeatedly asked us to return the discourses of Dr. Wokka to these pages. We couldn't. Dr. Wokka was in communicado as his respected and anonymous alter ego worked on a complex Olympic Sound System. When our Technical Editor, Mike Klasco, appeared in Albertville, Dr. Wokka appeared there also, and passed on the following communique (complete with supplied "Editor's Notes" presumably written by the Doctor himself). We print it in its entirety:

Dear readers,

We are basically breathless! The following correspondence was forwarded to us recently. It was handed discreetly to Mike Klasco as he covered the Ceremonies Fermiture of the recent Winter Olympics in Albertville, France. The donor disappeared with a wink and a nod, without a trace, into the heaving throng of jetsetters and Albertville urchins. The document, though crumpled, stained with drops of water and folded many times, included an envelope with a forwarding address on it. Without going on further, we have transcribed the contents of the letter for you. The conclusions are obvious.

Dear Dr. Wokka,

I understand that your Great Grandfather Werner Wilhelm Muttshundt Wartenburger Wokka XXIXV was somehow involved in the tearing down of the Berlin Wall last November. Please tell us to what extent and exactly what he did.

Your Faithful follower
Arnaud Claude Besoin de Toilette
Toillieries des Carteaux Blanc
Nouveaux
Polly Wolly Voux Les Voux
Vichyswoixettes, Quockaquoi,
France

Dear Mr. Besoin,
No.

Editor's note, continued:

What does this mean? It means he lives! Yes, Dr. Wokka is alive and not writing under some pseudonym somewhere. Imagine our reaction. Vinny Testa was delighted too, especially in that Dr. Wokka owes him money. But, business aside, we contacted The Doc at the return address, withheld here for obvious reasons. I mean, since he disappeared, more people in the sound business want to talk to him than to Bruce Springsteen. And we're totally perplexed. He never called, never wrote. Imagine our consternation. What did we do wrong? Was it something we said, was it something we thought? (He reads minds, you know). So, to add impact, we actually wrote to the Doc himself. The following are our letter and the shocking reply, complete with . . . well, jubilant reader, you can read it and get ready for the fireworks.

Dr. Wilhelm Wokka
(address deleted)

Our expert in foreign policy, Mike Klasco, received an anonymous donation of a letter which includes a question to you and your reply, complete with return address in France. We thought you were dead, or writing for some (gasp) other magazine under a pseudonym. How glad we all are that you are alive.

Let us cut straight to the point: We are prepared to offer you a monthly retainer fee of $(deleted) to have you resume your column in our magazine. Although your disappearance corresponded with a 126% increase in total issue sales, we feel that the prestige of the magazine suffered considerably with your disappearance. We would sleep better at night knowing we had a firmer spiritual and technological base to the magazine. Even if the reader base narrowed as a result of your return, the quality of the readership surely would be of a more suitable quality. Forget making money. After all, we serve mankind first and make money second, n'est ce pas? By the way, speaking of the devil; forget the money you owe us. All is forgiven. Please come home. Send a letter soon.

Yours truly,
Sound & Communications

Editor's continuingly annoying note:

So, here is the Doc's reply.

Dear friends at the Testa Communications Empire,

It is with tears in my eyes that I return your letter. Imagine my surprise — my old compadre Vinny and the Testa Communications staff writing in friendship after all these years. And forget the money? Amazing.

First of all, I accept your proposal and will continue my column, which I know has been a continuous inspiration to the readers of your magazine. The fee is excellent. Lastly, I must confess that it was I, in clever disguise as a French cheese farmer, who delivered the old crumpled letter from Arnaud Claud Besoin de Toilette. Imagine Arnaud linking me and grandpa Muttshundt Wokka to the razing of the Berlin wall. What nerve and insight! (More on this later—this required a rather unusual speaker system).

Although I never returned the letter to Claud, I did answer it and it moved me to tears, bringing all those repressed feelings of shirked responsibility along with it. The water stains on the letter were my own heartfeld tears. I just didn't have the courage at the time to let anyone know where I was.

When The Olympics came to town, I knew someone from your staff would

be at the Ceremonies and I knew I could recognize them. So I went and sure enough, there was Mike Klasko, sticking out like a sore thumb in a sea of dignified Frenchmen, climbing all over the speaker systems there with his camera and micrometer, as usual. They had to pull him off, kicking and screaming, and force him to sit down. Why does he insist on looking like a Hell's Angel while representing your (our) magazine and our country? I mean is all that Harley Davidson attire and chrome chains necessary? You know, the chains made so much noise at the ceremony, he was asked to leave. Of course he refused, threatening legal action from New York lawyers and waving his $300 ticket (with all its rights and priveleges) at the shocked volunteer usher. No wonder Americans get such a bad reputation abroad. And can't you make him cut his hair and stop using all that Vaseline (motor oil?) on it? Honestly. Anyway, let me tell you how all this has come about.

As you know, my last series of bouts with the evil audio empire left me drained and useless. Coincidentally, I received a letter from old grandpa Muttshundt Wokka in Dresden about taking care of his castle in southern France for a year, as he had become involved in building up the new German army. So I packed Marge and the kids and headed for "the other side of France" in a minute. Of course, Marge didn't appreciate the women in hula skirts (and believe me, nothing else!) running around all over, playing flutes to baskets full of cobra snakes and smoking cigars. I mean, the south of France is something else. But the palm trees are nice, and I can always sneak a peek when Marge is distracted by the gigolos there. So there we were, in paradise, taking care of grandpa Muttshund's estate overlooking the Mediterranean. So I had a lot of time to think.

The locals have many surfing competitions, beauty contests (oh, la la) and soccer (football) matches and often need permanent sound systems. So I continued my work and research in relative quiet and seclusion. The contrast to the American ways of doing business was startling, and I am now prepared to return to the U.S. and to the Philadelphia Medical College of Musical Knowledge and take up my long-neglected work there, and of course get settled into the Testa Communications Empire once again.

Believe me, I have thought long and hard about this in the quiet of this idyllic place and it's time to do the right thing. When you receive this, I will already be back home, setting up shop, and your readers can reach me as usual through the magazine. Although I must catch up on my correspondences, and answer poignant reader inquiry, I can tell you that I am planning a complete series on sound contracting, exposing all the evils in America and developing plans for doing sound contracting the Right Way. Grandpa Wokka is moving back here (something about angry East Germans being after him) and we are looking forward to being Americans once again. Of course, I'll miss the Hula Girls and french fries here, but the Big Hair at the Jersey Shore and MacDonalds fries are better anyway. I hope Marge doesn't read this. Anyway, I'm back.

Editor's continuingly annoying comment, though the last:

There you have it. Can you believe it? Look forward to new insights into audio psyclophobenia and dissertationality by the Original Great Man of Science. Next Issue: Dr. Wokka's return to the Testa Communications Offices on Long Island. ■

{ *A short story about inspiration and heavenly results.* }

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TOA's new wireless system, the modular miracle — add or change frequencies — up to four channels in one rack space.

That first system included a true diversity receiver, one that fit the new half-rack standard, and a featherweight lavalier. The Reverend noticed his new TOA mic gated silently on and off and delivered excellent field strength, up to 300', for more than 12 hours — all from a single AA battery.

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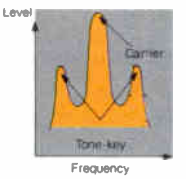

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Complexities of the Theme Park

Sophisticated Equipment Makes Them Work

BY DOUG MOBLEY

At theme parks the *Show* is the primary consideration. An installations look and sound must reinforce or even create the Show without distracting the audience or calling any attention to itself. This must be done while building a system which might be called upon to run 12 to 18 hours a day and 365 days a year and will be operated by minimally skilled personnel. Its reliability must be such that it can not be damaged by the average ride operator or passing vandal, and when there is a failure, it can be repaired and brought back on line within minutes by even a minimally skilled maintenance person.

Just what defines the Show is usually a concept which is somewhat nebulously defined by the artists who have designed it. If any information has been put down on paper which specifies exactly what is needed for an attraction, it is guaranteed that this will have nothing to do with what is actually needed. In dealing with artists, you must be able to take sweeping hand gestures and grandiose descriptions and translate them into a system which will do the job at an acceptable cost. Contrary to popular belief (with one exception), the world of entertainment isn't made of projects with unlimited budgets.

Entertainment installations are among the most complex you can find. The sound system must not only be able to stand on its own, it must work with a wide variety of other complex systems, many of which are unique to theme park installations. A single installation can include such esoteric equipment as animation control systems, laserdisks, compact disks, digital audio repeaters, lighting control and dimmer systems, lasers, special effects systems, pyrotechnics, fog and smoke machines, safety systems, film projection, video monitoring systems, ride conveyance systems, pumps and compressors, complex public address systems, and audio processing systems. Even though many systems will be provided by separate vendors, all of them must work seamlessly with each other.

When there is a problem it is almost always caused by one system's inabilities to connect to another.

When there is a problem during an installation, it is almost always caused by one system's inabilities to connect to another. This is what makes coordination between all the vendors on a project so important. Wherever your part of the installation comes close to any other vendor's equipment, you must be willing and able to take the time to contact all of the other vendors on the job to work out even the most mundane details (like numbers and types of wires, connectors and signals). You shouldn't entrust any technical details to the project coordinator (if there is one).

Something you won't often find these days are any form of tape systems. Low maintenance and long term reliability are of paramount importance in any installation that must run reliably through a daily 12 to 18 hour day. EPROM-based playback for audio and animation and LaserDisks for video have virtually

Doug Mobley is the Owner of Gilderfluke & Co. of Glendale, California.

A Gilderfluke animation programming console.

replaced all forms of magnetic media. High Definition Television (HDTV) is being used increasingly to replace film systems.

EPROM audio playback systems for use in entertainment installations must have a bandwidth and dynamic range which must at a minimum match the sound qualities of the tape systems they have replaced. The majority of EPROM audio playback systems today use a simple 3 or 4 bit ADPCM encoding and fairly low sampling rates. This makes them suitable for simple voice announcements or telephone applications, but unusable in most entertainment applications.

High Definition Television is being used increasingly to replace film systems.

A small number of manufacturers make higher quality digital audio repeaters for entertainment applications. The majority of these use an 8 bit Law encoding and sampling rates of up to 35 kHz. This gives a dynamic range of 72 dB and bandwidths to 15 kHz.

The next generation of repeaters will be using 16 bit over sampled encoding.

The next generation of repeaters will be using 16 bit oversampled encoding and 32 to 48 kHz sample rates to produce full CD quality audio reproduction. With the proliferation of CDs, DATs, and other 16 bit audio hardware, the cost of manufacturing the higher resolution digital audio repeaters is falling rapidly. Since they use twice the amount of memory to store the same amount of sound, the cost of EPROMs is currently the only thing slowing down the popularity of these systems.

The big disadvantage of all EPROM audio storage is the cost of the EPROMs themselves. Unlike a tape system, adding a few minutes more playback time to an EPROM system can multiply its installed cost. This will occasionally make it cost effective to use a LaserDisk player like the Pioneer LD-V8000 with its four audio outputs even when the video output isn't needed. Strong, the commercial projector and spotlight manufacturer, has recently introduced a LaserDisk player which has eliminated the video channel in favor of more audio tracks and longer playback times.

The costs for both EPROM and LaserDisk systems regularly falls with the continuing price reductions for EPROMs and the costs of pressing custom LaserDisks.

The Animation Control System is one of the more unique pieces of equipment you will find in any installation. It is a computer-based system which is used to control and tie all of the show elements together. The difference between an Animation Control System and any other type of

Animated show in shopping mall built by Advanced Animations using control systems and EPROM audio playback by Gilderfluke & Co.

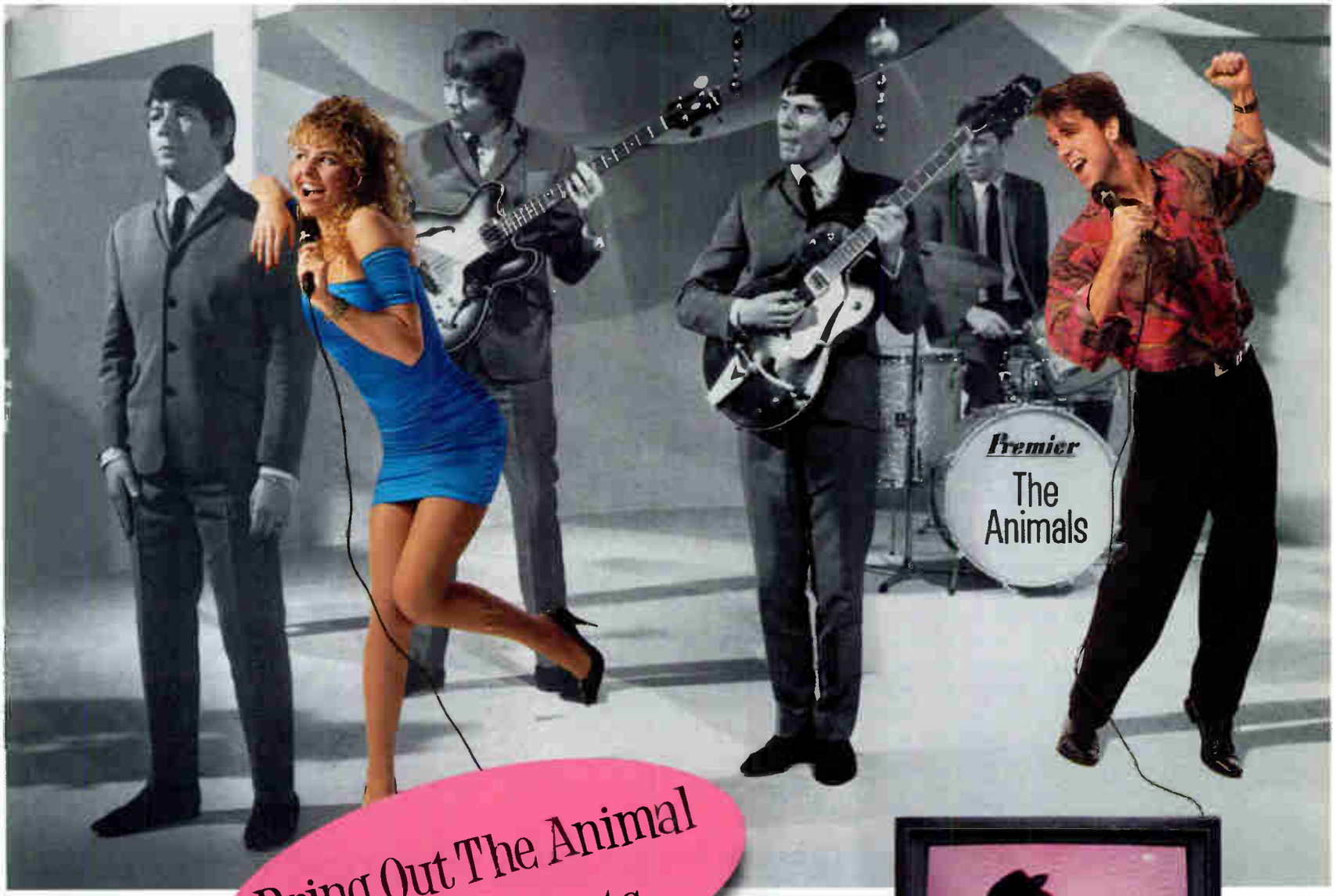
Scene from show installed in Lotte World (Seoul, Korea) by Creative Presentations using equipment from Gilderfluke & Co.

control system you may have encountered is that an animation system is programmed "real time." Instead of typing in tens of thousands of lines of instructions to program the show, the programmer simply manually operates one or two outputs at a time as the system "remembers" exactly what the programmer did and when he did it. On the next pass, these preprogrammed movements will "play back" exactly as recorded as the programmer adds in

The programmer simply manually operates one or two outputs at a time as the system "remembers."

a few more movements. The programmer keeps adding more movements ("tracking up") until all of the outputs are "roughed out". The show data can then be edited 'off line' or reprogrammed as needed until all the outputs are programmed exactly as the programmer wants them. The show data is then usually burned into EPROMs for permanent installation in the animation system.

The architecture of the Animation Control System will depend on the manufacturer and the physical layout of the show. With a large show



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where all of the controlled devices are located within fairly close proximity of one another, a centralized control system is the most convenient design. With a show which is spread out throughout a large area, it is usually preferable to distribute a number of small independent control systems to near whatever they are controlling. This eliminates the massive amount of wiring which would otherwise be needed if all the control signals had to be run from a single location. If all of the show elements are to be run together (synchronized), a small cable can be run between each system to keep them all in sync. If the show elements are all to be run asynchronously, trigger inputs can be run from photo electric switches or other sensors along the ride conveyance system as needed.

If the show elements are all to be run asynchronously, trigger inputs can be run from photoelectric switches.

All animation systems have basically two types of outputs. Digital outputs are used to control anything which requires a simple *on/off* type of control signal. These are used to control solenoid valves for 'digital' movements in animated figures, or to turn on and off pumps, lights, or other simple functions. The digital outputs from most Animation Control Systems are solid state outputs which can switch a 12 to 24 VDC output at 150 ma. Relays are used as needed to control larger current and higher voltage loads.

Analog outputs are used to control

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Animated display in retail store built by Advanced Animations using control and animation systems built by Gilderfluke & Co.

Miami Vice Show at Universal Studios, California using animation, pyrotechnics, lighting, EPROM audio playback and other systems. Safety systems are used to protect live actors from harm. Helicopter controls by Gilderfluke & Co.

anything which needs to be turned *on, off,* or anyplace in between the two. Typical of these are higher quality "analog" movements in animated figures, light dimmers, or Voltage Controlled Amplifiers (VCAs) for programmed audio controls. An analog output from an animation system is usually a 0 to 10 VDC signal at up to 24 ma. This is compatible with most devices that need analog control signals.

Other outputs from some Animation Control Systems can be used to send serial data for controlling LaserDisk players or other serial controlled devices, DMX-512 multiplexed dimmer control signals, and tape deck control signals.

The Public Address Systems used in theme park attractions have to be fairly complex. From any station, it may be necessary to access a series of overlapping zones depending on the situation. Most ride-through style attractions have a video system for guest monitoring. If an errant visitor needs some reproach, the operator at this PA Station needs to page into only the area of the attraction where that person is located so as not to disturb the other riders in the attraction. PA Station locations at the turnstile or load/unload stations may need to selectively page into the ride load/unload areas, queue areas, preload areas, entry areas outside the entrance to the attraction, or any combination of these. Stations located at the emergency exits to the attraction need to be able to page into their local areas for use in ride evacuation situations. Automated announcements will often need to be fed into the PA System from EPROM audio play back cards. These are automatically triggered by the rides conveyance or other source in emergency or other unusual situations. Other announcements which may need to be fed into a single attraction's PA System may come from the park's overall PA System for use in emergencies or for any important park wide announcements. ■

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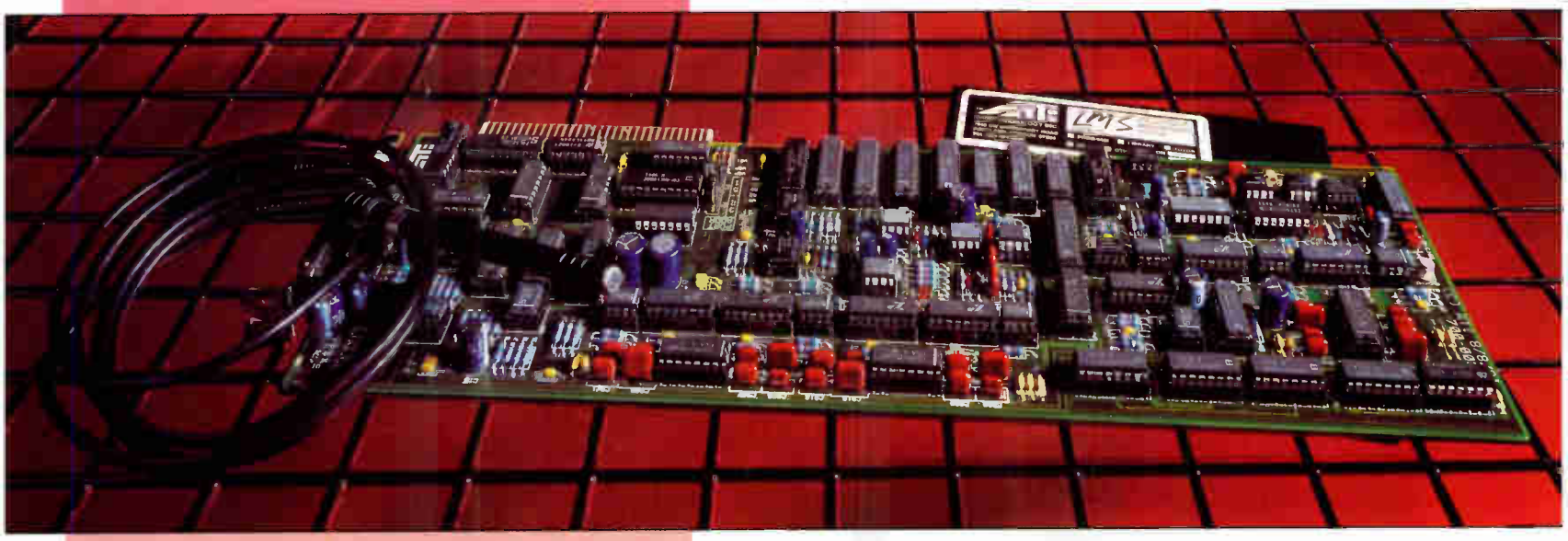

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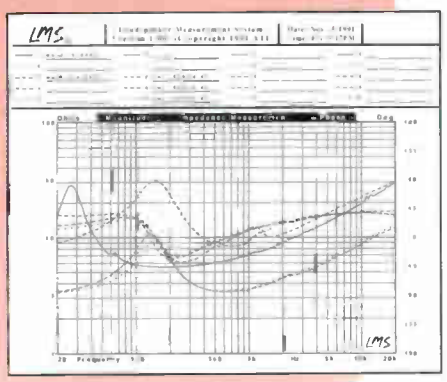

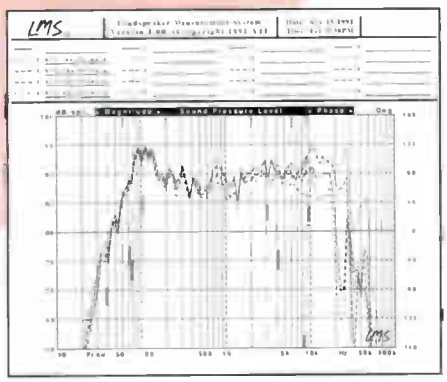

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An Audio Attraction at Sea

Retrofitting a 27-year-old Yacht

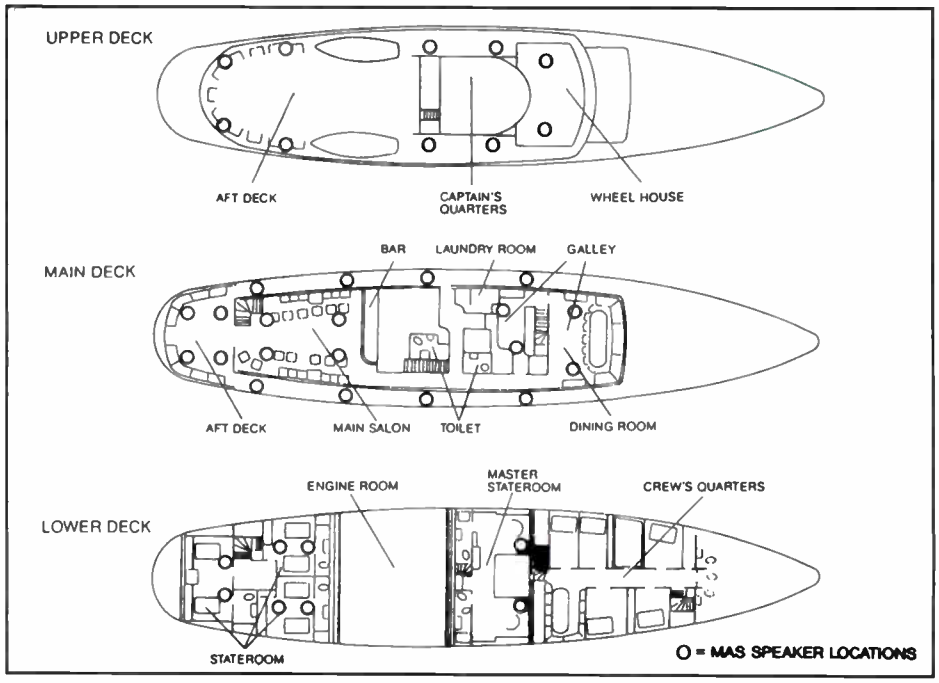
BY ART STEINMARK

After 15 years in the business, MAS Audio was beginning to think they'd seen it all . . . from tour support to service contracts. Then they got the call to retrofit the Imperator, an ocean-going motor yacht. It was the beginning of a challenging, unforgettable assignment.

"We went down to Penn's Landing (on the Delaware River) in Philadelphia to evaluate the job," says Roger Williams, partner in MAS, "and it was the biggest boat there, it was a ship, it filled up your entire field of vision."

It's true. The Imperator is 142 graceful feet of seaworthy steel, brass and exotic wood. A trans-Atlantic vessel, it has a full complement of navigational instrumentation and communications gear, 1300 H.P diesel engines, a cap tain and crew of eight, and a cruising range of 3,500 miles. From New York, that could mean a non-stop trip to London.

Yes, what the MAS Audio design team boarded in Philadelphia was a 27-year-old nautical masterpiece in pristine condition. Except for one thing: the audio system, installed in 1977, was out-of-date and seriously deteriorated from the salt sea air.



Survey diagram of the boat's three levels showing speaker locations.

The Imperator is owned by A.P.A. Yacht Charter Corporation, which leases it for meetings, events, and cruises. A first- class sound system is not an extra, it's a functional part of the yacht's commercial equipment. "They wanted us to bring the system up to the incredibly high level the boat is operated and maintained at," recalls Michael McCook, co-owner of MAS Audio, "the level people expect when they charter a yacht like this."

Having contracted with MAS Audio for installations in other facilities, the owner was familiar with their work. "Other systems we've done for them were engineered solutions to audio problems, top-of-the-line commercial equipment combined with our own components," says Williams. "So

Art Steinmark is a business writer based in New Hope, Pennsylvania.

when we got together for the first meeting on the boat, we could get right down to questions of what was needed and how to do it around the Imperator's schedule."

After the initial evaluation in Philadelphia, MAS returned to the yacht in Hudson Harbor, West New York, for system design presentation and final negotiations. The Imperator was at its private Hudson River pier and would sail for Florida only days after the work was completed. During the installation, the MAS team would stay in a suite at the APA corporate guest quarters in Weehawken.

System requirements were straightforward: it had to allow for a variety of inputs including microphone for shipboard announcements; it had to accommodate multiple stereo listening zones, with volume control in each and a discrete system in the master stateroom; and, naturally, it had to withstand the rigorous shipboard environment. "They wanted a system that was flexible and bulletproof," McCook says, "waterproof, actually."

Finding the right speakers was the easy part. At NSCA Expo '91, the MISCO exhibit featured a speaker operating submerged in an aquarium. A few months later, that memorable exhibit paid off: MISCO waterproof co-axial speakers were installed throughout the Imperator, a total of 38 speakers in 12 listening zones, each with a Mallory MGLL16 Remote Volume Control. "The waterproof speakers and MIL-spec L-pads were absolutely necessary for this job," Williams says, "especially since four of the 12 zones are outside." Silicone was used to form speaker gaskets and protect electrical connections.

Equipment rack on the Imperator.

A boat creates a unique set of working conditions. The Imperator was in service, so the work was done around chartered excursions. "First thing

The Imperator steaming past the financial district in New York City. The 142-foot yacht was designed by Philip L. Rhodes and built in 1964.

"There's a lot of steel on this boat to cause interference, but the wireless mike performed powerfully and clearly."

every morning we'd find the crew polishing teak and brass," says McCook. Dropcloths were used for extra safety and each day ended with a meticulous clean-up. "For a week, we became part of this shipboard crew, right alongside these guys, in the inner workings of the boat," Williams adds.

The boat was moored while they worked; still the team had to develop sea legs. "You'd be on a ladder trying to run a wiring harness past some boat linkage in the overhead, when suddenly the boat would pitch," McCook says. "After a while you get used to hanging on and working at the same time."

Confined space, a fact of life on boats, affected every consideration, even in the master stateroom. Here, so the owner or occupant can listen to programming apart from the main feed, MAS installed a special-order Sony sub-compact component system. Fitted in a small cabinet with center-pull doors, speakers mounted beneath bedside tables, the Sony features total remote control of all functions, including recall of preset EQs and input selection. The master stateroom is wired to tap the main signal through the Sony.

For the main equipment rack, room was found amidships, in the main salon, behind the bar. The system is driven by Hafler PRO 2400 power amps. MAS is a Hafler dealer and often specifies Hafler components. According to Williams, the PRO 2400 was chosen for its sound and durability, especially its ability to drive a very low impedance load without failure. A Hafler SE-100 preamp was selected because it has a good clear signal path and accepts many inputs, allowing for system expansion, which MAS expects to include video, cassette, and, possibly, DAT.

Current inputs to the system are a Carver PSD-36 ten-disc CD player, an innovative product introduced last year; a Hafler SE-130 AM/FM tuner;

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and a Lectrosonics PRO DIV-T wireless system. The Imperator is used on scenic cruises, and the wireless PRO DIV-T allows an announcer to go anywhere on the boat to easily point out landmarks or things of interest. "There's a lot of steel on this boat to cause interference, but the wireless mike performed powerfully and clearly," McCook says.

Dockside, the Imperator gets power from a land feed; at sea, power comes from onboard generators. Two Furman PL-PLUS were included for power conditioning and protection, particularly during switchover between sources when a voltage spike can occur. A BBE 422-A is used for sonic enhancement. Williams says, "It's an improvement to the sound that's obvious to the ear. We include them in all systems of this calibre."

Misco's JC80WP speaker in use on the Imperator.

Equipment List

2 Hafler PRO 2400 Power Amplifiers
1 Hafler SE-100 Pre Amp
1 Hafler SE-130 AM/FM Tuner
2 Ross Systems R-15S Equalizers
1 BBE 422-A Stereo Sonic Maximizer
1 Lectrosonics Pro DIV-T Wireless
1 Carver PSD-36 10-Disc CD Changer
38 MISCO JC80WP Waterproof Speakers
12 Mallory MGLL16 Remote Volume Controls
2 Furman PL-Plus Power/Light Modules
1 Sony MHC-2600 Mini-Component System
1 Middle Atlantic D3 Drawer w/Lock
1 Middle Atlantic D4/CDP Drawer w/Lock
1 MAS Custom Rack Harness
3 Middle Atlantic SF-1 Security Covers
2 Middle Atlantic RK-20 Racks
1 Anti-Stat Rack Riser
2 Double Space Vent Panels
1 Single Space Vent Panel

Complete, the installation provided required zone control, range of inputs, and high fidelity. The system's shakedown cruise included testing all modes through the entire operating range. After setting EQ, security screens were installed.

The last order of business was conducting a full tutorial for the crew. Assembled by the captain, the eight crew members listened and watched as MAS demonstrated the system, explaining each component's function and operation. Particular questions centered on operating the wireless, setting stations, and changing

(Continued on page 131)

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FROM THE COCKPIT TO THE ORCHESTRA PIT — PAUL S. VENEKLASEN

By Pamela Michael

Chances are some of the techniques or equipment employed by a sound contractor on a given job are the result of research conducted by Paul Veneklasen, founder and president of Paul S. Veneklasen and Associates in Santa Monica, California.

From his involvement with the development of high quality motion picture sound systems (1945) with Altec Lansing and early work (1947) on stereophonic sound with Cinerama, Veneklasen is responsible for numerous advances in the audio field. Add his extensive acoustical research during World War II on aircraft noise reduction to the mix and it can be said that from cockpit to orchestra pit, Veneklasen has the field covered. Today Paul S. Veneklasen and Associates provides consultation, design, research and testing in architectural acoustics, audio-visual design, auditorium functional design, environmental and industrial noise, vibration, and aero-acoustics. Its sister organization, Western Electro-Acoustic Laboratory, is a fully accredited independent laboratory facility which provides testing in accordance with ASTM standards.

The firm maintains a strong commitment to in-house sponsored research and development using advanced acoustical and electronic measurement techniques. The firm pioneered the use of practical acoustical model measurements with criteria derived from their Auditorium Synthesis Studio. They developed the first practical, fully adjustable orchestra enclosure with integral lighting, which could be stored within a stage house.

We spoke with Paul Veneklasen, who at 76 still puts in a full day's work, about his interests, accomplishments and challenges. The "Young Turk" of the firm, Senior Associate Neil Shaw and Principal Associate Jerry Christoff also spoke with Sound & Communications. With Principal Associate Jose Ortega, they have more than a total of 78 years with the company.

From left to right — Christoff, Shaw, Veneklasen, Ortega.

Sound & Communications: How did you find your way to acoustics? Were you a tinkerer as a kid?

Paul Veneklasen: Yes, my Dad had tools at home and I used to take on various projects, like cars and model airplanes.

Sound & Communications: How did your interest in music develop?

Veneklasen: My mother was a fine musician — piano and organ — and my father was active in choral work. I played trumpet and French horn and then focused on choral oratorio.

Sound & Communications: What about your formal education?

Veneklasen: My undergraduate work was in Aeronautical Engineering and Physics, including an M.S. In 1938, after Northwestern University, I came out to California to work on my Ph.D. at UCLA with Dr. Vern O. Knudsen, one of the greatest gentlemen anyone could ever know, who was then Dean of the Graduate School and a lecturer in Acoustics. After two-and-a-half years at UCLA, the Japanese struck in December of 1941 and that ended my Ph.D. work because I was immediately thrown into what was known as "war research

work."

The initial focus of my work was in ear protection, which was classified as a secret project for reasons which only came out after the war, but suffice it to say I spent a good deal of time protecting hearing from loud noise. Then after a year of that in my own lab at UCLA, we branched off as an adjunct to Research on Sound Control going on at Harvard University. I became sort of the western branch.

We were concerned about the extreme noise in military aircraft and the reason for that was that communication became more and more impossible in the noisy environment of aircraft. So I was flying around out here in military aircraft making sound spectrum measurements. Then I continued the war work in long distance sound ranging at Duke University and speech communication at Harvard University.

After the war I had to make a very crucial decision about whether to remain in acoustical endeavors, primarily musical acoustics, which I had begun in my Ph.D. work, whether to continue that, or to go back into aeronautical engineering. I had two offers from major aircraft companies and decided on the other hand that I was too interested in the music field. What was missing from that field was adequate loudspeakers for respectable reproduction of musical material. So after the war I spent fours years developing a Research and Development Department for Altec Lansing.

Sound & Communications: That must have been an exciting and fruitful time.

Veneklasen: Yes, it was. As a result of the work on instrument development, I later split off and continued only on a consulting basis with Altec, while starting Western Electro-Acoustic Laboratory. This was 1948. That work started with the assistance of an old family friend with whom I worked weekends in his garage. Sort of a one-and-a-half man operation. That developed to the point that people using my instruments became aware of my existence and I started getting more consulting work. My first two clients were Northrop Aircraft and Aerojet. This gets to the span of our company's current activities. The musical interests led to what has been my predominant activity — auditoriums, concert halls and theaters.

Sound & Communications: Tell our readers a little bit about your Auditorium Synthesis facility.

Veneklasen: We've been using it for

Portland Civic Auditorium.

Compact Video Entertainment Center.

about 25 years now. Our first major auditorium project was the Seattle Opera House. In that design I had emphasized the generation of lateral reflections, as we reported in a JASA article. Dr. Knudsen supplied the term "envelopmental" sound. Later, further developing this feature for the Saratoga Pavilion, the comment of an astute reviewer made me realize that we needed a way to determine quantitatively the D/E/R (Direct/Envelopment/Reverberant) ratio. Auditorium Synthesis was born.

The main work in auditorium design has to do with a quantitative research approach. We earnestly believe that design must start with quantitatively derived performance criteria. I think it's fair to say we have done a great share of the real research work making these spaces effective for their purpose, not only for acoustics. When it comes to theaters and concert halls, there are many functional factors which are rarely recognized when an architect plows into such a project; many factors which have to be individually designed for perfection, but must be also designed for proper coordination, in other words, for cooperative and compatible design. So that has led us into acoustical design that starts out with questions about even the very purpose, and integrated design in terms of traffic patterns, backstage facilities, that sort of thing.

Sound & Communications: Describe some of your research projects.

Venklasen: We are constantly looking at the acoustics of concert halls and auditoriums. We've come up with a great many new and highly developed features that enhance the utility and perfection of these spaces, a whole list of them. That research involves intensive acoustical modeling, and it also involves a technique we call Auditorium Synthesis.

In this space, which is really just a small studio, we are able literally to synthesize auditorium sound. I say auditorium because in it we can synthesize the sound of a small review studio, let's say, for the motion picture industry, or synthesize the sound of a lecture hall, a small recital hall, a large scale concert hall or theater to illustrate how the acoustical design must vary depending on the application. We can even recreate the sound of a great cathedral.

Sound & Communications: The sound of a specific great cathedral?

Veneklasen: Yes, take your pick, choose your location. So we are able to demonstrate to people, say sitting in the "hall," preferably with eyes closed, because the acoustical environment is totally incompatible with the visual one in this setting, you see. And we are able to demonstrate the proper acoustical environment for everything from a mammoth pipe organ, down to a single flute, or a speech by Charles Laughton. So this has been an invaluable guide for what must be achieved in the acoustical design of auditoriums.

Sound & Communications: At what point did you introduce computers into the mix?

Veneklasen: In Auditorium Synthesis we needed delay lines. Envelopmental sound requires that the sound be projected from the equivalent of side walls with exactly the delays that would occur by natural reflection. In order to produce those delays, we had to use electro-acoustic means. We still preserve in our laboratory the delay tube with its series of microphones along the tube which was used to produce those delays. About 12 to 15 years ago, the delay process created by digital means became available. We held off until we were sure they had proved themselves, then introduced them. Interestingly enough, the electro-acoustic original ones we used for years never had a failure; they just went on and on, never needed any service whatsoever.

The digital delay lines, like all this digital wizardry, need constant maintenance. We now use digital delay lines. But the digital processing for reverberation has not yet reached a stage of perfection which can compete with a true reverberation chamber. So we use our true reverberation chamber, which is downstairs, introduce sound into it and couple it back into the listening space to produce the reverberant sound. As for acoustical modeling by digital means in our business — here I would have to say, and not just because of my age, that I am still not convinced.

Sound & Communications: A holdout, huh?

Veneklasen: It's a worthy endeavor, but the techniques do not recognize nor are they by any means capable of handling anything like the complexity of what goes on in the acoustical

Toyota Motor Sales Training Center.

field in the concert hall. They cannot handle acoustical diffraction, and complex acoustical shapes can only be approximated with a series of flat surfaces, which is a totally inadequate approximation. The difference between coverage and delay gets mixed up whenever you use curving surfaces. So, while I would not want to discourage research by any means, digital techniques cannot do the degree of complexity that is handled by acoustical modeling, and as a matter of fact, do not even duplicate what we need to know and can find out by using the simpler technique of optical modeling. Good luck, fellas.

To claim that computer techniques can do these things less expensively is not true, either. If you take the effectiveness/cost ratio, we are still way ahead with optical and acoustical modeling.

Sound & Communications: That leads to my next question. What do you see as the issues and design challenges of the future? Equipment of the future?

Veneklasen: I was just working on an outline for a talk I'm giving to the local chapter of the ASA here in Los Angeles this spring. It deals with some of these very concerns. The title is "The Performing Arts — Whither and Where?" Where are we going with these arts? Where, and by whom, will they be appreciated? That's a big question. I'm an old guy; however one

of my biggest problems is getting young people to look ahead and speculate on these issues when they design a concert hall and theater. To consider what will the arts be like 50 or 100 years from now. Where will they be?

Sound & Communications: Where will we all be; an unspoken "design element" in every project, perhaps?

Veneklasen: Well, for our purposes, let's assume civilization will be here. People still subject to inspiration and empathy. Several years ago, someone from Time magazine called me and asked me to predict the future for music presentation on television.

They touched a chord there. At that time the capability had been there for quite awhile for three channel stereophonic sound. It was only beginning to become possible for large screen presentation. I see a great opening for the performing arts. Something I heard in my youth from commentator Deems Taylor at the earliest performances of the New York Symphony under Walter Damrosch broadcast over radio. There was concern that radio would eventually eliminate live audiences. Who would come out in any kind of weather, find parking, pay money to hear something they could hear at home for free? Deems Taylor said, "No, that will not be the case. Through radio and recordings people who have never had an opportunity to hear symphonic music will become acquainted with it; you will increase the exposure and appreciation for the arts. The field will expand rapidly." There are some reasons for some of the same concerns now; I talk about this in my paper. The question is whether this will continue now as large scale performances become more and more accessible to people who aren't necessarily sitting in theater seats.

So our work continues. We have a group of more than 20, and one of the most rewarding things is the continuity of the group. Many have begun as students and after graduation spend their whole careers with us. My two right hands each have been with me for over 30 years, Jerry Christoff and Jose Ortega. This kind of continuity makes ongoing research possible. That, and a mutual understanding of what we are trying to accomplish. We are able to learn much more because of mutual understanding of what we are trying to ac complish. We are able to learn much more because of mutual cooperation than we ever could in individual accomplishments.

Sound & Communications: Can one of you describe your Santa Monica facilities for us?

Neil Shaw: We have 22 people. In addition to offices for the Associates, conference facilities and the Auditorium Synthesis studio, there is a drafting room, a CAD room, a metrology department and laboratory where we have an engineer who calibrates and maintains the equipment, an instrument storage room and a shop where we build prototypes and models from scratch. Most prototypes are built from wood and metal. We do heliarc welding, whatever is needed. We have a testing laboratory that has a reverberation chamber and microphone calibration facilities. We do microphone calibrations for several large manufacturers that are traceable to the National Institute of Standards and Technology (NIST, the successor to the National Bureau of Standards, NBS). We're part of N.V.L.A.P., the Lab Accreditation Program of the NIST.

Sound & Communications: What changes have you seen, Neil, since coming to the firm as a UCLA student?

Shaw: We have found that a lot of our design philosophy that in earlier years was pooh-poohed is now standard practice. For instance, amplifier self protection and protection of load, a lot of people thought we were crazy years ago when we used to ask for

these things. Loudspeaker design — not that the laws of physics have changed, no matter how much marketing people and evangelists in the industry wish they would — but the use of collinear, or column, loudspeakers seems to be getting wider acceptance. And the attention we ask of contractors for quality control: owners are finally seeing the utility of this. In other words, if you hire a contractor to put your system in and you don't want them to debug it at the site, you prefer them to do it in your shop, you also want to have your 'as-built' documentation process sufficiently rigorous so that you can actually utilize it. If you get a car manual, you want it to have some connection to the car you're driving. Unfortunately, there's still a lot of "go-go" in the industry, people who are only marginally competent.

Sound & Communications: How much of the company personnel and endeavor is devoted to research and how much to brass tacks?

Shaw: We have an extensive laboratory here with a full time director, manager and engineer. We are involved in consulting and testing. As far as research, we have a physics professor at a local university who pursues research here. Paul Veneklasen and others actively participate.

Sound & Communications: Tell us about the Nixon Library.

Shaw: That was an interesting job in that there aren't that many presidential libraries around, so it was quite an honor to be selected.

Sound & Communications: How'd you get the job?

Shaw: We had worked with the architect previously. They selected us based on their past experience with us.

Sound & Communications: Is that the way you get most of your jobs?

Shaw: Yes, I'd say that about 65 percent of our jobs are through repeat customers. On the Nixon Library, we worked with the architect on the general architectural/acoustic design of the main building and of the auditorium. We were the designers of the automated 35 mm motion picture projection system which included an endless loop of 35 mm film. We designed the projection systems, the film playback systems and the automation system.

Sound & Communications: What kind of automation sequence did you design?

Shaw: There's a "countdown clock" in the lobby saying "so many minutes 'til the next showing" — then we dim

Terminal One -- LAX.

the lights, we roll the projector, open the dowser, open the curtain, run the film, bring the lights up, close the curtain, stop the projector, run a little recorded message with exiting information and "Don't forget to visit our gift shop," something like that. There was also a sound reinforcement system in the building for use when they use the facility for something other than visitor orientation.

I got to the Nixon Library job site one day, and I looked up to where the speech reinforcement loudspeaker was supposed to be and not only was it not there, there was no hole for it. We were able to make it work, as originally designed, working with the architect, who somehow had forgotten to accommodate it.

Sound & Communications: So you're doing retrofitting before the facility is finished, essentially.

Shaw: Yes. But we made it work. In fact, I was impressed by how well it worked when President Nixon was speaking. He's the kind of speaker who likes to hang back from the microphone. But we had adequate gain and it sounded very natural.

Another heart stopper on that job: A week before the opening dedication ceremonies, I was checking out the installation and discovered the screen was not perforated. The loudspeakers are mounted behind, so it's critical. We worked with the sound contractor and the sound mix technician on the film that was being shown to solve the problem. I ended up being the stage manager for the grand opening. The Library people threw us a curve and moved the date for completion ahead, so, for the first event, I was there running back and forth from the projection room to the stage, holding the curtain back for guest speakers, setting and striking the mike, things I don't usually do at jobs. Fun, though.

Sound & Communications: What do you look for in a contractor?

Jerry Christoff: Track record. Skilled personnel, management that understands that it takes time and smarts to get certain things done. And attitude, that's very crucial.

Sound & Communications: What about size?

Christoff: Size is important in that

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I wouldn't want to see a contractor who'd done background music in a 2,000 square foot retail space doing a million dollar project. I'd also be surprised if a large contractor was interested in doing a small background music project. Determining that the contractor is capitalized properly is a concern, too, of course. If he's capitalized for the size job he's doing, generally, it's okay.

Sound & Communications: How do you determine that?

Christoff: Can he get bonded for the job?

Sound & Communications: Do you have project managers for each job, or are tasks more compartmentalized?

Shaw: We have two principal project consultants in the firm, Jerry Christoff and Jose Ortega, the Principal Associates. Working under them are various project managers. I have overall supervision of audio-visual contracts. I'm one of six Senior Associates. In reality, though, everyone pitches in, in whatever capacity they are needed. We have quite a few associates who recently received their bachelor's or master's degree. We encourage people to start working for us while they're still in school.

Sound & Communications: What do you look for in a new employee?

Christoff: A bachelor's degree or the desire to get one. We look at what they studied in school, how well they did academically. What work they did while they were in school.

Sound & Communications: What kinds of courses do you prefer they have under their belts?

Shaw: We have different disciplines here, so it depends. We have mechanical engineers, physicists, electrical engineers, architects. The basic background is in physics, math and engineering. Everyone, of course, has to have a background in acoustics. But you can get that in a variety of places. You can get acoustical experience through mechanical engineering, through electrical engineering, through physics. We value highly university experience. My feeling is, "If you can't explain what you're doing with math, then you don't know what you're talking about; then it's metaphysics." ■

A NEW PARADIGM IN PSYCHOACOUSTICS, PART TWO

By Steven Orfield

In Part one of this series, the concept of sound quality was discussed, along with myriad applications. In Part Two, we will take a more in-depth look at the issues of sound quality research and testing, with an eye toward the types of systems and procedures which are used, and the process which is undertaken. As we look deeper into the sound quality process, it is important to keep the intent of its typical range of background questions in mind:

- How pleasant does the product sound ?
- Does the sound suggest power?
- Does the sound seem appropriate for the product?
- Does the product sound expensive?
- Does the product sound annoying or peculiar?
- Should the sound quality vary over time?
- How many "listeners" (groups/types) are to be considered?
- Among multiple "listeners," which is more important?
- Can the near field and far field sound be controlled separately?
- Does the product have an environmental acoustical impact?
- Is there an advantage to "adjustable" sound quality?
- Is there an "ideal" sound quality which cannot be provided by the product naturally and may need to be synthesized?
- Are the demographics of the users similar or contradictory?

Further, it is important to understand that sound quality is not dependent upon any technical definitions but is rather investigated most accurately via the use of a non-technical or product consumer audience. Any investigation of sound quality not governed by the listener has no basis for claims of validity.

Therefore, the search for product sound quality is not a measurement and analysis type of process; it is rather a process governed by procedures developed solely to elicit iterative responses from the listener. The elegance of this analysis is in its dependence upon the skill of the investigator to understand a broad range of parameters related to the listener expectations and concerns regarding the performance of the product.

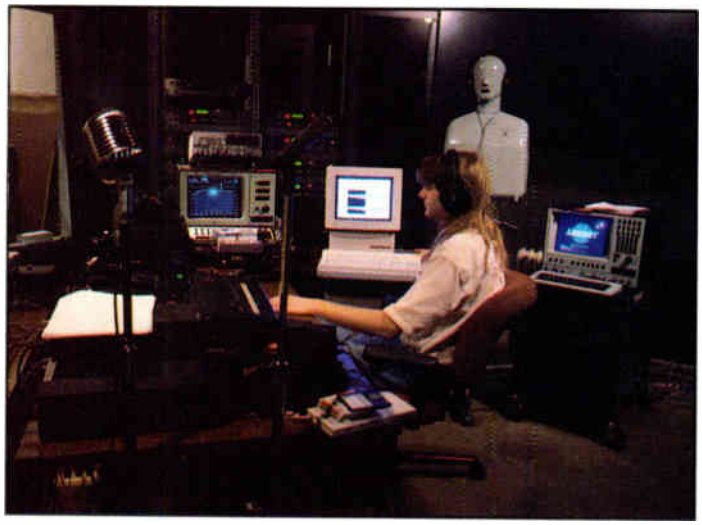
Further, understanding of quantitative jury analysis work is important; current market research suggests the view that while the subject (listener) may respond verbally to many types of inquiries, such as focus group questioning, there is very little validity in assuming that the subject, in fact, has an analytical understanding of his preference or preference behavior. In other words, via the use of poor experimental questions, it is very easy to lead the subject to respond in ways which represent his "opinion" of a product but do not represent his "response" to the product. For example: Will he purchase? Will he feel positively ?

Secondly, typical focus group methods of evaluation tend to be skewed by group responses following the most dominant participants or on the expectations of the experimenter. Thus, conventional focus groups are generally not a suitable tool for sound quality work.

THE EXPERIMENTAL PROCESS

The manufacturer of a product is, to some degree, an anecdotal expert on consumer response to his product; he does, in fact, know which products are more successful, and he does have field reports of positive and negative comments regarding his product. He may also have significant market research regarding consumer response to general or specific aspects of his product, such as quality, performance and cost. This is generally a good beginning point in the development of a sound quality program. With this point of reference, it is useful to inventory descriptive terms related to the acoustic performance of the product, and these terms should ideally be bipolar, such as those shown below.

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



Sound Quality Editing / Analysis System

The Sound Quality Process

Bipolar Sound Quality Parameters

Good — Bad
Loud — Quiet
Harsh — Pleasant
Sharp — Mild
Strong — Weak
Rough — Smooth
Powerful — Gentle

Secondly, it is useful to work with the marketing and engineering staffs of the manufacturer to develop two demographic views of the product; on one hand, the consumer anecdotal responses and market research responses should be assembled. On the other hand, responses from the marketing and technical staffs regarding their own views should be assembled. (The second set of information may assist in understanding the body of long-term market response information which has been inculcated by the firm, possibly without analysis or verbalization.) Once this information is assembled, an initial set of bipolar parameters can be developed; next, these parameters should be presented to both the consumer and staff in the form of semantic differential ratings (1—10, typically) based on listening to the product in question.

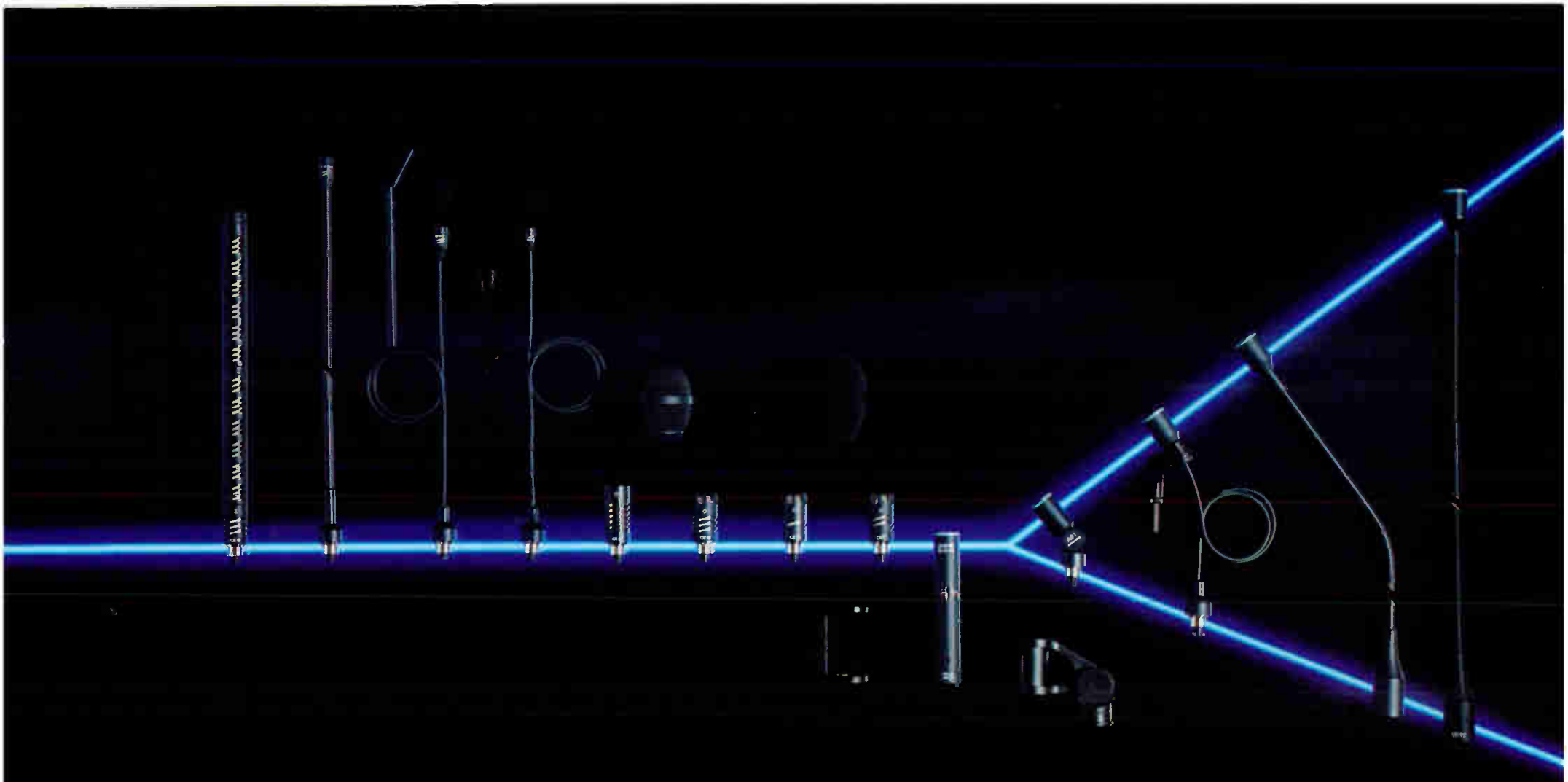
AURAL PRESENTATION MATERIAL

In order to present aural information to the listening jury, it is necessary to assemble that information via some type of recording process. The three most common recording types used are monaural, stereo and binaural. The monaural recording, such as a typical acoustical noise recording, has time and frequency content, but provides no directional or localization cues. The stereo recording provides cues across one axis, typically left-to-right for the listener. The binaural recording provides three axes of aural cues for the most accurate source localization of the product under study. (Some products, such as audio stereo system components, will generally find little application for binaural recording.)

The choice of methods relates to the importance of localization in the typical process of listening to the product. For example, a motorcycle rider will find localization very important, as he hears a quite different distribution of sound sitting while riding the bike from that which a pedestrian would experience. On the other hand, a recording of a home food processor may find little benefit in source localization methodology.

Depending on the method of recording, the method of listening will also need to vary, and there are three typical methods. The first method is the presentation via a single loudspeaker, the second via presentation with two loudspeakers, and the third via presentation binaurally via loudspeakers (with cross-cancellation systems) or headphones. There is also a fourth method via the use of an acoustic simulation room (See Sound & Communications, December 1990, March 1991).

A second issue with regard to presentation is background noise and room acous-



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tics. Listening to products such as appliances which are typically heard against a spectrum of background noise and room effect is quite different from listening to those products in an anechoic (dead) environment with unnaturally low background noise levels. It is important that aural demonstrations not over emphasize the product noise but rather attempt to recreate it in its natural acoustical environment.

Finally, the ear is very capable of discerning extremely small acoustic differences, but there is a clear inverse relationship between aural acuity and memory of sounds. Thus, sounds presented sequentially may elicit clear negative-to-positive preference responses which may not be elicited by sounds presented independently. The issue of sound quality relates more to the second condition than to the first, due to the poor performance of aural memory. (In sound quality, we are often looking for reponses to the product in the absence of immediate comparisons to other product sound possibilities.)

PREPARATION OF THE AURAL PRESENTATION

The recordings for use by a sound quality jury generally exhibit the following characteristics:

- They are significantly similar to live listening to the product.
- They are recorded at typical listener positions.
- The recordings or their playback include background noise characteristic of their use environment.
- The recordings or their playback include reverberation and time delay characteristics typically found in their use environment.
- The recordings or their playback must not be negatively affected by the listening system or environment.

(It is important to keep in mind that many products have significant perceptual stimulation other than aural; for example, the sights, feel and smell of a vehicle may clearly affect the overall response of the consumer. Thus, other presentation variables, such as video films of product operation, may provide a more valid overall presentation.)

If the recordings are to be made via monaural or stereo methods, it is important to follow the tenets of professional recording with regard to equipment specifications such as frequency response, signal-to-noise ratio, time response and dynamic range. It is imperative that precision microphone systems be used and that the overall recording system can handle the dynamics and range of product acoustical performance. Digital Audio Tape (DAT) recording is the preferred method for this type of recording, due to its accuracy and dynamic range. There are many good recording manuals for the inexperienced technician.

If the recording is to be performed binaurally, it is important to use a validated binaural recording system (See Sound & Communications, September 1990 and October, 1990). The Sound Quality Working Group (SQWG) is using this combination of components for binaural recording:

RECORDING SYSTEM

- Bruel and Kjaer 5930 Recording Torso
- Bruel and Kjaer 4128 Measurement Torso (optional for verification use)
- TEAC RD 120 or 125 T DAT Recorder
- WB 1057 Power Supply (B&K 4128)

After successful recording, there is a need for a capable playback system based on the method of recording and corrections needed. For monaural and stereo recordings, the playback system may be nothing more complex than an accurate sound system and loudspeakers, including equalization methods and measurement systems. For binaural DAT recordings, the more typical case, this playback system becomes increasingly complex, and for this purpose the Sound Quality Working Group is using these components or variations of them:

Playback System

- Bruel and Kjaer 2133 Analyzer
- Bruel and Kjaer 4128 Measurement Torso (optional for verification use)
- TEAC RD 120 or 125 T DAT Recorder
- Yamaha DMP-7 Mixer
- Yamaha DEQ-7 or 5 Digital EQ
- Yamaha D-A DA 202 Converter
- Yamaha P2075 Power Amp
- Yamaha NS-10MC Near Field Monitor
- Sennheiser HD-560 Headphones

The final system in the recording process is the editing and computational analysis system. This system is used for these purposes:

- Correcting inaccuracies in the recording.
- Changing the recording to simulate changes in the product.
- Equalizing the recording for playback.
- Editing the recordings made into a final presentation tape for the jury.
- Providing initial computational analysis of the sound quality of record
  ings in order to consider editing options that suggest a significant possibility of sound quality improvement.

The SQWG analysis and editing system is made up of the following components:

EDITING/ANALYSIS SYSTEM

- Two channel digital editing workstation including MAC and associated electronics (We are currently using Digidesign Sound Tools)
- Bruel and Kjaer 2133 Analyzer
- Bruel and Kjaer 4128 Measurement Torso (optional for verification use)
- TEAC RD 120 or 125 T DAT Recorder
- Yamaha DMP-7 Mixer
- Yamaha DEQ-7 or 5 Digital EQ
- SWSG Sound Quality Software

- IBM Compatible MS-DOS 486 PC with LabWindows program and audio board

These three systems together comprise the basic equipment for gathering the acoustic signal, editing this signal and presenting it, edited and unedited, to the sound quality jury.

PREPARATION OF THE SOUND QUALITY JURY

The sound quality jury is intended to be the final arbiter of decisions on sound quality of the product under investigation; therefore, in significant ways it must represent the consumer group which is either available or targeted for the product. (Both options are suggested, as many products are most popular among a different demographic group than intended in the marketing plan.) Some of the demographics important in typical selection processes are: Age, Sex, Education, Income, Purchasing history, Product use history, Geographic purchasing patterns, Aural, visual and physical impairment.

Ideally, the market research (MR) division of the manufacturer (or their independent MR firm) will provide criteria for current client demographics and desired demographic changes in customer profile.

Using the established MR criteria, a jury is then selected, including a statistically relevant sampling of the identified population. This group is then assembled for preliminary testing of hearing (and possibly vision), possible MR interviews are held to verify the sample, and a final jury and alternates are selected for use as the sound quality jury. (Hearing and vision generally verify whether the subject is typical of his/her age group in acuity and other attributes.) With regard to issues of jury statistics, etc., I refer the reader to the marketing research community.

Prior to the presentation of recordings to the sound quality jury, it is important that they be accommodated to the presenation and noise levels; thus, a general introduction to the material over a period of 10-30 minutes is useful for understanding and adaptation to ambient levels of the material.

EDITING THE AURAL PRESENTATION

Generally, the aural presentation is intended to perform these tasks:

- Present the sounds of the current product and product line.
- Present adjacent comparisons with competitive products.

Sound Quality Recording System

Sound Quality Recording System

• Present adjacent comparisons with edited recordings which are intended to characterize product improvements. 4. Present non-adjacent recordings of the same phenomenon for absolute rather than comparison ratings.

Normally, the jury is given a scoring sheet (1-10) with bipolar attributes and is asked to circle one attribute position for each presentation (i.e., loud versus quiet). If multiple attributes ratings are desired, the stimulus is presented additional times. In addition to acoustically descriptive attributes, other types of comparisons are often made based on consumer expectations and parameters (i.e., "pleasant," "powerful," "comfortable," "appropriate"). These jury presentations and their responses are generally considered to be building blocks for assembly of additional presentations leading to final jury results.

Editing of original recordings can be used in preparation of these presentations for purposes of these types of changes:

- Frequency response characteristics.
- Time response characteristics.
- Background noise characteristics.
- Positional listening characteristics.

STANDARDS DEVELOPMENT

After sufficient jury testing has been completed and after computer runs on alternate acoustic presentations are performed to determine which sound quality metrics parallel jury responses, intitial standards are created for: noise reduction; frequency response changes; temporal response changes; sound enhancement.

While the majority of these changes will generally be attenuation based (noise reduction) changes, in some cases, acoustic levels may be increased in certain frequency ranges which are considered beneficial to the consumer, and time-based response may also be altered. Once these initial standards are created, additional sound quality jury work is often performed for final verification before these standards become operative. After the standards have been verified and accepted, the next stage of the sound quality process is product noise analysis, and this will be the subject of the next article in this series.

In review, the following is the set of steps typical of sound quality analysis, and the remainder of this series will involve the application of these steps and specific examples of them.

Sound Quality Standards Development

- Product listening and market discussion.
- Market research.
- Binaural Recording of current and competitive products (See Sound & Communications, Sept. and Oct. 1990).
- Playback to a listening jury.
- Calculation of sound quality parameters.
- Editing of sound to reduce annoyance and increase positive sound quality based on jury response and calculations.
- Playback to a listening jury of alternative solutions for validation.

Sound Quality Initial Measurement

- Playback and measurement of above recordings.
- Application of alternative analyses of time and frequency-based components.
- Characterization of acoustical performance at all points of operation (speed, cycles, etc.).

Sound Quality Source Localization Measurement

- Sound Intensity measurement based on measurement findings and targets for reduction in sound components (See Sound & Communications July, Sept. 1989).
- Sound Intensity measurement of components of the product under test, often with product covers removed.
- Sound Intensity mapping of sound power over engineering diagrams of product surfaces.

Sound Quality Modal Measurement

- Modal Analysis measurement based on intensity measurement findings and the analysis of the structural vibration components of the noise.

Sound Quality Prototype Development

- Production of an operational prototype based on sound quality standards and measurements.

Final Sound Quality Jury Presentation

- Presentation of recordings to jury
- Presentation of actual product prototype
- Market research on prototype

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THE WINTER CONSUMER ELECTRONICS SHOW

By Edward J. Foster

Twice yearly — winter in Las Vegas, summer in Chicago — the Electronic Industries Association Consumer Electronics Group (EIA/CEG) does its thing, to wit, a Consumer Electronics Show (CES) whose tentacles spread octopus-like across the length and breadth of its host cities. It's not an easy show on reporters. CESs are *large* and there's more to do than there's time in which to do it.

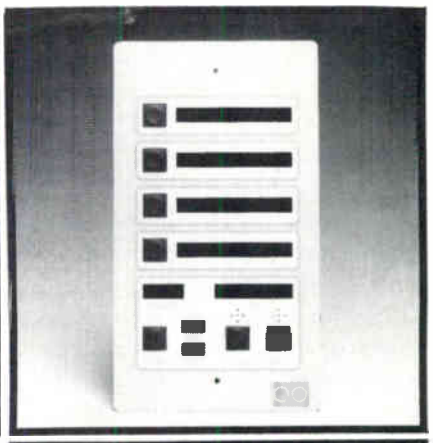
Scenes from winter's Consumer Electronics Show.

If business is on the upswing, Consumer Electronics Shows get crowded. (If the Winter CES proves an accurate indicator, the economy is no longer in recession, albeit that's hard to swallow here in the Northeast.) Come next summer, the powers that be have decided to open the doors to the public, *i.e.*, real live consumers, for the last day and a half of the show's four-day run. If the public shows up in force, the Chicago Zoo will have moved down to Lakeshore Drive. Should be interesting!

Sound contractors who concentrate in the professional market don't always show up at Consumer Electronics Shows; it's not the ideal venue for their ilk. Those who operate in the custom-installation home market would do well to investigate the CES; CEDIA (the Custom Electronic Design & Installation Association) and PARA (the Professional Audio Retailers Association) play major roles at the show and, according to CEDIA, custom installation remains one of the few bright spots in an otherwise lackluster economy.

Although "home custom installation" cuts a wide swath — anything from a multi-room stereo to a security system fills the bill — the fastest growing segment seems to be the "media" or "home-theater" room which may or may not include a stereo system. Suggested retail prices on large-screen (circa 50-inch) rear-projection TVs are falling below $3,000, Dolby Surround decoders (many with Pro-Logic enhancement) are plentiful, and Lucasfilm's THX system is beginning to make its presence felt thanks to support from Technics, Lexicon, Snell

Edward J. Foster heads up Diversified Science Laboratories in West Redding, Connecticut.



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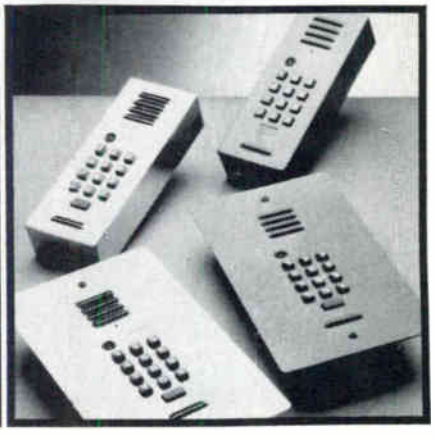

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and others. Home theater is the "in" thing, and home theater means lots of speakers — at least a stereo pair in the front (preferably also with a center-front driver to stabilize the image and a subwoofer for "movie bass") plus a pair of speakers to the sides or rear (depending upon the installation).

Custom installations generally mean in-wall speakers. Thankfully, today's quality in-wall speakers are light-years ahead of the driver-and-grille products of the past. Sonance, who arguably can claim to have launched the "high-quality" in-wall loudspeaker 10 years ago, now has more than 250 custom-installation products on the market including in-wall and in-ceiling hi-fi speakers, amplifiers, controls, etc. One of the company's recent introductions — the Ambient Imaging System 500 (AIS 500) — is particularly intriguing for use in applications where the speakers must be mounted at or near the junction of two surfaces (wall/ceiling, wall/floor or wall/wall). The system uses two baffles, one on a 21-degree angle to the plane of the mounting surface, the other on a 45-degree angle to that plane. A two-way mini system (4-inch polypropylene woofer and 1-inch polycarbonate ferrofluid-cooled tweeter) is mounted on the 21-degree baffle; a single full-range 3.5-inch driver is mounted on the 45-degree baffle. The two-way is aimed into the listening area to establish a solid image while the full-range driver creates an ambient soundfield by reflection off the adjacent surface.

Of course, Sonance isn't alone in the quality in-wall market. Altec Lansing, Boston Acoustics, and Phase Technology — he latter using its unique solid-piston driver in two models — are just three of the many American companies showing quality in-wall products at the show. In addition, Atlas/Soundolier introduced its new line of residential speakers.

B&W, Celestion, and KEF — the British big three — also have growing lines of in-wall products. Never one to hide its design talent behind plasterboard is Bang & Olufsen. This Winter's CES saw a new entree from the intrepid Danes: the Beolab 8000, an ultra slim (6-inch wide), tall-standing (52-inch), self-powered loudspeaker that literally balances on the point of a cone! In-wall, no. Stylish and unobtrusive, definitely yes!

Technics renewed its commitment to Lucasfilm's THX with a new $8,500 (suggested retail) system: the SH-TH200. The system offers three audio modes (THX Cinema, Dolby Pro

Logic Surround and simulated surround), digital signal processing, MASH 1-bit D/A conversion, a 6 x 70 watt power amplifier, three front speakers, two subwoofers and a pair of THX-type surround speakers.

NAD introduced a new 6 x 30 watt power amplifier (Model 906) for the custom-installation market. It can be used either for multi-room/multi-zone audio applications or for a media room. Pairs of channels can be bridged for 90-watt mono applications. Additionally, NAD, which claims to have been the first manufacturer of a home THX-certified power amp, has introduced a new one, the 2700THX. Rated at 150 watts/channel, the 2700THX sports the latest NAD Power Envelope and Soft Clipping topologies to deliver up to 600 watts IHF dynamic power per channel with 4-ohm loads.

AudioSource has opted to use Analog Devices' 18-bit Bipolar/CMOS Dolby Pro Logic chip in its new SS Four Surround Sound Processor. The Analog Devices chip sports on-board auto-balance, decoding matrix, center model control and noise generator — a single-chip solution to a multi-dimensional problem. The chip claims a dynamic range of greater than 100 dB, 0.015-percent distortion and a decoded channel separation of 35 dB. The attractively priced SS Four (suggested retail of $329.95) offers two built-in 24-watt amplifiers for rear and center channels.

AudioSource also offers a 6-piece prepackaged setup, the HC-1 Home Cinema System. The HC-1 includes the SS Three/II Dolby Pro Logic Decoder (also using the Analog Devices chip and sporting a Dolby 3 mode for use when only the three front channels are operative), an Amp One Power Amplifier, SW Three Subwoofer, LS TEN/A Rear Channel Speakers, VS One Shielded Center Channel Speaker, 200 feet of 18-gauge speaker wire and interconnects.

Carver and Luxman have new Dolby Pro Logic Audio/Video Receivers. Carver's $1,199.95 (suggested retail) HR-895 (available in April) includes a 5-channel amplifier, a Multi-Room selector that permits the user to play different sources in different rooms at the same time, and Carver's proprietary Sonic Holography system. The HR-895 offers seven audio inputs, four composite video inputs and three S-Video ins. The Dolby Pro Logic decoder supports four modes: Dolby Surround, Hall Surround, Matrix Surround and Simulated Stereo (for monaural sound-

THOSE WHO OPERATE IN THE CUSTOM-INSTALLATION HOME MARKET WOULD DO WELL TO INVESTIGATE THE CES.

tracks). Front amplifiers are rated at 110 watts/channel with a 75 watt amp for the center and a pair of 35 watt amplifiers for the rear.

When introduced, Luxman's $1,400 (suggested retail) RV-371 will offer Dolby Pro Logic Surround and five channels of amplification, tentatively rated at 70 watts/channel in the front and 50 watts/channel for the center and rear. A Luxman RV-371 based system can be expanded for multi-room operation via the addition of M-111 amplifiers, S-503 or S-505 speakers and additional RC-50 1 sensors.

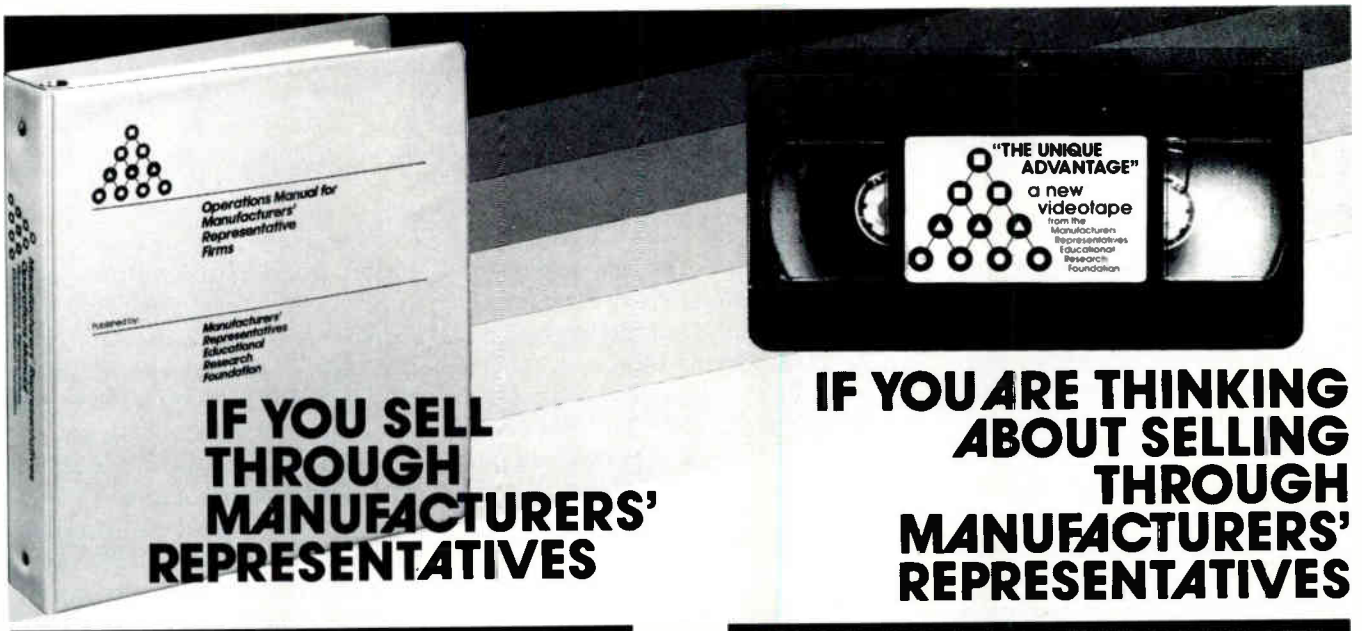
Yamaha offers both receiver-based and processor-based home entertainment electronics. The new RX-V660 will be the least expensive ($699 suggested retail) Yamaha Audio/Video Receiver. It includes a 5-channel amplifier (65 watts/channel for the front, 25 watts each for the center and rear pair), provides four audio DSP modes — Concert Video, Mono Movie, Rock Concert and Concert Hall — and digitally processed Dolby Pro Logic Surround. The Dolby Pro Logic system can be used with or without Yamaha's Digital Sound-Field Processing which is claimed to yield "the most dramatic 5-channel presentation possible from the Dolby format."

Yamaha's new 5-channel DSP-E1000 is designed for audio/video enthusiasts who do not wish to replace their current main amplifier or receiver. It utilizes the same processing circuitry and offers all of the DSP and home-theater capability of the previously introduced (and well received) DSP-A1000 with five rather than seven channels of amplification. Yamaha has also introduced a 3-channel processing amplifier for home theater — the DSL-E200 — that, in combination with a receiver or stereo amplifier for the front channels, provides 5-channel home theater recreation. The DSP-E200 incorporates four DSP modes and Digitally Processed Dolby Pro Logic Surround.

Philips is blitzing the market with five new audio/video receivers including the company's first Dolby Pro Logic models, the FR950, FR940 and FR930. Marantz is launching the SR-92, a Dolby Pro Logic equipped five-channel receiver (110 watts per side in the front, 75 watts center, and 35 watts per side in the rear) that includes a bass EQ control to improve deep bass impact.

Among the less exotic (but often needed) doodads in the custom installers' bag of tricks are adapters, switchers, line drivers, etc. Sonance and Niles each has new goodies to choose from.

Sonance's LS-1 Balanced Line Sender converts unbalanced preamp outputs to drive balanced lines; the LR-1 Balanced Line Receiver converts from balanced to unbalanced. Both are active devices powered from an outboard supply and help attain



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the noise-pickup immunity of a balanced transmission line when using the unbalanced outputs typically found in consumer products.

The Sonance SCF-1 is a 6th-order active high-pass filter (40-Hz cutoff) designed to remove very low frequency signals that might "saturate autoformers and destabilize amplifiers at low impedance loads." The new LL-1 Line-Level Attenuator is a simple screwdriver-adjusted attenuator that can be used to balance relative signal levels from different program sources.

The Sonance SM-1 Stereo-to-Mono Adapter "can transform any two-channel amplifier into a mono unit delivering nearly 3½ times its rated power per channel than in its unbridged, stereo, configuration." The SM-1 accepts stereo left-and-right line-level inputs, combines them into mono, and develops non-inverted and inverted signals to drive the two channels of a stereo power amplifier. Screwdriver-adjustable level controls provide ± 6 dB range for adjustment and balancing. Rather than combining left and right inputs before deriving the balanced signal (as does the SM-1), the Sonance SBA-1 Stereo Bridging Adapter derives separate balanced drives for two stereo power amps from the left and right sources. Like the SM-1, the SBA-1 has adjustable level controls with a ± 6 dB range.

Also in Sonance's new goodie bag are the AS-1 and AL-1 — units that automatically switch sources when triggered by the appearance or disappearance of one of them: the "priority" source. Each unit has inputs for two stereo sources. Input A is designated the "default" source; input B, the sensing, or "priority," source. Whenever the B source is live, it is fed through to the speakers. When B turns off, the unit switches to A after an installer-adjustable delay.

One possible application might be in a bedroom with a local TV and the main stereo located elsewhere in the home. With the bedroom TV connected to B and the remote stereo to A, the stereo will be heard through the bedroom speakers until the TV is turned on. At this point, the selector automatically switches to the priority channel, B, the bedroom TV. When the TV is muted or turned off, the selector reverts to input A, the stereo system after an installer-adjustable delay that can range from seven seconds to several minutes. The AS-1 is wired between the amplifier output

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GUEST COLUMN

COMMUNICATION FOR THE AUDIO INDUSTRY

By Bruce Rempe

As technology in communications continues to envelope us, many of us are turning to our computers to enhance our ability to communicate in an efficient manner. A new Telecomputing Host System calling itself "AUDIO-BASE" recently went online to help facilitate this process for the audio industry.

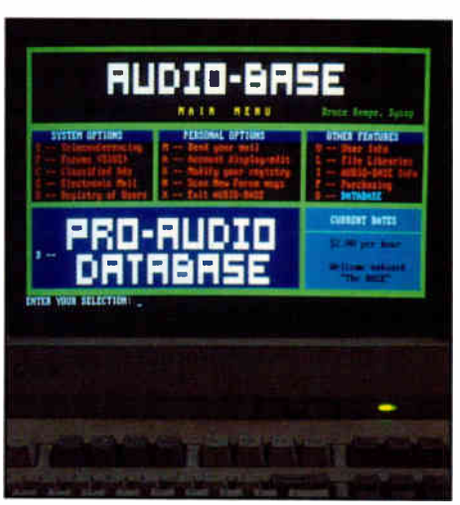
Unlike many other computer bulletin board systems which focus on file libraries, the Audio-Base System provides the framework for communications and information services.

The Audio-Base System is operated by Rempe Audio Services. It was developed during the early months of last year and was put online only recently. The system offers a number of communications services for both individuals and corporations. These services range from simple electronic mail to sophisticated file shuffling, and dedicated business communications tools.

The E-mail system not only allows users to exchange private messages, but also allows the optional attachment of a file to each piece of E-mail. In fact your first piece of E-mail (which is automatically sent to you when you first sign-on) has a file attachment which contains the system's operational manual. The system also provides Carbon Copy, Auto Reply, Threading, Forwarding, and Distribution List services. A "return receipt" to notify you when your message is read is also available.

The Forums section (often called the SIG section) also allows many of the same features as the E-mail system including file attachments. The forum section is essentially a "public" area where users may post questions, answers, or provide information while engaging in general exchange on a number of different topics.

Topping off the communications features, the Audio-Base System offers over 65,000 teleconference channels. All activity in the Teleconference section is in real time, allowing users that are simultaneously on the system to converse. This works much like a conference room in that users may enter into the "conference" or exit at their own will. Live conversation or discussions may take place on numerous topics as determined by the participants. Since there are so many available channels, and "unlisting" your channel is an option, a certain amount of security is possible. Restricted channels are also possible as part of the DBF program detailed below.



In the area of information access, the Audio-Base System offers a variety of services. The online Pro-Audio Database structure is home for a number of these services.

The online database allows manufacturers to provide searchable information about their company, reps, and dealers, and the related online contacts. There are also several databases for basic product specifications. The User Registry also resides in the database, allowing users to search for other users based upon their state, company, last name, or UserId.

Audio-Base is also exploring the possibility of setting up a database to store information and facilitate searches for the many performance halls across the country. The Database would allow you to search for a particular auditorium in a particular city and state. The view screen would provide basic specifications concerning the hall's technical capacities, and would provide a reference to a file in a dedicated file library where you

Bruce Rempe heads up Rempe Audio Services of Pella, Iowa.

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may download detailed information. Audio-Base is seeking the industry's reaction to this concept.

A Manufacturer File Library (MFL) is another information service provided by Audio-Base. Major manufacturers in the audio industry are encouraged to establish an MFL on the Audio-Base System. This provides them with a dedicated file library where they may upload information-oriented computer files for the industry to download. These files may include product specifications, audio design software templates, PostScript "slick" files, or whatever they feel the industry might find useful. The MFL program is provided to the manufacturer at no cost. The application is online.

For software companies, Audio-Base offers MFLs with upload royalties. Essentially, this operates just like a standard MFL, except that downloaded files are assessed an additional charge which is then paid back to the software company. This is a great forum for software support, update files, fixes, etc.

For corporate, business, or association communications, Audio-Base provides the Dedicated Business Forum (DBF). This is a dedicated service of the system which provides several private communications features for "spread-out" organizations. A DBF provides your organization with a dedicated file library, a forum, and a teleconference channel. These areas are strictly reserved for use by the designated organization. Individual and public access to these areas is controlled by the organization's designated representative. The DBF program carries an annual subscription charge. Setting up a DBF for your business or organization is a very easy process which can be done within 24 hours.

Access restrictions are entirely transparent on the Audio-Base System. No passwords are necessary outside of your personal password for logging on. Only the areas that you have access to are presented as options to you. Error and help messages are always available.

In additional to all of the features listed above, the Audio-Base System also offers classified advertising and will soon be offering an online purchasing department.

No membership is necessary. Simply call the system, log on as 'new,' and provide your name and address information. Audio-Base will automatically award you 5,400 credits when you create your account. Credits are the system's money. They are spent for online time and certain other valuable services and products of the system. Your 5,400 credits will give you 90 minutes of free usage (1 per second) provided you don't use any services that charge additional credits. After this runs out, you're on your own. Additional credits can be purchased from Rempe Audio Services for $2 per block with a minimum purchase of 10 blocks ($20). Advance payment/billing is also an option, and information concerning this program is also online.

Accessing Audio-Base is a very simple procedure. For those of you who are avid computer BBSers the settings are: 1 start bit, 8 data bits, 1 stop bit, and no parity. The system does support ANSI, so turn that on as well. The number is (515) 628-8999.

For those of you who aren't familiar with the telecomputing process, Audio-Base offers a basic communications package that does all of this for you. All you need is a modem properly installed on your computer. The Audio-Base "Dial Utility" software will find the modem, take care of all of the settings, and dial the Audio-Base System for you. ■

The Speaker Design Toolbox

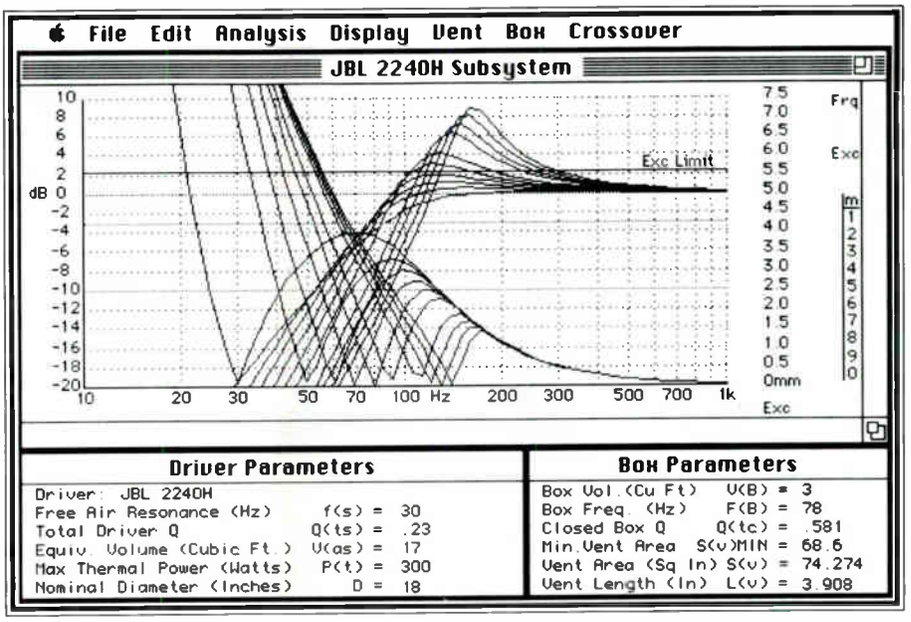
An In-Depth Look at MacSpeakerz

BY MIKE KLASCO

Computer-aided speaker system design programs have become popular during the last five years. Hobbyists, sound contractors, and even the engineering departments of most loudspeaker system manufacturers use these programs.

The main purpose of this software is to figure out which woofer should go with what size box and what the resulting frequency response will be. It is faster, simpler, and cheaper to use these programs to predict results than actually building up many prototypes. Of course, the computer predictions really only get you to the "rough cut," and eventually a prototype must be built and tested.

Most of these design aids also calculate vent dimensions as well as many other useful factors such as cone excursion, impedance, crossover network component values, conversions from metric to English, etc.



Pull-down menus are along the top. Multiple "what-ifs" would be clearer in a color printout.

CUSTOM DESIGN VS. PACKAGED

Why build your own box instead of simply ordering a woofer/enclosure or a full range one-box speaker system from a speaker manufacturer? Ordering packaged speaker systems often does make sense for many applications and installations. But cosmetics, physical space allotment, or even special acoustical demands may require a custom design. Another factor that motivates custom design is competition. If too many outfits are selling the same products, then price usually becomes the tie breaker. Proprietary designs help some sound contractors maintain both a competitive edge and profit margin.

MacSpeakerz, from True Image Audio (619-480-8961) is one of the few commercial speaker design programs for the Macintosh computer. This review is of the just released version 2.5, which sells for $250. John Murphy, whose speaker design background is pro sound, first introduced MacSpeakerz about three years ago under the name AudioCAD. I have used this program, from time to time, from its inception. The program is constantly expanded and refined, with minor updates provided to registered

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

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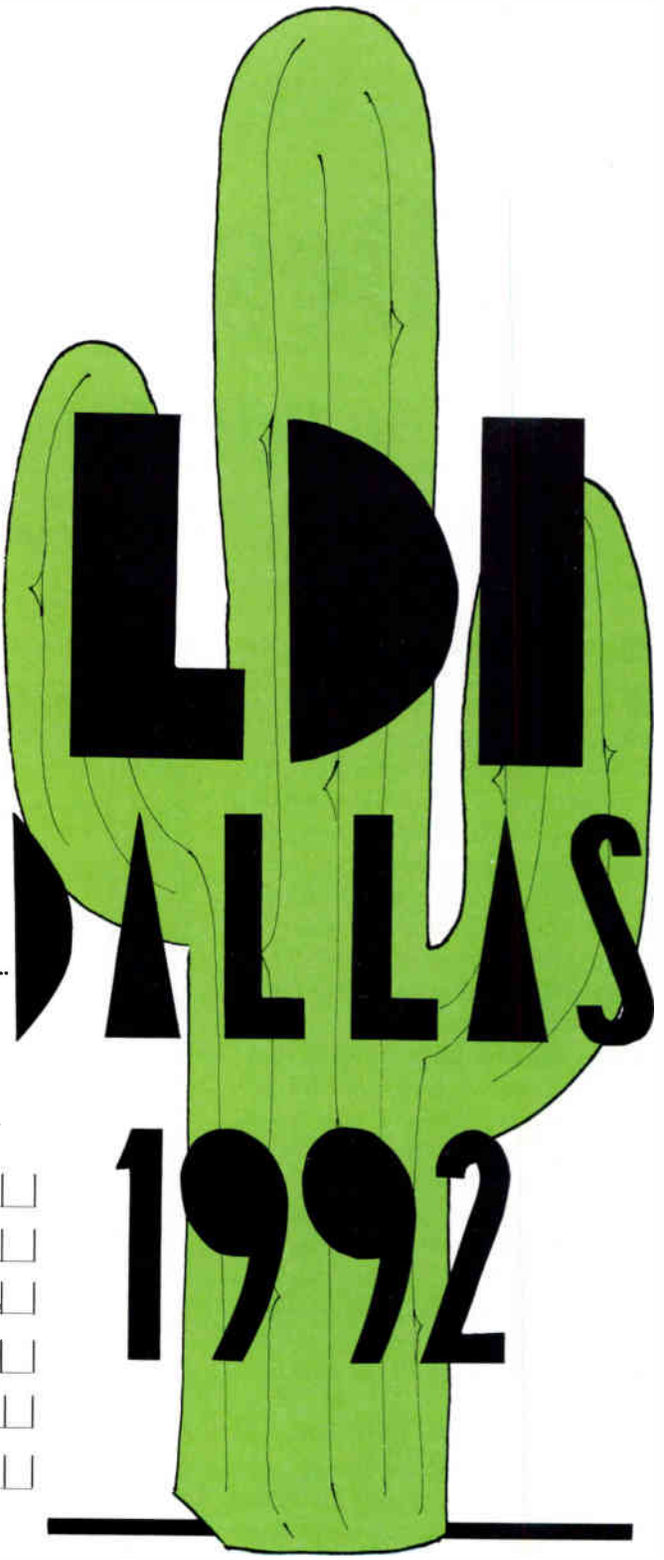

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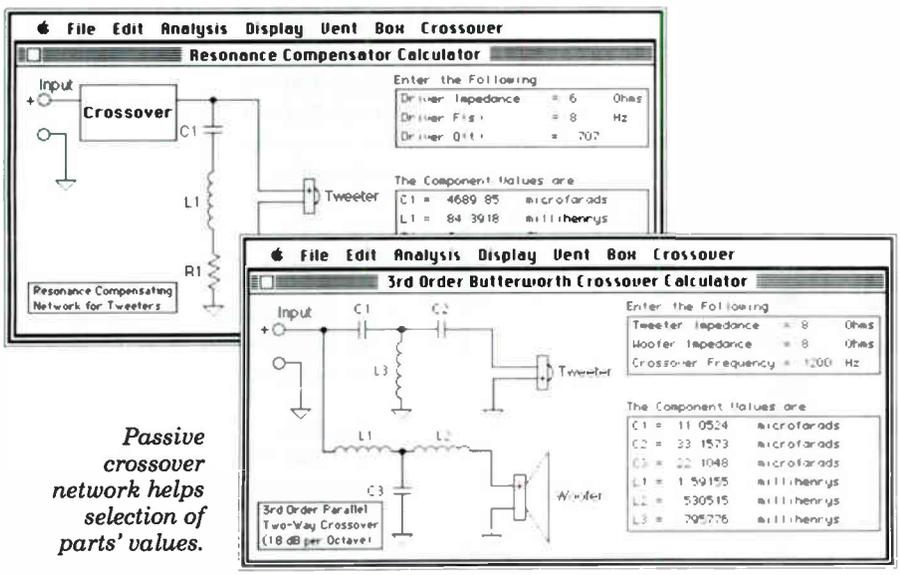


Passive crossover network helps selection of parts' values.

users at no charge.

The program is fairly sophisticated, yet would still be a good program to buy even if you have never previously used a computer-aided speaker design program. Like all Macintosh software, MacSpeakerz is based on the Mac interface, which consists of a number of overlapping windows and pull-down menus.

Operation is mostly intuitive, but some reading of the manual is necessary if the full use of the program is to be attained. For those who refuse to read the (well-written) manual, a one page "cheat sheet" is included to get you through a basic design. The manual has a Getting Started section for new users, a more complete tutorial section, as well as a reference section. Or you can call True Image Audio, as their customer support is excellent. MacSpeakerz does not have on-line help.

PROGRAM OPERATION

When the program starts, you see a main window labeled Frequency Response, and two smaller windows below it: Driver parameters and Box parameters. The Frequency Response window is where the predicted response will be displayed. Actually, the user can activate many different responses in this window in any combination, or all at once. These responses include excursion, impedance, phase and group delay. The scales are easily changed from a pull down menu. A Driver Response Window displays a list of specifications of any driver that you select. The Box Parameter window is where you try out different size boxes with different bass reflex tunings (or sealed boxes).

What are these "parameters"? They refer to Thiele-Small parameters, which characterize the mass, compliance, strength of the driver's magnetic system and so on. These parameters are provided by the driver manufacturer, or you can measure them yourself with the proper equipment. The latest version (2.5) of MacSpeakerz provides complete and painless instructions for measuring speaker impedance with a digital multimeter and determining the key parameters; although such factors as thermal power handling and cone excursion are best determined by the factory.

Once you have defined your enclosure, whether you will use a bass-reflex design (and its tuning frequency) or a sealed design, you can then specify the speaker you are going to use. This is entered either by selecting a driver from the library of over 240 drivers included with the program, or you can enter the parameters of a new driver.

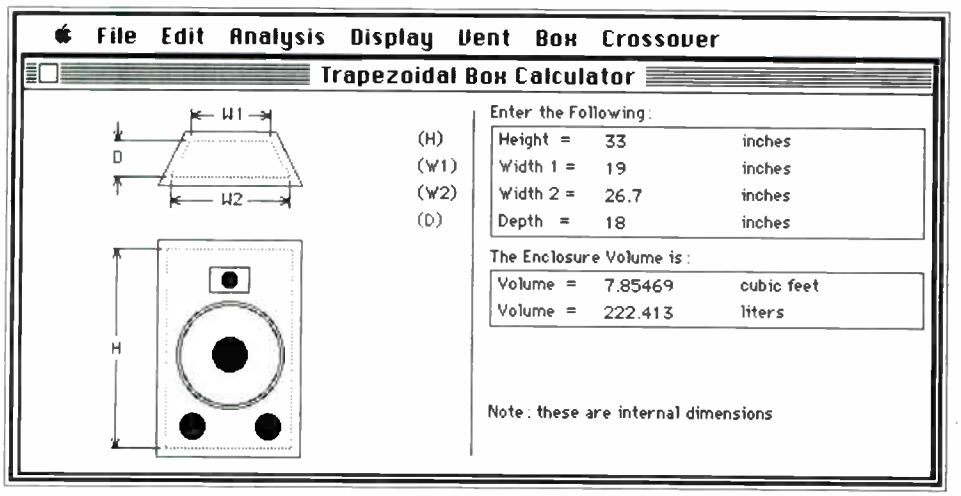
The analysis capability of the program has recently been expanded to include Impedance, Excursion, Phase and Delay.

Impedance is not just the rated nominal value, but a curve which can tell you a great deal about a particular speaker/enclosure design. A closed box will have a single resonance peak while a vented box will have two peaks. The shape of the peak(s), spacing and relative heights of the peaks in the vented design can indicate potential transient response and/or loading problems and provide an early warning to revise your selection of either the speaker or enclosure characteristics.

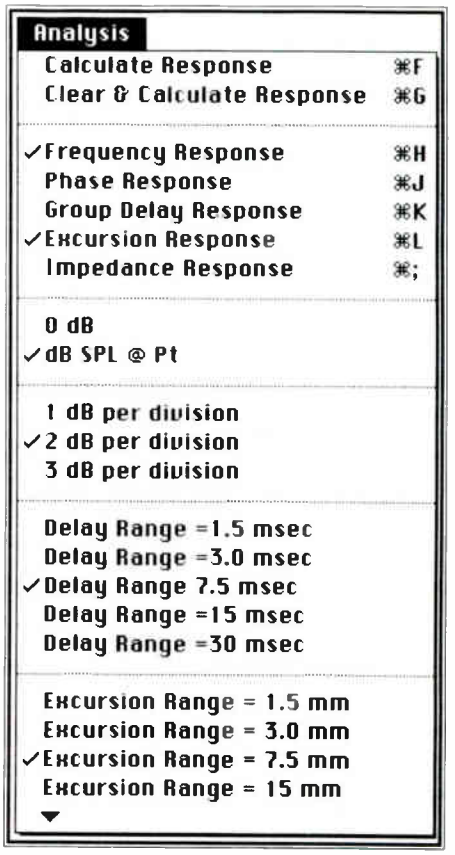
Excursion versus frequency is an indication of the power handling of the speaker. Excursion is defined as Xmax, the peak cone displacement (in one direction only). Woofer power handling can be split into two factors: thermal and excursion. Thermal is the heat capacity and dissipation capability, while excursion is the back and forth movement. No matter what the thermal power handling rating of the woofer is, if the cone will bottom out, then you have run out of output capacity. For pro sound applications, excursion is an important power handling characteristic. MacSpeakerz plots a horizontal line at the excursion limit of the driver you are analyzing to show if your systems's excursion requirements at the driver's thermal power handling limit would be greater than the candidate driver's excursion capacity. Box volume calculators enable you to enter the dimensions of the enclosure, either for rectangular or trapezoid enclosures. MacSpeakerz then calculates and displays the box volume in both cubic feet and liters. Many options for vents are supported, including different diameter vents and multiple vents.

LIMITATIONS OF MACSPEAKERZ

MacSpeakerz does not support multi-tuned enclosures that are sometimes used for subwoofer designs. Examples of commercial multi-tuned subwoofers are the Bose Tandam-Tuned 302 and JBL's Triple-Tuned Chamber designs. The next major release of MacSpeakerz (3.0) will support these types of enclosures. Current users will be able to upgrade for half price.



A Box calculator is one of many handy utilities.



Analysis sub-menu selects what will be calculated and displayed on graph as well as graph scales.

One unconventional technique that MacSpeakerz does support is compound woofer mounting: two woofers bolted face to face or mounted one after the other in a short tube. Although these approaches may sound silly, there are a few good reasons to use compound configurations for special applications, and JBL has tried this successfully in one of its smaller triple-tuned subs. High power operation is just beginning to be supported by MacSpeakerz with excursion plotting, but voice coil heating effects, non-linearities of voice coil excursion and ferrofluid effects are not yet supported (again, you will have to wait for release 3.0).

I mention all these limitations as there are speaker design programs that do predict the above effects, although they are more costly and require more effort to learn and apply. But if these techniques are beyond the scope of your design aspirations, if you really only want to know what happens if you have to make the box a little bigger than the manufacturer's suggested design and/or how long you should cut the vent in the new box, then do not worry about these esoteric limitations.

Still another area is crossover network design. Electronic crossovers have eliminated the pain of passive crossover network design for most of us. But if, for reasons of cost, you still do passive network designs, MacSpeakerz support will only get you to the first level of design effort. A few other programs allow the import of response curves from actual measurements, have response optimization routines that synthesize circuits to linearize response and so on. I am not convinced about the benefits of "Circuit Optimizers" for sound contractors, as the resulting networks are too complex and are often not practical to implement for passive high output level deigns. Often, using an optimizer takes longer to model than empirically working out the solution. Even in the case of a manufacturer developing a new speaker system, it is my belief that it is easier and better engineering to go back to the driver and optimize the selection of cone, dust cap, voice coil, etc. rather than to end up with a tray full of compensating electronic components.

SYSTEM HARDWARE REQUIREMENTS

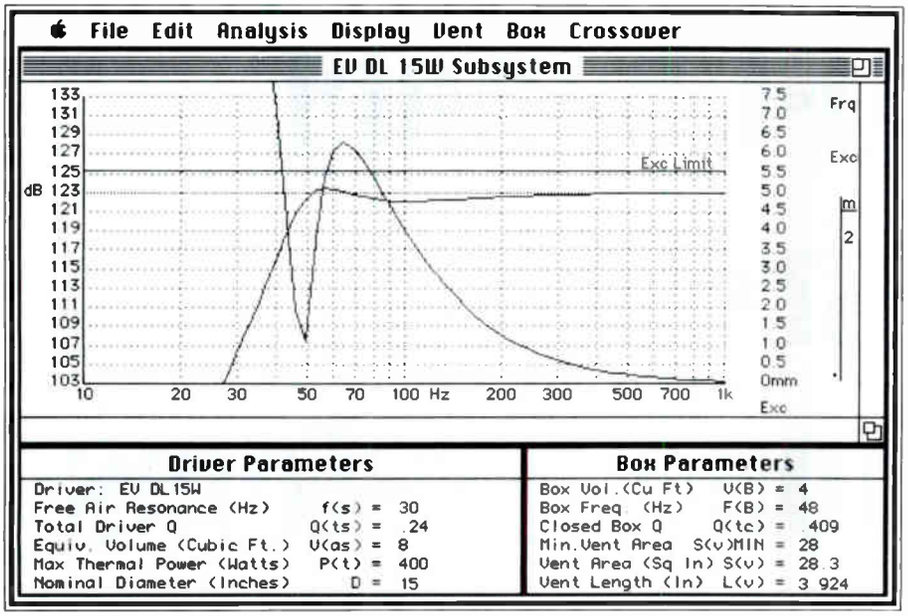
MacSpeakerz only requires a Mac computer with 512K of memory and one 800K drive. This is about as basic as you can get, with any Mac in the present lineup back through 1988 being compatible. Color is supported, and this comes in handy when many characteristics are plotted on the screen at the same time; such as frequency response, vs. impedance, vs. excursion, vs. phase. A color printer is also helpful for showing how all these factors correlate without the printout getting confusing. Color printers for the Mac have come way down and HP has a few models for well below $1,000 retail.

PRINTOUTS

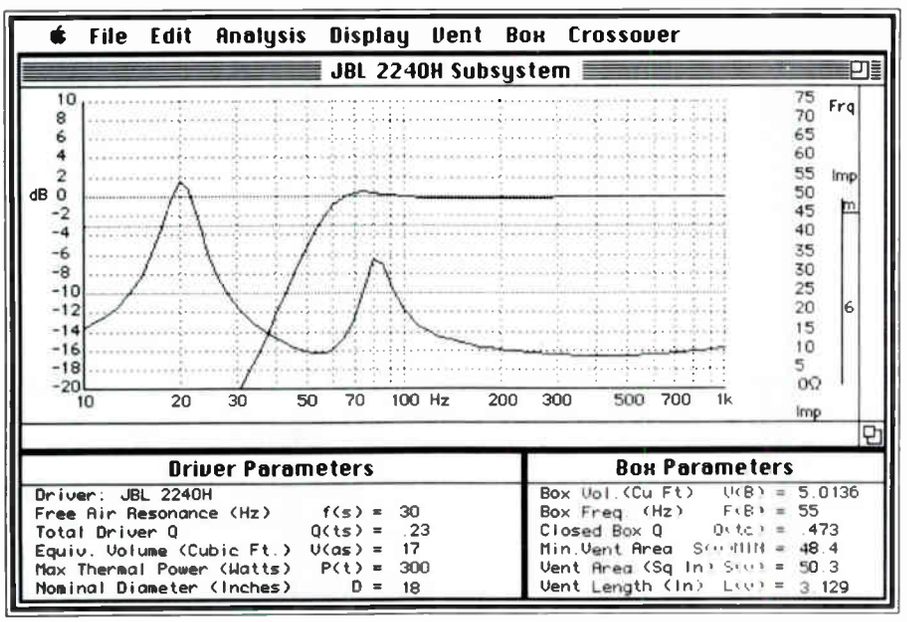
The quality of printouts is limited by your printer. As with all Macintosh programs, if your printer is compatible with the Mac, it will work with all your software. MacSpeakerz lets you display successive attempts on the screen, and you can output this to the printer, but you must first save each set of curves to a memory location. This is easier than it sounds and takes about one second to save the data from a pull down menu.

SPEAKER LIBRARY

The library includes 240 drivers, a mix of hi-fi and pro manufacturers, including JBL, Gauss, E-V, Fostex, and Fane. The E-V folder has about 25 different models in it. Of course, you can enter new drivers and delete old ones.



In this plot, woofer cone excursion is plotted against maximum SPL at full power.



In this plot, response vs. impedance is displayed.

CONCLUSION

The present release of MacSpeakerz is a well thought out program that works as claimed. It is easy to learn and use and is more than satisfactory for both beginners and intermediate level engineering efforts. The $250 price of the program is reasonable. From the growth of this program during the last few years, I anticipate that MacSpeakerz should keep up with the technical growth of most of its users. Assuming your design efforts are for sealed and bass reflex systems and you do not plan to attempt to model bandpass subwoofers (multi-tuned enclosures), then MacSpeakerz will accommodate your requirements. If you use a Mac, this is the best speaker design program for you.

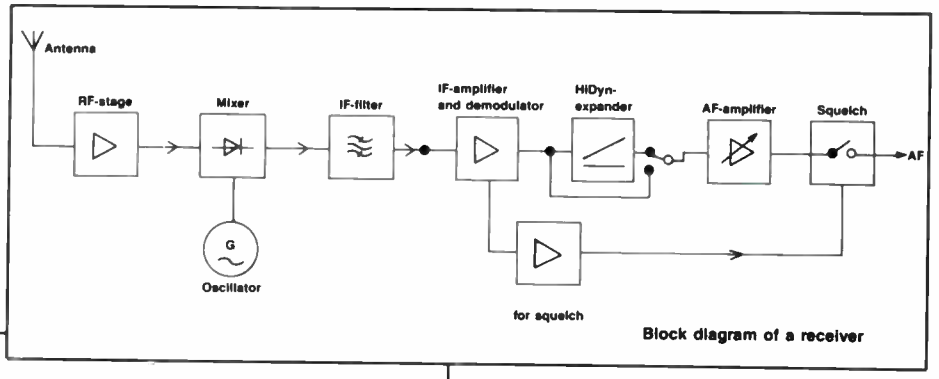
Future speaker system design program reviews are planned. This year we will take a look at DLC's Speak, Scientific Design Software's CACD and CASD, Audio Teknology's LEAP 4.1, and SpeakEasy's Low Frequency Designer. ■

Multi-Channel Wireless Microphone Systems

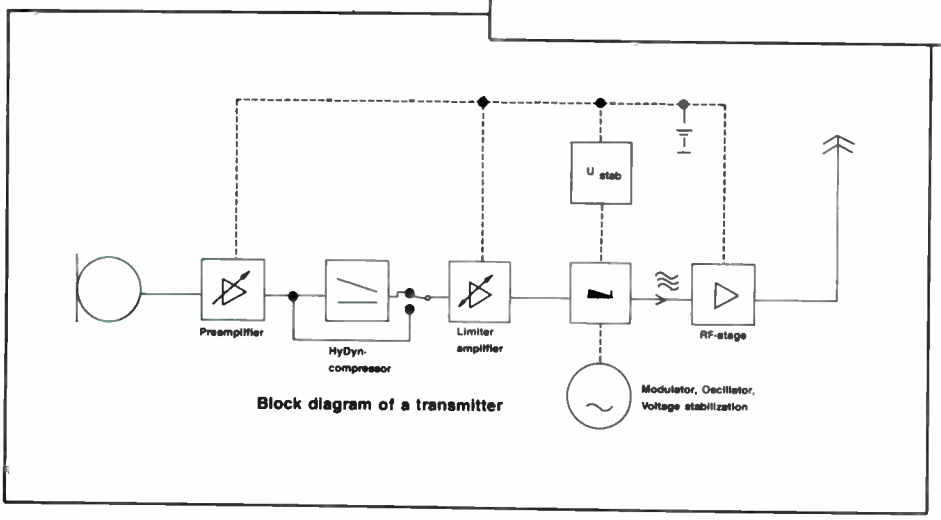
Making Theater Systems Work

BY JOE CIAUDELLI

The use of wireless microphones has mushroomed in the past few years. This is due to advancements in technology, a trend towards greater mobility on stage, and the desire to control volume and equalization of individual performers. Consequently, installations where the number of wireless microphones, referred to as channels, being used simultaneously has increased dramatically. In the past, six channels seemed to be the limit. Now theaters and studios with large multi-channel systems, 10 to 30 channels, are common. The largest installation to date is 44 channels being used in a theater in Japan. Systems of this magnitude are a difficult engineering challenge. Careful planning, installation, operation, and maintenance are required.



Block diagram of a receiver



Block diagram of a transmitter

FREQUENCIES

Manufacturers generally produce wireless microphones on very high frequencies (VHF) and ultra high frequencies (UHF) with specifications outlined by government agencies such as the Federal Communications Commission (FCC). Since the two frequency ranges have different associated wavelengths, they behave differently. The wavelength is inversely proportional to the frequency. Higher frequencies have shorter wavelengths. VHF frequencies (165-216 MHz) have a wavelength of approximately two meters. They exhibit good ability to bend around objects. UHF frequencies (450-960 MHz) have a wavelength of less than one meter. They have excellent reflective characteristics. They can travel through a long corridor, bouncing off the walls, losing very little energy. Due to its short wavelength, a UHF wave can sneak through small areas more easily. To take

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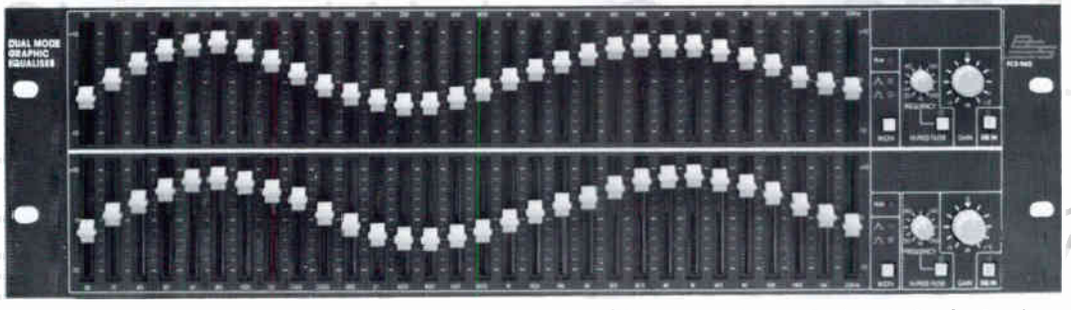

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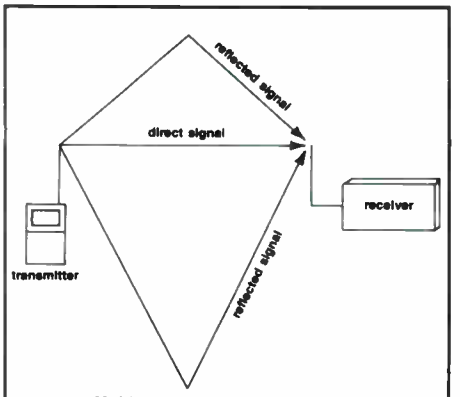
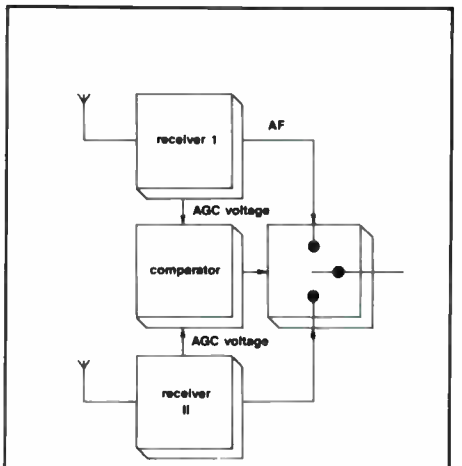
an extreme example, in a jail, the metal bars form a lattice or a "Faraday's Cage" that will easily block a VHF frequency, while a high UHF wave (950 MHz) is small enough, approximately 30 cm, to escape in between the bars. However, the shadowing effect is more critical in the UHF range. A small solid metal object could block a UHF wave while a VHF wave could probably bend around it.

On the practical side the UHF spectrum is less congested. VHF wireless microphones operate on frequencies used by TV channels 7-13. Frequencies should be chosen to avoid TV channels that are active in the city where the performance is taking place. This often presents a problem for a traveling performance company. Also, computers and other machines emit frequencies that can cause problems in the VHF range. Furthermore, thousands of VHF systems are in use already and hundreds more are sold every month. All these units are beginning to crowd the VHF spectrum. Even though they are low power devices, the possibility of picking up someone else's performance on your system is increasing daily. The UHF range also has a larger share of the RF spectrum, about 500 MHz (450-952 MHz). UHF TV channels are less redundant. For example, only a few locations have channel 19 active. UHF stations are usually located on the outskirts of major cities, and generally have less transmitting power than the stations operating on the VHF channels. There is significantly less potential interference from machinery in the UHF range as well. However, UHF equipment is more expensive than VHF, with little difference in audio quality. It demands highly sophisticated RF design techniques with more stringent tolerances.

To summarize, if the system is to be installed in a fixed location, carefully chosen VHF frequencies are an economical choice. If the system is to be used by a traveling performance company or in a theater that has saturated the VHF spectrum with wireless equipment, then UHF should be considered.



Multi-path propagation



Functional diagram of diversity receiver

TRANSMITTER CONSIDERATIONS

A radio frequency (RF) transmitter works like a miniature FM radio station. First, the audio signal of a microphone is subjected to some processing. Then, the processed signal modulates an oscillator, from which the carrier frequency is derived. The modulated carrier is radiated via the transmitter's antenna. This signal is picked up by a complementary receiver, via its antenna system, and is demodulated and processed back to the original audio signal.

FREQUENCY DEVIATION

The modulation of the carrier frequency in an FM system greatly influences its audio quality. The greater the deviation, the better the high frequency response and the dynamic range. The trade off is that fewer channels can be used within a frequency range. However, since audio quality is usually the priority and the UHF spectrum has increased the num-

ber of available frequencies, wide deviation is most desirable.

POWER

Transmitter power is a rating of its potential RF signal strength. This specification is measured at the antenna output. The actual transmitted power is influenced by the efficiency of the antenna. Therefore, power specifications are of only limited use in assessing a transmitter's range, considering largely variable antenna conditions. Also, battery life is associated with RF output power. Increased power will reduce battery life with only a moderate increase in range.

DC-TO-DC CONVERTER

Transmitters should be designed to provide constant RF output power and frequency deviation throughout the event being staged. This can be achieved through the use of a DC-to-DC converter circuit. Such a circuit takes the decaying battery voltage as its input and regulates it to have a constant voltage output. Once the voltage of the batteries drops below a minimum level, the DC-to-DC converter shuts off, almost instaneously. The result is a transmitter that is essentially either off or on. While it is on, the RF output power, frequency deviation, and other relevant specifications remain the same. Transmitters without regulation circuits, once the battery voltage begins to drop, will experience reduced range and the audio quality will start to deteriorate due to a degradation in the modulating signal.

COMPANDING

Most wireless microphone systems use a companding (compressing/expanding) noise reduction system, similar to those used in recording studios and home stereo equipment, as well as a pre-emphasis/de-emphasis process to maximize signal-to-noise ratio, dynamic range, and transmission reliability. The transmitter pre-emphasizes, or boosts, the higher audio frequencies. The modulated signal is then compressed before being trans-

mitted. This raises low audio levels sufficiently higher than the transmission noise and suppresses overmodulation. The receiver uses complementary expanding to restore the dynamic range and de-emphasis so that the overall response is linear.

SPURIOUS EMISSIONS

Apart from the wanted carrier frequency, transmitters also may radiate some unwanted frequencies known as spurious emissions. The carrier frequency is obtained by electronically multiplying a crystal frequency. A frequency is generated after each multiple. For example, a 25 MHz crystal is doubled to 50 MHz, which is doubled again to 100 MHz, which is doubled once more to the final carrier frequency of 200 MHz (8 times the original crystal frequency). However, spurious signals every 25 MHz might be generated. For large multi-channel systems these spurious frequencies cannot be ignored. They can be significantly reduced through elaborate filtering and contained by using a well constructed, RF "tight," metal housing for the transmitter. This metal casing should not have any slits since RF can leak through them. Therefore, it ought not be two half shells screwed together, it should be one molded piece. Small round holes in the casing are acceptable since RF cannot escape through them. They can be employed for access to adjustment locations on the circuit board. Also, an RF tight transmitter is less susceptible to outside interference. Despite this precaution, choosing a frequency for a new channel that falls directly on one of these possible spurious emissions should be avoided.

A metal housing is not only important for its shielding properties but also its durability. These devices usually experience much more abuse by actors and other talent than anyone ever predicts.

ANTENNA

A transmitter antenna should be tuned to its carrier frequency. There are generally two types, the long straight "whip" antenna and the coiled "rubber duck" antenna. The whip antenna is tuned by cutting it to of the wavelength of the carrier frequency. The duck antenna is used on VHF transmitters to stifle objections to the length of a whip antenna necessary for the VHF range. It achieves its radiating efficiency along its shortened length over a much narrower frequency range. The coiling of the antenna wire concentrates its tuning elements. The tuning is sharply influenced by close proximity to conductors. On body pac transmitters, the duck antenna tends to be stiff and rest against the user's body. Since the human body is largely composed of water and salt, it is quite a good conductor and could easily detune the duck antenna. Therefore, the whip antenna is recommended for body pac transmitters. If a duck antenna must be used, it is recommended to bend it slightly so it does not rest against the performer's body. UHF antennae are short enough so that there are generally no objections to the wave whip antenna.

Handheld transmitters are often designed with their antenna incorporated on their circuit board under the outer housing. This design is not efficient because the perfomer's hand will absorb some of the radiated energy. It cannot be implemented with a metal, RF tight housing either.

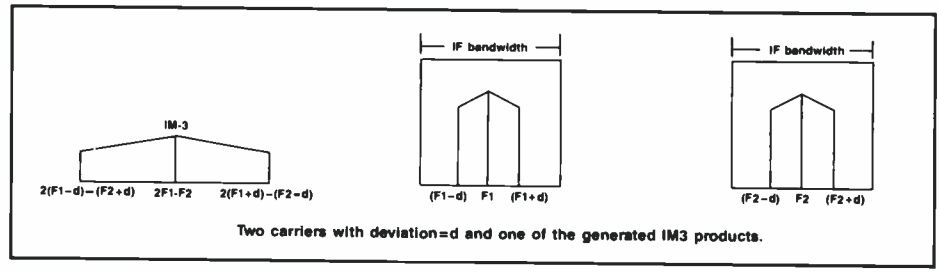
RECEIVER CONSIDERATIONS

An ideal wireless microphone receiver would capture the carrier frequency of its corresponding transmitter and reject all other signals. Short of this unrealistic expectation, a receiver should be designed to capture its carrier, reject most other signals, and avoid mixing its carrier with the other signals it does pick up. When designing a multi-channel system, the "non-ideal" characteristics have to be overcome. These include widely varying RF signal levels, intermodulation, frequency spacing, and spurious oscillator frequencies.

RF SIGNAL LEVEL

Varying RF signal strength is mainly due to multi-path propagation, absorption and shadowing. These are familiar difficulties also experienced with car radios in cities.

Audible effects due to low RF signals, known as dropouts, can occur even at close range to the receiver, due to multi-path propagation. Some of the transmitted waves find a direct path to the receiver antenna and others are deflected off a wall or other object. The antenna detects the vector sum, magnitude and phase, of direct and deflected waves it receives at any particular instant. A deflected wave can diminish a direct wave if it has different phase, resulting in an overall low signal. This difference in phase is due to the longer path a deflected wave travels between the transmitter and receiver antennae and any phase reversal occuring when it hits an object. Obviously, this phenomenon needs to be addressed in an indoor application. It is less critical outside.



Two carriers with deviation=d and one of the generated IM3 products.

RF energy can be absorbed by non-metallic objects resulting in low signal strength. As stated previously, the human body absorbs RF energy quite well. It is important to place antennae correctly to minimize this effect.

Shadowing occurs when a wave is blocked by a large obstacle between the transmitter and receiver antennae. This effect can be minimized by keeping the receiver antenna a distance of a wavelength away from any large or metallic

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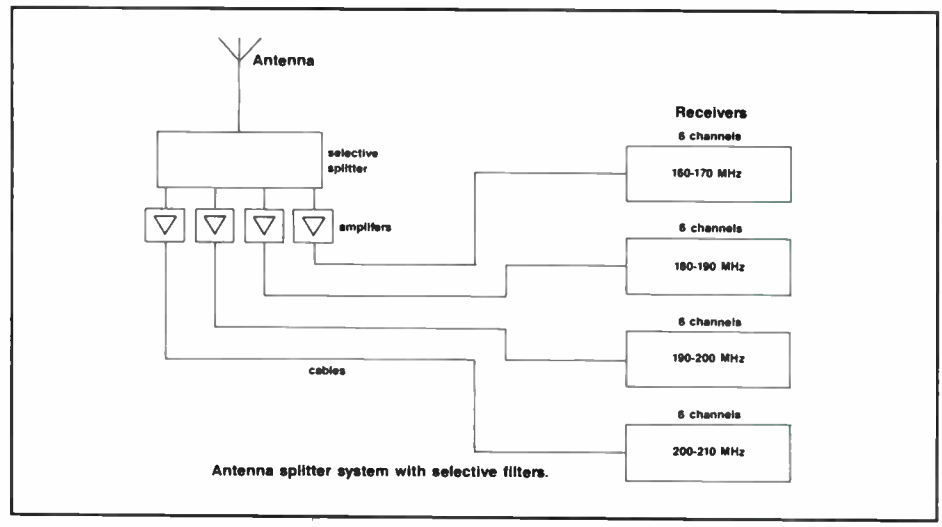


Antenna splitter system with selective filters.

objects.

These problems are addressed by a diversity receiver. A diversity system is recommended even if only one channel is in operation. Large multi-channel systems are only possible with diversity operation.

Comparing the different diversity systems, the "true" diversity has proven to be the most reliable design. This design has two independent receivers (usually incorporated within a single housing), each with its own antenna, with a logic switch between them. The logic switch constantly monitors the RF field strength as seen by each receiver. The receiver with the highest RF level is used for the audio output. This switching action can occur very fast and often, especially in UHF equipment. It is not audible in a well designed receiver. It is difficult to define an absolute value for the improvement when using this type of receiver. It can only be determined by statistical methods. The improvement when using a true diversity system is that it has a similar effect of amplifying the wanted signal by at least 25 dB.

Another method of diversity is "antenna" diversity. This incorporates a single receiver with multiple antennae, usually three. Using this method, the signals from each antenna are summed together. It assumes that if a weak signal is detected at one antenna, the sum of the other two will provide a sufficient signal. The problem is that both the phase and the amplitude of the signals are summed. Due to phase cancellation, the summed signal is often lower than the signal seen by a single antenna. Another problem is that each antenna needs an amplifier to keep it electrically independent from the others. These amplifiers can be a source of intermodulation.

A third technique is known as "phase" diversity. With this method, one receiver and two antennae are used. If the signal drops below a certain threshold, the receiver switches the phase of one of the antennae. This method assumes that a low RF signal is due to multi-path propagation. However, it may be due to shadowing or absorption. Switching the phase may aggravate a multi-path propagation problem.

INTERMODULATION

Intermodulation is the result of two or more signals mixing together to produce a sum or difference signal. It is a common misconception that intermodulation is produced by the carrier frequencies mixing within the air. Intermodulation occurs within non-linear active components, such as transistors, exposed to strong RF input signals. This usually happens in the RF section of the receiver or in antenna amplifiers. In multi-channel operation, when several RF input signals exceed a certain level, the intermodulation products grow very quickly. There are different levels of intermodulation defined by the number of addition terms. Each addition term (f1, f2, etc.) represents a carrier frequency:

Only the odd order intermodulation products need to be considered since the even ones are out of the frequency range of concern. The frequency of a new channel should be carefully selected to avoid intermodulation products of the other signals.

Equipment can be designed to minimize intermodulation. A specification known as intermodulation rejection is a measure of the RF input threshold before intermodulation occurs. For a well designed receiver, this specification will be 60 dB or greater. An intermodulation rejection of 60 dB means that intermodulation products are generated at input levels of approximately 1mV. The highest quality multi-channel receivers presently available feature an intermodulation rejection of 80 dB.

Another important design feature is selective filters. Filtering out signals other than the wanted carrier frequency is no easy task. The filtering "window" should be as narrow as possible. This can be achieved through the use of helical filters in the first stage of the receiver.

Present technology does not allow the use of highly tunable receivers in large multi-channel systems. The filtering window of this type of receiver has to be wide enough to accept all the frequencies it can be tuned to. This wide window is an invitation for unwanted signals to get into the receiver and cause intermodulation. A receiver with more than one frequency is acceptable as long as the difference between the highest and lowest frequency is only two or three MHz so that helical filters can still be employed.

Despite these precautions, frequency coordination must be done. Only the 3rd and 5th order intermodulation products need to be considered with most equipment. The higher odd ones are too weak to cause problems. If high quality receivers are used, having an intermodulation suppression of 60 dB or greater, only the 3rd order products need to be considered. The distance between an intermodulation product and a carrier frequency should be kept to a maximum. A theoretical minimum safe distance can be determined by considering two criteria. First, an intermodulation product should not enter the final filtering stage, the intermediate frequency (IF) bandwidth, of the receiver. Secondly, since the carrier frequencies are being modulated, the bandwidth of an IM3 product, by nature of the algebra listed previously, is three times the bandwidth of the carriers. If full modulation is assumed, the bandwidth of an IM3 product is three times the max-

imum frequency deviation of the carriers. Therefore, the minimum safe distance regarding IM3 products is three times the maximum deviation of the transmitters plus half the IF bandwidth of the receiver. This is the theoretical ideal, however. Often, full modulation in the transmitters is not achieved. Therefore, the IM3 products would not be as wide. The prac- tical minimum safe distance is often a debated subject. Nevertheless, it is recommended that IM3 products should be 250 KHz away from any carrier frequency. If IM5 products are to be considered, they should be assumed to have a bandwidth of five times the maximum deviation of the transmitters.

Intermodulation products are not only generated in receivers. Transmitters also have antennae which tend to pick up other signals. When these signals pass in a reverse fashion across the output filter of the transmitter, they are fed to a nonlinear component: the output stage transistor. In this way, transmitters can generate intermodulation products themselves. With body pac transmitters the problem becomes less critical since the antenna is close to the body. Actors with body pac transmitters can come rather close to each other without significant problems of transmitter intermodulation products. The situation changes dramatically, if several transmitters, still in operation, are put side by side on a desk. This mistake must be avoided. A highly selective output stage in the transmitter should be incorporated to minimize these problems.

Frequency coordination can be extremely complex. It requires an appropriate computer program. For a six channel system, for instance, 90 IM3 products have to be taken into consideration. For 20 channels this figure grows to 3,800. The necessary RF bandwidth rises exponentially as the number of channels is increased. This graph only considers IM3 products. The other constraints that need to be considered make the graph even more dramatic.

External disturbing sources such as TV transmitters, taxi services, police services, digital equipment, etc., also have to be taken into consideration. Fortunately, the screening effect of buildings is rather high (30 to 40 dB for VHF carriers). For indoor applications, this effect keeps strong outside signals at low levels. A significant problem can occur when poorly screened digital equipment is working in the same room. These wideband disturbing sources are able to interfere with all VHF channels. The only solution to this problem is to replace the poorly screened piece of equipment with a better one.

SPACING

In order to have a defined channel, without crosstalk and with an intermodulation safety gap, a minimum spacing of 300 KHz between carrier frequencies should be employed. A wider spacing is even more preferable since many receivers often exhibit desensitized input stages in the presence of closely spaced signals. However, caution should be used when linking receivers with widely spaced frequencies to a common set of antennae. The frequencies need to be within the bandwidth of the antennae.

LOCAL OSCILLATOR

Receivers contain one or two local oscillators (single conversion or double conversion). In most VHF systems it is 10.7 MHz below the carrier. A small part of the oscillator energy could be radiated via the antenna or via the housing. Although this energy is small it is not negligible. When the receivers are connected to each other through an antenna system, this potentially dangerous frequency will find access to the input stages. This must be considered in the com- puter program. The difference between two carriers should never be equal, or even close to this oscillator frequency. A safety margin of 200 kHz is recommended. Another related frequency, the image frequency, two times the local oscillator, should be avoided in the same way. To minimize this problem, high quality receivers apply a double screening. Inside an all-metal housing, hermetically sealed metal boxes contain the complete RF circuitry. This technique reduces the spurious emission by 20 dB.

ANTENNAE

A good receiver antenna system is extremely important. There are several types of receiver antennae available. Similar to microphones, there are omnidirectional antennae and directional ones. There are far more omnidirectional antennae in use presently. However, in areas that are saturated with RF equipment, directional antennae become more attractive.

Omnidirectional antenna are generally tuned by cutting them wavelength of the operating frequency. This type includes the "rabbit ears" seen in the majority of systems. These are attached directly to the receiver. This is simply a monopole or Marconi type of antenna and is generally reliable.

A more sophisticated antenna is a remote ground plane antenna connected to the receiver by a coaxial cable. Besides having a main radial to pick up the signal, it has at least three others that form a virtual ground plane which protects the main radial from potentially interfering deflected waves bouncing off the closest large reflective surface, usually the floor. If the antenna is mounted from the ceiling, it should be turned upside down since the ceiling is more of a threat than the floor.

An antenna has a bandwidth. It is sensitive to the frequency that it is tuned to while it attenuates other signals. For a single receiver, it is desirable to have a very narrow bandwidth. For larger systems where several diversity receivers are linked to one set of antennae, it is necessary for the antenna to have a bandwidth that includes all the frequencies in operation. The bandwidth of an omnidirectional antenna can be broadened by increasing the diameter of its radials.

A directional antenna, similar to a cardioid microphone, is more sensitive to signals arriving from the front and attenuates signals from the rear. This is an excellent choice for a fixed installation

where other nearby venues have wireless systems as well. An example is a theme park, especially if it has outside theaters. By carefully aiming these antennae, one can provide RF pick-up of the intended stage and reject the potentially interfering signals from other areas. This type of antenna is also tuned but generally has a broader bandwidth, an advantage with a large multi-channel system. However, correct installation is critical. They are larger than the omnidirectional type, need to be distanced farther from potentially blocking objects, and aimed in the correct direction. They can not be disassembled and neatly packed like omnidirectional ground plane antennae. These disadvantages are more pronounced with a VHF version. A UHF version is much more compact.

Polarization refers to the direction of the electric field of a transmitted wave. It is best to have the transmitter and the receiver antennae polarized, which means oriented in the same direction, both horizontal or both vertical. However, reflected waves often change their polarization slightly. This is why the receiver antennae in a diversity system are often angled approximately 45 degrees. The worst condition, the transmitter antenna and the receiver antennae at a 90 degree angle to each other, should be avoided.

To prevent the receivers from getting unacceptably high input levels, the receiving antenna must be installed at a minimum distance to the transmitters. The receiving antennae should be positioned at a minimum distance of 6 meters (20 feet) from the transmitters. This condition is of high importance for good operation of large multi-channel systems.

SPLITTER SYSTEMS

Ideally, each diversity receiver should have its own set of antennae tuned to the frequency that it operates on. However, this is often cumbersome and unnecessary. One can still obtain optimum performance by operating several receivers from one set of antennae within the same frequency range. To accomplish this a splitter system needs to be used. However, signal loss between the antennae and the receivers needs to be considered.

The two major sources of signal attenuation are line loss and splitter loss. As a signal travels down a cable, some of its energy dissipates. The amount of the signal loss is directly proportional to the conductivity and the length of the cable, as well as the carrier frequencies traveling through it. Higher frequencies in the UHF range are attenuated more than VHF frequencies. Therefore, if long antenna cables are needed, lowloss cable or an in-line amplifier, or both, is recommended. If amplification is to be used, usually 10 dB will be sufficient. Higher amplification invites stray signals to be picked up and can aggravate intermodulation. The amplifier should be positioned near the antenna to obtain the best signal-to-noise ratio. Splitter loss should also be addressed. Each receiver that is added to the antenna system requires another split to be made. Every time a split is made, some signal is lost. Therefore, an active splitter, should be considered, especially if no previous amplification was used. An active splitter as opposed to a passive one, is a powered device that incorporates amplification. Any amplifiers used must be of high quality, and should just compensate for the cable and splitter, losses.

For additional security from interference, selective filters should be used in the splitter system. If an RF bandwidth of 40 MHz is available for a 24 channel system, the bandwidth can be divided into four subgroups of 10 MHz, and the 24 channels channels can also be divided into four groups of six channels. The subgroups can be separated from each other by highly selective RF-filters. The subgroups then become nearly independent of each other. In this way, any non-critical coordination violations between frequencies in different subgroups can be ignored.

CONCLUSION

Large multi-channel systems demand excellent planning, especially in the initial phase, and good technical support. Observing all the above mentioned items, perfect operation of a system can be guaranteed, even under difficult conditions.

Graphs provided by: Hans Kuhn, Sennheiser electronic KG, Wedemark Germany ■

Electrosonic Starts New Division; Hughes Introduces New Circuitry

Electrosonic Opens New Division; Signs Agreement with Philips

Electrosonic U.S.A. has opened Electrosonic Leisure Systems, a new division, to service the leisure entertainment marketplace. The new division is headquartered in Burbank, and is headed by Doug Hunt, the long-time audio visual technology executive and consultant. Hunt's mission is to expand Electrosonic's activities in what the company estimates is the $20 billion entertainment and leisure systems marketplace. The division is currently working on a program at the National Holocaust Museum and is beginning the final phase of its work on the Simon Weisenthal Museum of Tolerance. Hunt was previously executive vice president of Audio Visual Headquarters in Los Angeles, and later headed his own consulting company whose clients included the Academy Awards.

Doug Hunt

In other news, Philips Vidiwall and Electrosonic Systems, Inc. have signed a USA distribution agreement. ESI will act as distributor in the U.S.A. and Canada for Philips Vidiwall products, including Super Projectors, Scanwall monitors, digitizers and peripheral equipment. ESI, which will continue to offer its line of Videowall products, will provide design, engineering, installation, maintenance and after sale services through its nationwide network of dealers.

Hughes Introduces Circuitry

Hughes Aircraft Company has developed circuitry, on which a patent is pending, called Voice Intelligibility Processor (VIP), which reportedly improves the listener's ability to understand an audio signal in a high noise environment without an appreciable increase in the volume of the audio transmission. The technology is incorporated in a line of standalone products developed by Hughes' Microelectronic Systems Division. The basic unit, Model VIP 100, is a fixed, one-zone system for PA use only, with a single unit list price of $500. Other models scheduled for introduction later this year will include multi-channel, multi-zone units with both PA and music capability. Volume shipments are set to begin in the third quarter. The full line will offer rackmount options. Plug-in module circuit cards will be provided.

Anixter Distributing IBM

Anixter Bros., Inc. has announced that it has been authorized by IBM to distribute the IBM PS/2 TV product. The PS/2 TV allows the IBM PS/2 or PC to be video compatible. The unit requires no adapter cards and contains a 181-channel, cable-ready TV tuner that accepts NTSC broadcast signals from a cable TV source or antenna, and standard baseband video input from a vcr, videodisk player or video camera. The unit is complete with an internal speaker, headphone jack and set of video and audio input/output connectors. Anixter sees the distribution agreement as 'greatly enhancing its multimedia system offerings.'

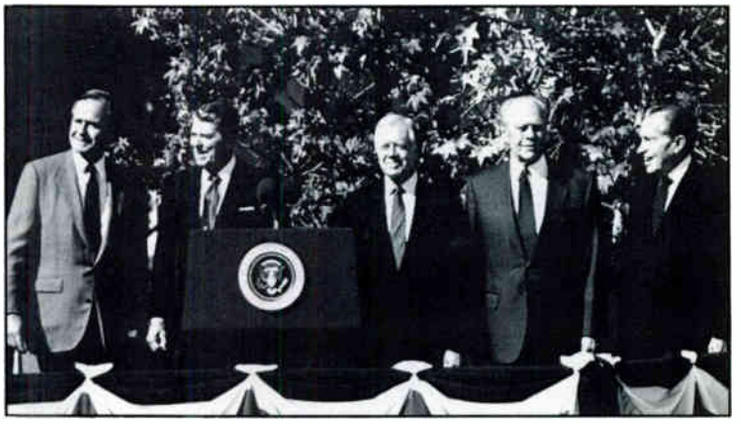
In other news, Anixter Bros has reached an agreement with TAI Industries to distribute TAI's teleconferencing products nationwide. TAI manufactures full duplex teleconferencing equipment as well as sound reinforcement systems.

Podium by West L.A.

West L.A. Music has completed the installation of microphones and lighting for two podiums belonging to former President Ronald Reagan. The system was unveiled as part of the opening ceremonies for the Ronald Reagan Presidential Library in Simi Valley, California. The podiums are replicas of the one used during Reagan's term as President. The original is now at the Smithsonian Institute in Washington. The podiums were outfitted with AKG's D330BT microphone and Littlelites with dimmers. Reagan requested variable lights to facilitate the reading of cue cards. The system was installed by West L.A. Music salesman Mark Spiwak who received a gold Presidential Seal keychain, tie clasp and cuff links, as well as an autographed picture from the former President.

Gentner to Acquire Macromedia

Gentner Communications Corporation has announced the signing of a letter of intent for the purchase of all products and technology of MacroMedia Inc. of Northfield, Illinois. The acquisition will be accounted for as an asset purchase. As part of the agreement, Gentner will not assume any MacroMedia liabilities. MacroMedia is involved in digital audio storage technology, with annual revenues of approximately $1.5 million in its second year of operation. Its 'Audisk' product is targeted to the small to lower middle segment of the radio broadcast market. Gentner makes a higher end DAWN product. Tim Valley, president of MacroMedia will be added to Gentner staff with non-competition and employment agreements.



Telecall in Montreal

The Telecall TD-1NW system has been selected by the City of Montreal as an 'affordable but efficient' access control system for its Biodome, housing flora and fauna from four different climatic areas. The Telecall Two-Wire Video Entry Intercom was deemed to be appropriate since the City required 'physical' surveillance. A traditional 9510F 10-call master station is installed, connecting other areas with the control desk. A separate 9503F three-call master handles the shipping/loading dock area.

Speakers in Coliseum

Grundorf Corporation has announced that its GAD GT series of loudspeakers was chosen to fly in Omaha, Nebraska's Ak-Sar-Ben Coliseum. Sixteen GT-1210 cabinets were flown as the primary announce system in the main hall by Seco Labs, the Omaha based sound contractor. The GT-1210 is one of a series of trapezoid enclosures introduced by GAD. Ak-Sar-Ben Coliseum houses the Omaha Lancers hockey team and the Omaha Racers basketball franchise.

PRODUCTS

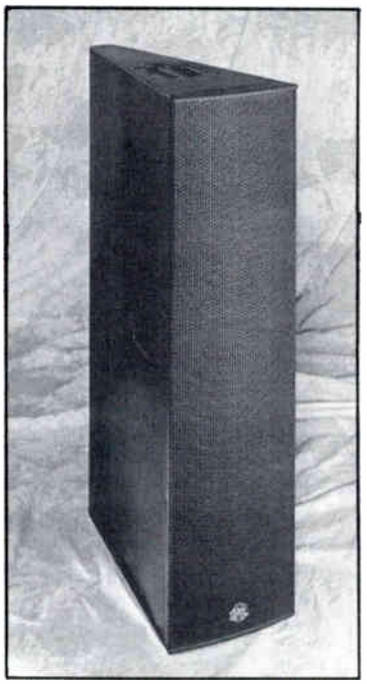
Clair Intros Pistons; New Nady Wireless

Piston Speaker

Clair Brothers Audio Systems, Inc. has introduced the P-4 piston speaker system. The P-4 is an arrayable, three-way, full-range speaker system designed for portable and permanent installation applications.

The frontal area of the P-4 box is approximately 13 inches with the side walls tapering to a rear dimension that can accommodate an EP-8 connector. This is accomplished through the use of 12-inch woofers for low and mid frequencies.

Circle 1 on Reader Response Card



VHF Wireless

Nady Systems, Inc has introduced its "top-of-the-line" VHF wireless system, the Nady 2000. It is available in instrument, handheld and lavalier configuration. The 2000 contains hiss mute circuitry and has a 120 dB dynamic range. Up to 20 systems can be operated on the same stage simultaneously, with custom frequencies available.

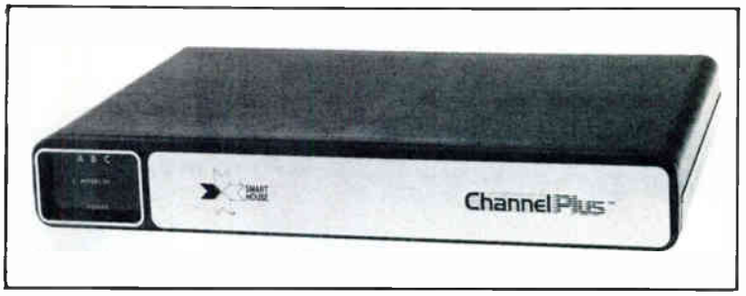
Circle 2 on Reader Response Card

Feedback Exterminator

The FBX 900 Feedback Exterminator from Sabine Musical Manufacturing Co., Inc. is a digital system that automatically eliminates feedback from PA systems.

The FBX 900 surpasses the previously released FBX-M in terms of speed in eliminating the feedback and the number and width of parametric notch filters used to control the frequencies that are feeding back.

Circle 3 on Reader Response Card



Eight-Channel Mixer

Rolls Corporation has introduced the RM81 8-channel mixer. The unit fits in a single space 19-inch-rack chassis intended for sound reinforcement, studio, choir and other applications where high channel-to-size ratio is desirable.

The RM81 has socketed ICs, a double-sided circuit board and painted chassis. It has eight microphone XLR and eight line quarter-inch inputs.

Circle 4 on Reader Response Card

All-Master and Master/Staff

Artel Communications Inc. has made available its M6 series intercom. Manufactured in two variations, for all-master and master/staff systems (desk and wall models), it is presently available in 10- and 20-station capacity and 30 through 60, special order.

Circle 5 on Reader Response Card

Video Disc Controller

Museum Technology Source has introduced the VDC-212 video disc controller. The VDC-212 is intended to fill a range of applications in the areas of museum exhibits, point of purchase displays, classroom use and forensics.

The unit has the ability to select from up to 12 segments from a video disc. Each of the 12 pushbuttons is assigned a start and end frame number from the video disc. Pushing the button instructs the player to play

the segment of the disc bounded by those frame numbers.

Circle 6 on Reader Response Card

Generator Sets

MagneTek's Genesys R-Series Generator Sets provide standby power for commercial buildings, communications, and municipal and state governments. Powered by 30-227 horsepower Hercules engines, the R-Series generators range from 20 kW to 150 kW standby for packages powered buy diesel fuel and 20 kW to 125 kW standby for spark-ignited packages.

Circle 7 on Reader Response Card

Omnidirectional Loudspeaker

Eclipse Research Corp. has introduced the Eclipse-OS 2000 series speaker system. The omnidirectional speaker system incorporates "Surround Plane Manifold" technology. The design incorporates a laminated composite hemispherical cabinet, large format coaxial drivers and a

time aligning phase plug within the 360-degree manifold.

Model 2000 is weatherproof, theft and vandal resistant, and is an outdoor ground burial unit with optional epoxy/aggregate architectural protective shell.

Circle 8 on Reader Response Card

Smart House Video

Multiplex Technology Inc has introduced, under the ChannelPlus brand name, three Video Transmitter Adapters designed for use in the Smart House home video network.

The Video Transmitter Adapters enable the Smart House homeowner to view an "in-house" generated video signal on a TV in a house by changing the channel. "In-house" generated signals include VCRs, laserdisk players and cameras.

The Video Transmitter Adapter converts an audio/video signal to a signal that can share a coax cable with other signals.

Circle 9 on Reader Response Card

Addressable and Intelligent

The Addressable/Intelligent Module (AIM) communicates to 198 addressable devices. It tells you exactly which device is in alarm or trouble. In addition, a pair of wires is required for all 198 devices.

The AIM-200 can communicate with each detector, measure its analog sensitivity and determine the type of detector or device. It can adjust the sensitivity of each detector to best fir its particular environment.

Circle 10 on Reader Response Card

Digital Screen-Splitter

The American Dynamics AD1479 "DigiSplit" time-base corrected digital screen-splitter simultaneously displays two cameras on one monitor with an adjustable split screen without the need for external synchronization.

The DigiSplit incorporates Time-Base Correction (TBC) for internal synchronization of the two cameras. No external sync is required between the cameras and/or the DigiSplit.

Circle 11 on Reader Response Card

Racks and Consoles

Four styles of vertical racks and sloped consoles are now offered by Equipto Electronics Corporation. Styles include the company's Solid-System, its Challenger designer series and two versions of the Heavy Duty line.

Equipto Electronics offers free engineering design service to customize its products for specialized user installations and OEM applications.

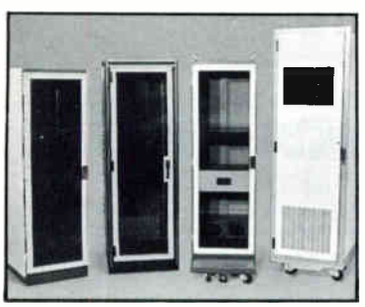
Circle 12 on Reader Response Card

Powered Stereo Monitor

The AMP-0.9 is an addition to the Wohler Technologies' line of rack-mount audio monitors. Housed in a one-rack-unit package, the AMP-0.9 can be used for stereo or fully discrete two-channel operation.

The AMP-0.9 is designed for a wide range of industrial and non-critical broadcast applications, as well as conferencing, security, page/intercom and radio relay installations.

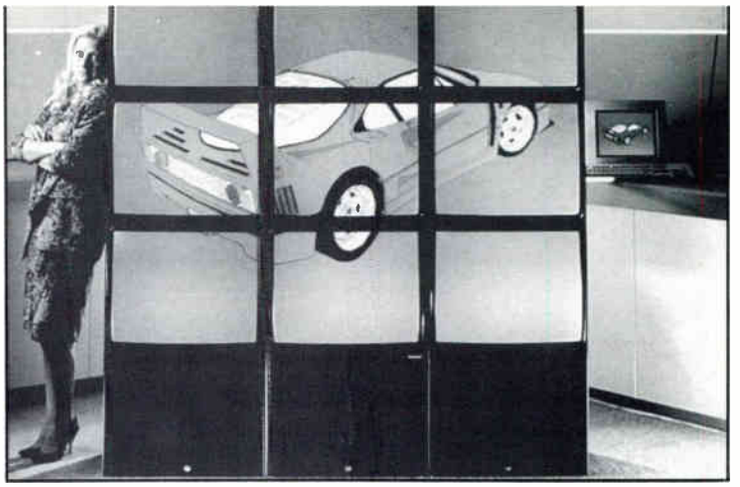
Circle 13 on Reader Response Card



Heat Shrink Tubing

A line of surface marked thinwall heat shrink tubing has been announced by Panduit Corp., Electrical Group for application in U.L.-listed equipment. It can be used to insulate, protect, harness and identify electronic and electrical components.

Circle 14 on Reader Response Card

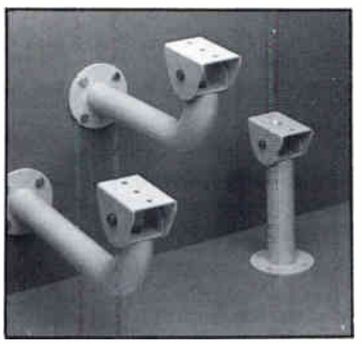


Media Wall

RGB Spectrum has introduced its MediaWall. The MediaWall looks like a video wall but is designed to accept computer graphics, animation and scanned images from a Macintosh computer through a direct digital connection.

The MediaWall interfaces directly to a computer but also accepts full-motion and still video and stereo sound.

Circle 16 on Reader Response Card

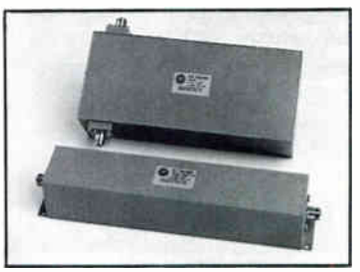


Camera Mounts

Burle Industries Inc., Security Products Division has introduced indoor and outdoor camera mounts. Designed for fixed camera or camera housing installations of up to 15 pounds, the mounts are constructed of lightweight aluminum with a corrosion resistant off-white semi-gloss finish.

The TC9210 is an 8-inch column mount that features an adjustable head mount. The TC9211 is a 10-inch wall mount and the TC9212 is a 12-inch wall mount. Both include an adjustable head mount that is on a 90-degree angle.

Circle 15 on Reader Response Card

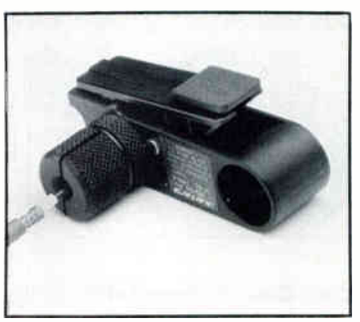


Low-Pass Filters

Bird Electronic Corporation has introduced a line of nine- and 13-section Chebyshev type 100W, 500W, 1000W and 1500W coax low-pass filters. A number of standard cutoff frequencies are used.

The filters exhibit a maximum VSWR of 1.3 with less than 0.5 dB insertion loss and are furnished with QC (Quick Change) type 50-ohm connectors.

Circle 17 on Reader Response Card



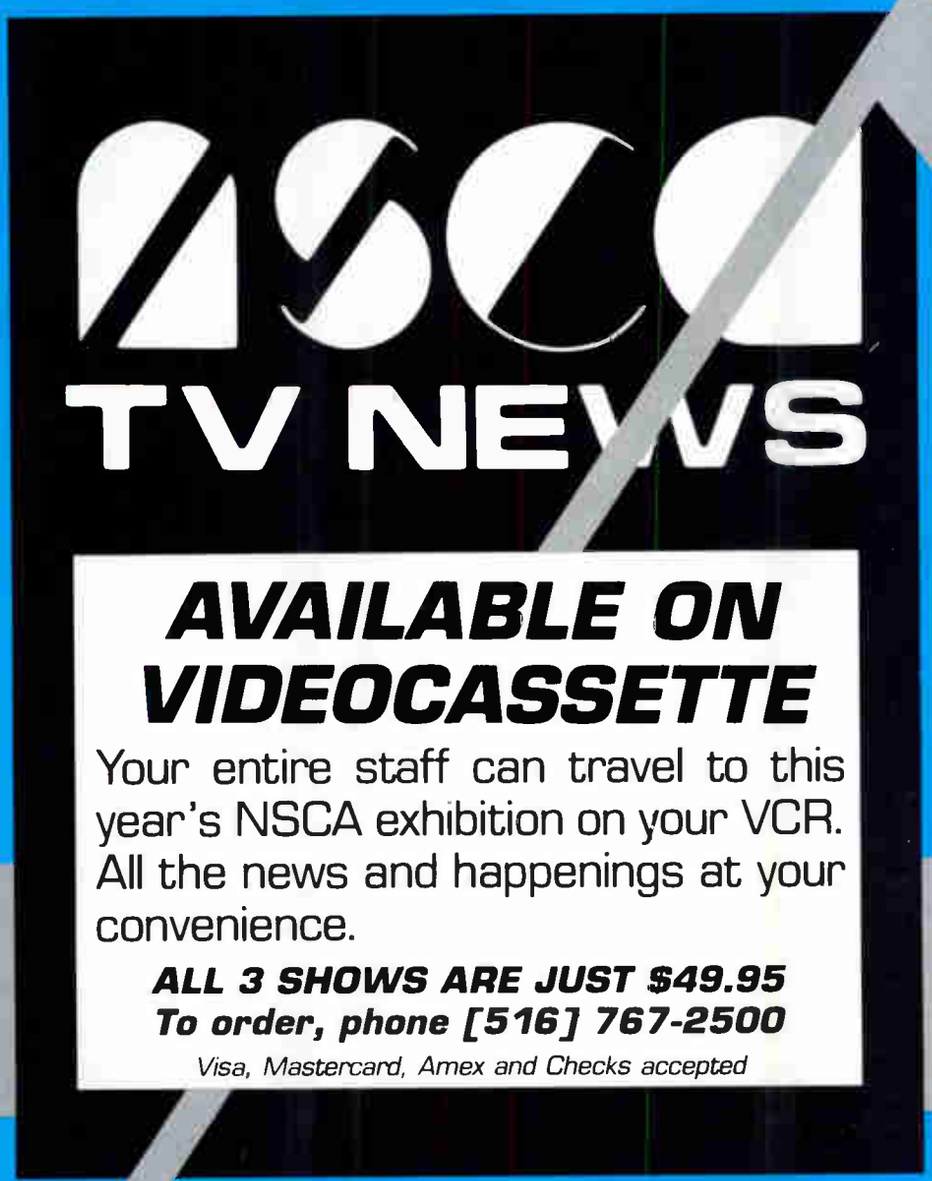
Coaxial Cable Stripper

Canare has introduced its TS-Series Coaxial Cable Stripper. The company claims 15 seconds to insert cable, rotate tool and pull out. Hardened steel blades revolve around cable.

Adjustable cutters trim all Canare video cable plus a variety of common coaxial cable types.

Circle 18 on Reader Response Card

AT THE ANAHEIM NSCA SHOW . . . WATCH



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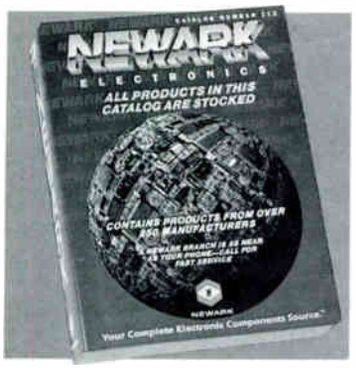
Newark and Panduit Catalogs

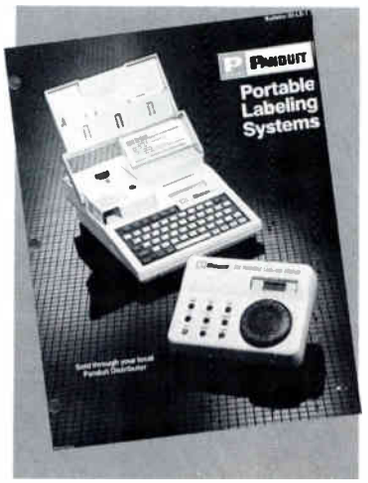
New from Newark

Newark Electronics has announced the publication of its 1,200-page electronics Catalog 112. The catalog contains detailed, technical information and dimensions on more than 100,000 products from 250 manufacturers.

Catalog 112 features 20 new manufacturers and in excess of 15,000 new products.

Circle 19 on Reader Response Card





Portable Labeling

A color bulletin available from Panduit Corp. Electrical Group describes two portable labeling systems. The LS1 labeling system can replace printed or engraved name plates. It uses 300-inch rolls of either clear or colored base tape.

The LS4 system uses 600-inch rolls of tapes in a number of colors and runs on four D-cell batteries.

Circle 20 on Reader Response Card

Packaged Sound

Perma Power Electronics, Inc. has released an eight-page catalog focusing on voice reinforcement sound systems in a variety of formats. Included are table-top systems, floor lectern systems and portable systems that are battery operable and designed for indoor and outdoor applications.

The color catalog also details a range of interchangeable Perma Power accessories.

Circle 21 on Reader Response Card

Software Bulletin

A product bulletin, introducing three IBM-compatible software programs designed for marking labels, tags and markers is available from W.H. Brady Co. Industrial Products Division.

Outlined in the bulletin are additions to the BradyLabel software product line; each of which gives electronic, electrical and industrial OEMs the ability to create product identification labels in house using either dot matrix, laser or thermal transfer printing systems.

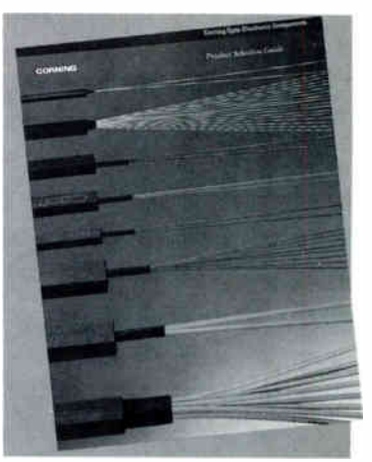
Circle 22 on Reader Response Card

Opto-Electronic Components

Corning's line of opto-electronic components is featured in a new product selection guide. The guide describes Corning's line of fiberoptic component products and is designed to link products to specific applications. Single-mode and multimode passive couplers, wavelength division multiplexers and optical gain modules for fiberoptic amplifiers are highlighted.

The product selection guide highlights applications including: telephony; cable TV; instrumentation and sensors; and military, government and computer interconnects.

Circle 23 on Reader Response Card



Niles Appoints Sterns; Philips Director

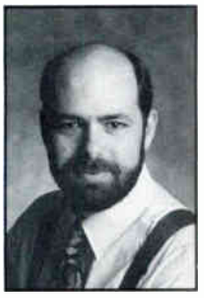
Metzger is Manager

Audio Animation has announced the appointment of Steve Metzger to the position of Assistant Sales Manager.

Metzger joined Audio Animation in 1989 as the company's Purchasing Manager. Prior to that, Metzger spent more than 10 years as General Manager and as Director of the Custom Home Products Division at Knoxville-based Lindsey-Ward.

Sales for Niles

Niles Audio Corporation has appointed Frank K. Sterns as Vice President of Sales. Sterns is leading the sales operation of the company.



Sterns

Prior to joining Niles Audio, Sterns directed marketing and sales efforts for Infinity Systems, Acoustat and the David Hafler Company. Sterns has a B.S. in Marketing from the School of Business Administration at California State University and is a member of the Audio Engineering Society and the Professional Audio Retailers Association.

Philips Director

Philips Consumer Electronics Company has named Jon Kasle director of public relations. Kasle is responsible for product and technology information, corporate communications and community relations for the Philips, Magnavox, Sylvania and Philco brands.

Kasle joins PCEC from the public relations agency Manning, Selvage & Lee/Los Angeles. Prior to MS&L Kasle was public relations manager for the Technics division of Panasonic in Secaucus, New Jersey.

VP at Pioneer Laser

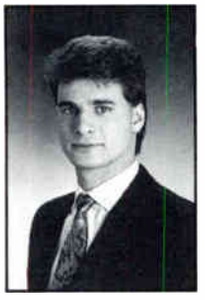
Pioneer Laser Entertainment has announced the hiring of Carlos Carney to fill the position of vice president of administration.

Carney

Carney is responsible for all administrative functions within the company, including finance, computers sales and distribution, order processing, human resources and general administration.

Bossinas at A-T

Darius Bossinas has been promoted to manager of graphic services for Audio-Technica. Bossinas is responsible for the presentation and market support of Audio-Technica's professional and consumer products including design and production of corporate communications.



Bossinas

Accounts Managers

Dale W. LaPorte, Kenneth M. Orbach, Steven Parker and Leonard B. Salley have been named national accounts managers for Videoconferencing Systems Inc. (VSI). In his 20 years in communications LaPorte has served as vice president of Melita International Corp. Orbach joins VSI from AudioFAX, where he served as director of sales for the company's southern region.

Parker has held sales and management positions with Dowty Communications Inc., Gunbdalf Data and BellSouth Corp. Salley has more than 20 years of experience working for companies such as Northern Telecom, Raytheon Data Systems, Telex Computer Products and Walldata Inc.

Motta at Pro-Com

ProCom Systems has announced that Thomas J. Motta has joined the staff as staging/rental manager. Motta comes to Pro-Com Systems from AmPro Corporation where he was the regional sales manager.

Motta is responsible for the marketing and coordination of corporate and industrial meetings, presentations and events.

Allied Names Director

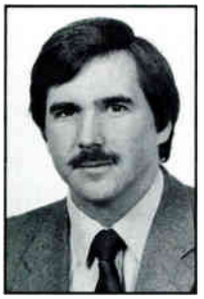
L. John (Jack) Spring has joined Allied Film & Video as Director of Sales & Marketing. Spring is responsible for developing and implementing marketing strategy, sales training, advertising, promotion and conference activity.

Spring

He came to Allied after 24 years with Eastman Kodak where he was most recently the Regional Business Unit Manager — Americas.

CEO of TTC

John R. Peeler has been appointed President and Chief Executive Officer of Telecommunications Techniques Corporation (TTC), and Corporate Vice president of TTC's parent company, Dynatech Corporation. Peeler succeeded Joseph A Sciulli, TTC's founder, who died January 28, 1992.



Peeler

Peeler has been in various positions with TTC since 1980.

Taipale at Wenger

Dale Taipale has joined the Wenger Corporation's Performance Division as Director of Engineering. Taipale is responsible for directing product design and development. In addition, he is involved in materials selection, product testing and the engineering aspects of custom-designed performance equipment.

APT Operations

Mike Smyth has been named U.S. Operations Manager for Audio Processing Technology. Smyth is in charge of opening the APT sales office in Los Angeles.

Smyth was previously involved in the development of APT's low bitrate audio dosing system.

Vermons at Fibertron

Robert Vermons has joined the Fibertron Corporation, a distributor of fiberoptic cable and equipment, as sales representative for Orange and San Diego Counties in California. Vermons is responsible for new market and customer development, in addition to primary duties as sales representative for the line of fiberoptic products.

Barnes Named

Preformed Line Products Company has named Jon Barnes the National Sales Manager of Telecommunications. The area includes stainless steel splice cases, vault closures and overhead strand products.

Barnes

Barnes is responsible for the telecommunications direct sales force, representative organizations and the supervision of the product management function. Barnes has been with PLP since 1977.

Contractor Coordinator

Mary Fitzgerald, account manager for CrossCom National has been named Contractor Network Coordinator responsible for the telecommunication company's North American network of 300 contractors.

Fitzgerald

Fitzgerald's responsibilities include hiring contractors and implementing CrossCom's performance program for contractors.

Manager at HME

HM Electronics, Inc. Communications Systems Division has appointed C. (Cees) J. Weij to the position of European Sales Manager. Based in the Netherlands, Weij's responsibilities include overseeing the management of all distributors, sound and communications contractors, representatives and house accounts throughout a number of European countries.

CALENDAR

Upcoming Events

MAY

International DJ Expo/West: Los Angeles, California. Contact: (516) 767-2500. May 4-7.

Society for Imaging Science/Technology: East Rutherford, New Jersey. May 10-14.

International Communications Association (ICA): Atlanta, Georgia. Contact: (800) ICA-INFO. May 17-21.

JUNE

ShowTech '92: Berlin, Germany. Contact: (030) 3038-0. June 2-4.

Test & Design Expo: Somerset, New Jersey. Contact: (617) 232- 3976. June 2-4.

International Conference on Consumer Electronics (ICCE): Rosemont, Illinois. Contact: (716) 392-3862. June 2-5.

Showbiz Expo: Los Angeles, California. Contact: (213) 668-1811. June 20-22.

Image World: Chicago, Illinois. Contact: (914) 328-9157. June 22-26.

JULY

Satellite Dealers Association: New Orleans, Louisiana. Contact: (317) 653-8262. July 8-11.

CD-I Publishers Conference: New York, New York. Contact: (914) 328-9157. July 22-24.

Night Club and Bar: New Orleans, Louisiana. Contact: (800) 247-3881. July 27-28.

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PROCESSOR

(continued from page 22)

commonplace. Noise cancellation, presently confined to industrial noise control applications may expand into reverberation and ambient noise cancellation in sound reinforcement.

The development of more sophisticated diagnostic, calibration, and processing electronics will take much of the guess work out of sound installation, but will also place increasing demands upon the sound contractor, who will have to acquire new skills and a new vocabulary to manage powerful automated controllers of the near future. The job of the contractor is not apt to be made easier by the new technologies of the nineties, but it is apt to be interesting, and dare we say, professionally rewarding? ■

SPECIFICATIONS

(continued from page 29)

tion of the owner. Deliberate methods to be employed in installation, wiring, testing, training, etc., are all detailed in this section. As this is the labor intensive portion of the project and the one most often responsible for subsequent disputes, it demands thorough attention. All details such as special practices, site availability and scheduling, operating instruction, disposal and demolition, painting, site cleanup, interface with other trades, etc., must be addressed. If it takes time, it costs money, and if responsibility is not spelled out in advance, there may be some sorry surprises in store.

Don't find yourself in the role of the Captain in Lewis Carroll's "Hunting of the Snark"!

> He had bought a large map representing the sea Without the least vestige of land And the crew were much pleased when they found it to be A map they could all understand.

The specification guide is your project map. Prepare it well! ■

YACHT

(continued from page 76)

inputs. The crew was interested because they liked the sound of the system, and because, as professional sailors, they want to know how to run everything on the boat.

Working on the Imperator wasn't all a matter of struggling with old mounting hardware rusted fast in tight spaces, or hurrying to install a speaker on the starboard outside passageway before it started raining again. After all, its a luxury yacht with Old Masters paintings and four-star cuisine. "We were just about finished with the job, when we were invited to go on a dinner cruise around Manhattan," McCook says. (Manhattan is bordered on three sides by rivers and on the fourth by New York Bay.) "We got a chance to see our work from the passenger's point of view, and how it will be part of their experience of this exquisite yacht, one of only a few in the world."

"This installation allowed us to exercise our craft in new ways, to build a shipboard system that would withstand the elements," Williams concludes. On the Imperator, MAS Audio met the challenge of the sea, and found it an adventure. ■

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PA Loudspeakers	ATLAS/SOUNDOLIER ALTEC LANSING*	JBL	BOSE
Microphones	SHURE BROTHERS	ELECTRO-VOICE	AUDIO-TECHNICA
Projectors	SONY	GE	BARCO, SHARP*
Lecterns	VANSAN	SOUND-CRAFT, ANCHOR, DA-LITE*	DRAPER
Screens	DA-LITE	DRAPER	STEWART
VTRs	SONY	PANASONIC	JVC
Videodiscs	PIONEER	SONY	HITACHI
Video Monitors	SONY	PANASONIC	MITSUBISHI
Racks	ATLAS/SOUNDOLIER	H.O.M.E.	STANTRON, DUKANE*
Wre/Cable	WEST PENN WIRE	BELDEN	SIGNAL, SOUTHWEST*

* indicates tie

. . . IN LAST SIX MONTHS

PRODUCTS	FIRST PLACE	SECOND PLACE	THIRD PLACE
PA Amplifiers	TOA	CROWN	BOGEN
PA Loudspeakers	ATLAS/SOUNDOLIER	ALTEC LANSING	JBL
Microphones	SHURE BROTHERS	ELECTRO-VOICE	AUDIO-TECHNICA
Projectors	SONY	GE, BARCO*	SHARP
Lecterns	VANSAN	SOUND-CRAFT, ANCHOR*	DA-LITE
Screens	DA-LITE	DRAPER	STEWART
VTRs	SONY	PANASONIC	JVC
Videodiscs	PIONEER	SONY	HITACHI, YAMAHA*
Video Monitors	SONY	NEC	PANASONIC
Racks	ATLAS/SOUNDOLIER	H.O.M.E.	STANTRON, DUKANE*
Wire/Cable	WEST PENN WIRE	BELDEN	SIGNAL, SOUTHWEST*

* indicates tie

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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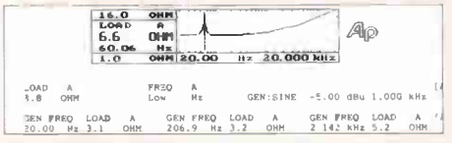

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