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January-February 1991 Vol. 25, No.1

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serving: recording, broadcast and sound contracting fields

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ABOUT THE COVER

• Maryland Sound has an active operation in Southern California. Our contributing editor, Jim Paul, interviews three employees with *entry into live sound engineering* as a focus. Our photo is of Maryland Sound technician Bryan Nemecek as he works in their setup lab. See page 17 for the full fascinating interview.

THE SOUND CONTRACTING ENGINEER

THE RECORDING ENGINEER

THE ELECTRONIC COTTAGE

DEPARTMENTS

CALENDAR

• The **UCLA Extension** is offering three courses during its winter quarter that qualify for credit toward its Certificate Program in Electronic Music.

"The Synchronization of Audio, Video and Film Technology for Musicians" will be discussed from 7-10 p.m., Wednesday evenings, from Feb. 13-March 20. Jeff Rona, composer, author and president of Musical Instrument Digital Interface will conduct the class. Fee is $225.

"Electronic Music II: Introduction to MIDI" will be taught 7-10 p.m., Wednesday evenings, Feb. 20-March 27 by Lachlan Westfall, president of The International MIDI Association. Fee is $175.

For more information on other courses, please call (213) 825-9064.

• The **1991 International Monitor Awards** has issued a Call For Entries. All entries must have been produced or post-produced during the 1990 calendar year. Individuals as well as companies and corporations may submit entries with no limit to the number of entries from any source. Deadline for submissions is Jan. 15.

For more information on categories or entry forms, please call CeCe Lazarescu at (212) 629-3266, or FAX (212) 629-3265. The price of entries, regardless of length, is $105 for ITS Members, $135 for Non-ITS Members.

• **Synergetic Audio Concepts** will present a Loudspeaker Designer's Workshop from Feb. 7-9 at the Ramada Renaissance Hotel in Atlanta, GA. After an abbreviated review of the basics, the workshop will concentrate on the present evolving loudspeaker designs.

Syn-Aud-Con has also announced their 1991 schedule for their 2-day audio engineering seminars. The seminar schedule is: Jan. 31-Feb. 1 in Orlando, FL;

March 12-13 in Anaheim, CA; and

March 20-21 in Seattle, WA.

For more information, please call (812) 995-8212 or FAX (812) 995-2110.

• **The Society of Motion Picture and Television Engineers 25th Annual Television Conference**, which will focus on the evolutionary flow of television technology from the past, through the present, and into the future, will be held Feb. 1-2 at the Westin Hotel in the Renaissance Center in Detroit, MI. The conference theme is "A Television Continuum--1967-2017."

Concurrent with the conference will be the **Audio Engineering Society's 9th International Conference**. SMPTE and AES registrants will be able to attend sessions offered by both groups for one registration fee. The theme of the AES conference is "Television Sound Today and Tomorrow."

A one-day tutorial on Digital Recording for Television will be held Jan. 31 also at the Westin Hotel. Presentations will be made by experts from the research, development, and engineering sectors of manufacturers, and from experienced users of digital recorders. The tutorial will conclude with opportunities for one-on-one interviews with the speakers and screenings of recent productions made with digital recorders.

For more information on any of the conferences, please call (914) 761-1100 or FAX (914) 761-3115.

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LETTERS

The Editor:

Your November/December issue contained an extremely useful and well-written article by Dan Rogers on the subject of Speaker Angles, and I would like to compliment you on its publication. This article, like its predecessor, contains the type of information that is pertinent and timely in today's highly competitive field of acoustical engineering.

We appreciate receiving articles such as this that can provide immediately useful results, for any reader, amateur as well as professional. My staff and I thoroughly enjoyed this series and look forward to actually applying this technology on a current project.

Stan H. King, Executive vice president, Mackensen Corp.

The Editor:

Thank you for a great magazine. I have enjoyed and benefitted from your magazine. I have only been running sound for a few years and have much to learn. The articles are full of valuable information—step-by-step instructions and diagrams allow me to see practical applications for equipment I have yet to experiment with.

The column "Audio for the Church" by Brent Harshbarger is very helpful to me as I desire to increase my business selling sound systems to churches; I want to know as much as I can to sell and install the most practical system.

Ed Learned's article "Higher Ground" in the May/June issue was great! Learning what the big guys use and what they prefer helps me decide what I need. I do not have the opportunity to experiment, so I need to have the gear and the knowledge to use it the first time out.

The experience I have is strengthened, then expanded on, by your contributing editors' articles. My thanks to these people. If you are still not sure of my opinion of your magazine, I think it's great! In closing, I again thank you for a great magazine. Thank you for the time and effort you give to make this magazine both instructive and informative.

Greg Miller
Owner, G.K. Audio

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Department of Correction and Other Things

In the November/December issue on page 61 an important digit got dropped. The New Products listing of the Aphex Dominator II turned a real bargain into a seemingly incredible one! TheDominator II has an Aphex list price of $1,495.00. We left the "1" off. Did Aphex ever get calls!

We left out Packburn Electronics, Inc. from our Buyer's Guide on Noise Reduction Equipment. They make a line of noise supressors and are located at P.O. Box 335, Dewitt, NY 13214. They'll be in next time we do Noise Reduction. *Mea Culpa.*

Other Things

Janus, the Roman god that gave January its name is usually depicted with his two faces looking at the same time ahead to the future and behind to still see the past.

db Magazine has been second to none in presenting the latest technology in a clear manner. However, we also need to look back at our audio past in a new series called "Historical Perspectives" These will be pictures and text, sometimes full articles, sometimes just a picture or text insertion. These historical perspectives are a part of our past, and it is a pleasure to present them. The first of this series is on page 50.

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Live Sound Reinforcement: Asia-Pacific '90

ED LEARNED

MY ASSOCIATION WITH THE USIA (United States Information Agency) in the 80s was a fruitful one for all concerned. As disseminator of American culture to the world, USIA sponsors a wide variety of artistic programs. Foremost among these are overseas tours by musicians representing the many facets of American music. Regular readers of **db Magazine** the past six years may recall my articles about several of these tours: I was involved in sound system design and live sound mixing for 12 different USIA-sponsored concert tours during the last decade. The importance of high-quality sound systems and expert sound mixing to a successful musical performance is appreciated more today than ever before. My combination of professional concert touring techniques and system design, coupled with the experience gleaned from 18 years of mixing different styles of music, conspired to create a new standard of excellence for USIA touring sound quality and reliability. The return on my invested efforts was substantial: I saw the world, worked with some of America's finest musicians, and got paid for it! We exposed our foreign audiences to many memorable performances, and made many new friends. Little wonder that both USIA/Arts America and I were eager to continue our working relationship into 1990. The new decade began with the most ambitious USIA touring package I'd ever undertaken.

Arts America Programmer Beverly Gerstein called me in early February, 1990, with news of two proposed tours of the Asia-Pacific region. The first project, scheduled for late summer/early fall, involved guitarist Charlie Byrd and his trio. Charlie is well-known as both jazz guitarist and exponent of Brazilian music. Jazz fans remember the "Jazz Samba" album, which Charlie cut in 1963 with Stan Getz that led to the 60's bossa-nova craze in the United States. But Charlie is also an excellent classical guitar player, so while you might hear compositions by Ellington, Monk and Jobim at a Charlie Byrd concert, you could also expect to hear him play Vivaldi and Villa-Lobos.

The second tour, scheduled for mid-fall, featured Wayne Toups & Zydecajun, with whom I'd worked nationally and internationally (see **db Magazine**, Volume 22, No. 2, pgs. 25-31; No. 3, pgs. 25-30; No. 4, pgs. 27-32). Wayne is a master of the Cajun diatonic accordion. Zydecajun is a blend of Cajun and Zydeco music with a healthy dose of rock 'n' roll thrown in. The new edition of Zydecajun rocked harder than ever before—even the Cajun waltzes were delivered with fire and a touch of stinging blues.

The two proposed itineraries had some regional symmetry; while each group had exclusive destinations to tour, Thailand, Singapore and the Philippines were due for visits by both. Wayne had requested my services for his tour already, and as it turned out, only 10 days separated the two tours. Gerstein's question to me: would I mix sound for both groups, and could I design a sound system both groups could use? Trans-continental airfare for equipment and personnel was substantial on a tour of this sort; use of the same system and operator for both groups meant one less fare to pay in each direction. What to do during my ten days off in Asia was another consideration: my original idea was a return to Bangkok after the Byrd tour, enjoying a brief rest before Wayne Toups/Zydecajun arrived to commence their tour. After some deliberation, Arts America proposed an incredible side trip: I would fly to the Peoples Republic of China for a week or so, and conduct a series of seminars on modern sound reinforcement systems and mixing techniques. Two great bands and an opportunity to visit China? I accepted the offer immediately.

The disparate nature of the two groups was the first thing I dealt with in designing sound for these two tours. From a mixing perspective, the "threshold of hearing" required by these musical opposites dictated different methods of balancing. SPL considerations figured into equipment planning, too: while the Charlie Byrd Trio used minimal stage monitoring, Wayne Toups/-Zydecajun called for a minimum of five rock-level monitor mixes.

International touring, however, quite often reduces production considerations from "what I want" to "what I can get." If you must have a particular piece of equipment, you'd better bring it with you, remembering the prohibitive cost of getting it over there in the first place! Cost factors make size and weight considerations just as important as brand preference and production desires. I had a weight limitation of 1,000 lbs. for the Charlie Byrd system and 1,250 lbs. for the Toups system. Cargo door clearance for the smallest commercial airliner we'd see limited case size to a maximum of 40 in. in any two dimensions. I knew that, with only a 250 lb. variance, most of the gear I could carry would have to be applicable to both groups.

My last tour of the region, with the Benny Golson All-Stars in 1987 (see **db Magazine**, Volume 22, No. 6, pgs. 36-42; Volume 23, No. 1, pgs. 44-52), proved we could find local PA systems sufficient for a jazz group, but what about Wayne's highly-amplified Cajun/Zydeco rock?

I'd observed a trend towards more high-quality, high-power systems in this area, especially in the major business centers of Singapore, Manila and Bangkok. Even in provincial towns, a decent caliber MI (musical instrument) PA system was usually available. Our logistical constraints limited options; we would have to take our chances with local house PA, which I felt would be adequate in most cases. Wayne and his group accepted the obvious: some nights would require major compromises, and they agreed to deal with whatever it took to make the house sound happen.

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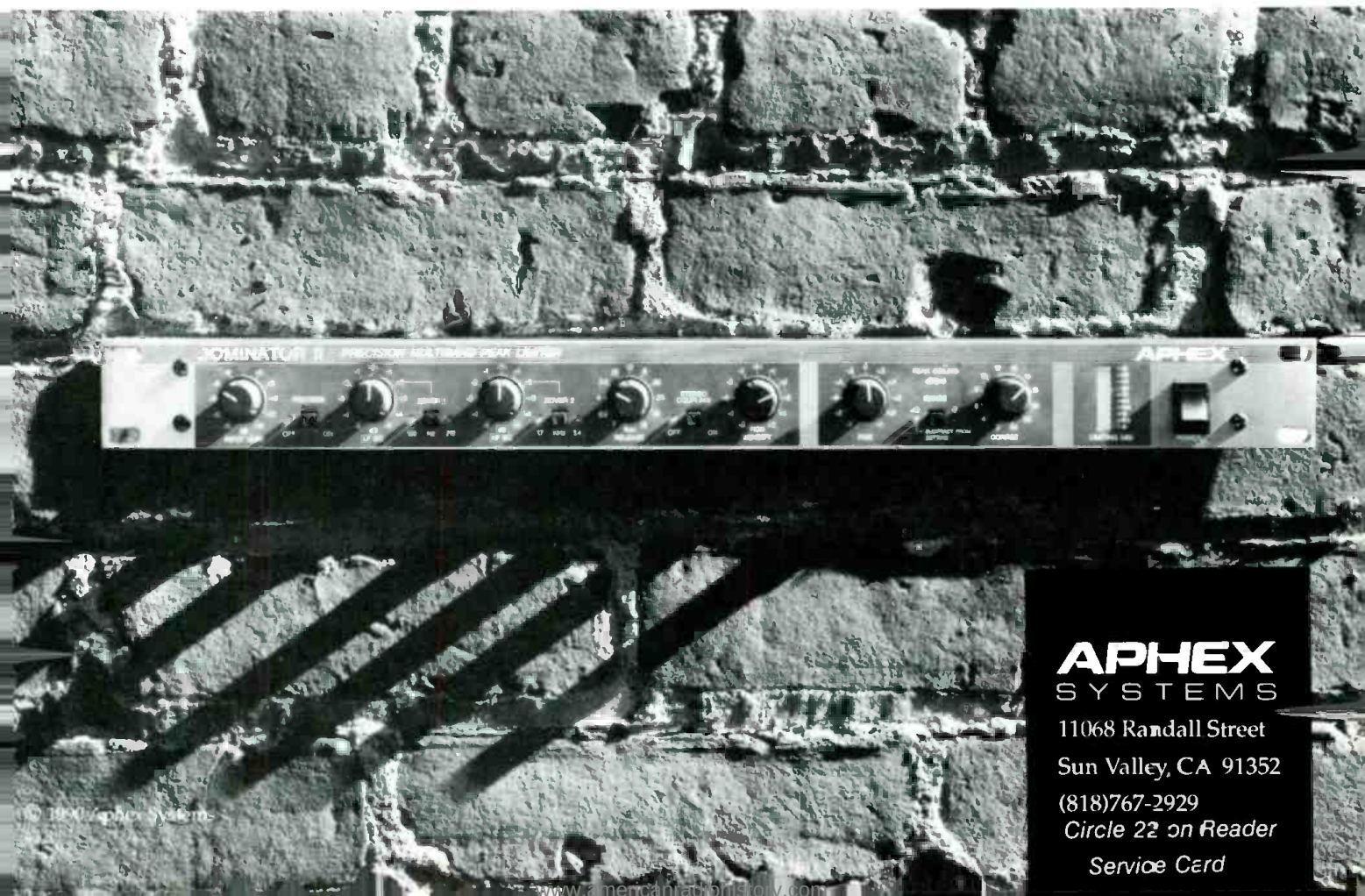

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My sound system rider made artistic distinctions between groups very clear, especially with respect to the different SPL power levels required. I did not want a huge rock PA system for Charlie Byrd, nor a small, high-fidelity, tripod-mounted PA system for Toups. I also specified preferred brands of equipment: believe it or not, PA systems by Electro-Voice, JBL, Meyer, Turbosound and Apogee Sound were available in some of the areas we visited. I elected to carry a small 16 x 4 x 2 house console and my own effects/system drive rack to lend some consistency in operation to our PA-du-jour situation. Audio for both groups could fit into 16 channels; my rack contained devices useful to both groups, although I could (and did) re-configure it slightly for each specific tour (see *Figure 1*).

SOUND FOR THE MUSICIANS

Musicians must have a comfortable, dependable stage environment if consistent, high-quality performances are desired; I usually request that we bring all our stage gear with us for that reason. Most musicians prefer to use their own drums, instruments and amplifiers, although there are exceptions (see Chuck Redd). An on-stage monitor system was a necessity for Toups, superfluous for Byrd. After some haggling, I got Toups to accept only four monitor mixes. Even so, it was by far the most complex monitor setup ever used during my USIA-sponsored tours. Wayne provided a 16 x 6 monitor console as part of his 1,250 lbs. of band gear; I covered the rest of the monitor system, including graphic EQs, power amplifiers, monitor speakers and all system cabling including monitor splitters.

The monitor cabinets I chose would have to meet the needs of both groups, yet not break the bank on weight. I'd used E-V's S-200 speaker cabinets at several jazz gigs in the United States, as house PA speakers on several USIA tours, and as floor monitors (using the screw-on tilters) at a local club with much success. I was most impressed by their power handling and smooth frequency response. They sounded "warm" enough to please discriminating acoustic musicians; the compact size and plastic cabinet matched my weight and space parameters.

Wayne and his group look for extremely loud monitors, with heavy kick and snare in most mixes along with vocals; their standard concert rider specifies wedges with at least a single 15 in. woofer and 1 in. horn/driver bi-amped. I wasn't sure if the S-200, with only a 12 in. and a tweeter, passively crossed, could handle this type of situation. I planned to power the S-200s with the new Carver PM-1250 amps; aside from the obvious weight advantage, I had the capability of putting 325 watts/channel to each S-200. I figured this type of power should at least get us close; understanding our limitations, the group agreed to deal with it.

AC power in the region varies between 220-240 volts, 50 cycles. Neutrals are very often "dirty," and most of the time equipment grounds are non-existent. I planned on carrying my trusty multi-tap Variac transformer to convert local voltage into US standard 120; its capacity of 30 amps would be more than enough for both groups. Voltage in many areas of Asia, however, is far from stable. My first few international tours were great tests for revealing which brands of equipment could tolerate voltage swings, and just what their "safe" range was. I've carried a VIZ power line monitor with me on every tour; This peak-reading AC line meter let me monitor the AC voltage, in real time, during setup and performance. By watching the behavior of the voltage over time and asking questions of local technicians, I could often get a realistic handle on the quirks of the local power system. I had total confidence that, with proper vigilance, my touring sound package could withstand these topical fluctuations. However, Wayne Toups/Zydecajun had some stage equipment, including digital keyboards, that we weren't so sure about.

AC PROBLEMS

Mark Miller, Zydecajun's bassist/manager, expressed some concern about past AC problems he'd encountered in the United States, and things would undoubtedly get even more dicey overseas. These days, there are several companies that sell rack-mountable AC outlet strips with surge protection, RFI filtering, and, in the more expensive units, AC voltage regulation. I suggested the group invest in one of these units, and Miller quickly concurred.

TWO GROUPS, DIFFERENT SOUND SYSTEMS

Charlie Byrd's music called for basic reinforcement, with minimal mic'ing, while Toups and company, looking for the "big" sound, needed at least eleven mics and four DIs. The different sonic demands of acoustic jazz and amplified rock required the use of flexible, all-purpose mics; I decided to use E-V ND 457 and 457A mics as the basis of my mic

Figure 1. The author's console and electronics package configured for Charlie Byrd.

MIDI Spoken Here

and here...

and here...

here, too.

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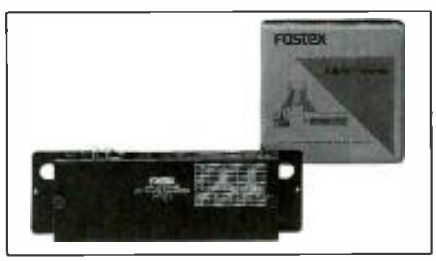

* The 280/MTC-1 interface does not offer all of the functions available with the open reel interface. • Atari and Macintosh are registered trademarks.

The Macintosh software works with Performer and Master Tracks Pro. The Atari software works with Master Tracks Pro and Dr. T's KCS.

Steinberg's Cuebase sequencer has a device driver for the MTC-1 and 8330 built-in, so you don't need MidiRemote software with it.

As with all computer interfacing certain restrictions apply. So check the details at your local Fostex Dealer or call Fostex.

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complement. These are great vocal mics, with excellent gain-before-feedback. I'd also used them as tom-tom, high-hat and overhead mics on drums; reed and brass mics; and for acoustic stringed instruments like piano, violin, mandolin and guitar. The 457 line features the tightest pickup pattern of any E-V ND mic, an advantage for loud stage environments. It's also the most sensitive hypercardioid dynamic mic on the market, with an excellent "reach" for distant sound sources, a quality I felt I'd need for Charlie Byrd. I included an E-V RE-20 and several Shure SM-58 and SM-57 mics for specific needs like kick drum, snare and the mic'ing of instrument amplifiers.

THE CHARLIE BYRD TRIO

Mixing a jazz trio isn't difficult—all you have to do is listen. This maxim sounds simple, but it seems to be incomprehensible to 99 percent of my peers. The simple fact is the music will dictate not only the balance, but the volume required for reinforcement. I've lost count of jazz concerts ruined by soundpeople with rock/pop sensibilities: when you just sit and listen to a trio, are kick and snare the most important instruments? And what about overall level—in an era of amplified music, how loud is loud enough? Assume the obvious: music performed softly and introspectively should be presented in the same manner. Dynamics are extremely important to a trio; the group, not the soundperson, should dictate when things are loud and when they are not. The very nature of Charlie's chosen instrument, and how the group dealt with their overall sound, made the concept of presentation very clear (see *Figure 2).*

Charlie Byrd played a Takamine Electro Classic acoustic guitar, using Savarez nylon strings. He played classical style: he stabilized the guitar against his right knee and chest, elevating it on a raised left knee via a foot stand. Charlie's guitar incorporated a built-in pickup with its own preamp, which required an internal 9-volt battery. He carried a Walter Woods 2-channel amplifier for guitar amplification, using one of my S-200 cabinets as his guitar speaker. We placed this behind him, aiming it slightly across the stage to direct some of the sound at the other musicians (see *Figure 3*). The guitar sounded fantastic; Charlie was very happy with the S-200 cabinet as guitar monitor. Surprisingly, his pickup/preamp system was fairly close to the "real thing" so, with Charlie's blessing, I took a DI straight off the guitar for house amplification. To prevent noise, I had to keep the guitar channel muted until after he plugged in; at the end of each performance, muting it again a split second before he unplugged it. Charlie exaggerated his moves with the guitar cord to insure I'd see them; with this kind of co-operation, we never had a single missed cue or loud "pop."

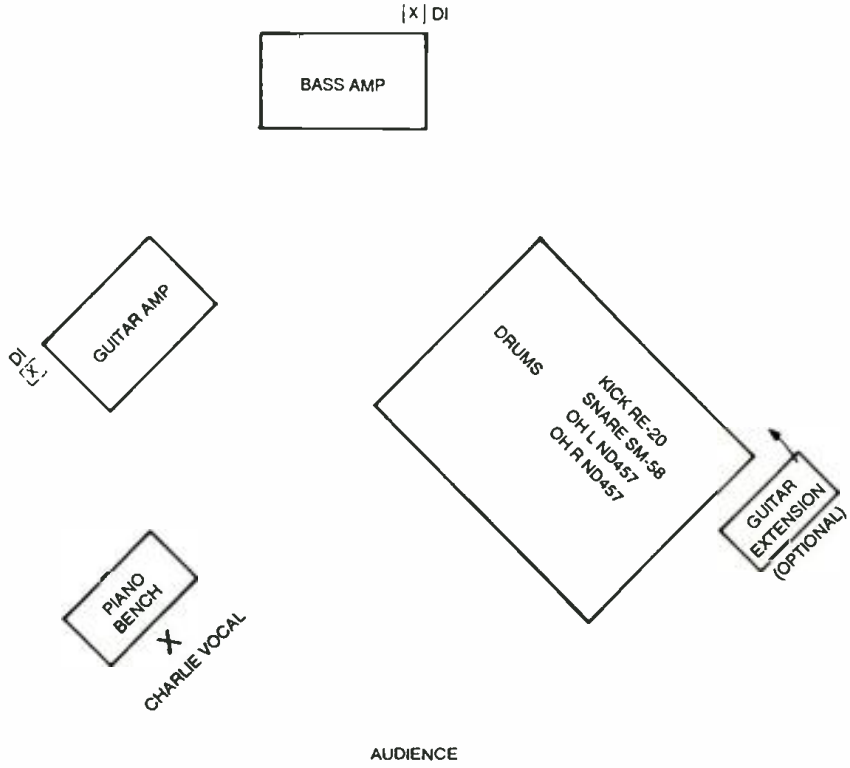

Figure 2. The stage layout for Charlie Byrd.

I used a 457A, with a windblast filter, on a boom stand as Charlie's vocal mic for announcements and occasional singing. At some point during each performance, Charlie would dismiss the group and play several classical guitar pieces solo. I encouraged him to use the vocal mic

Figure 3. Charlie and Joe Byrd.

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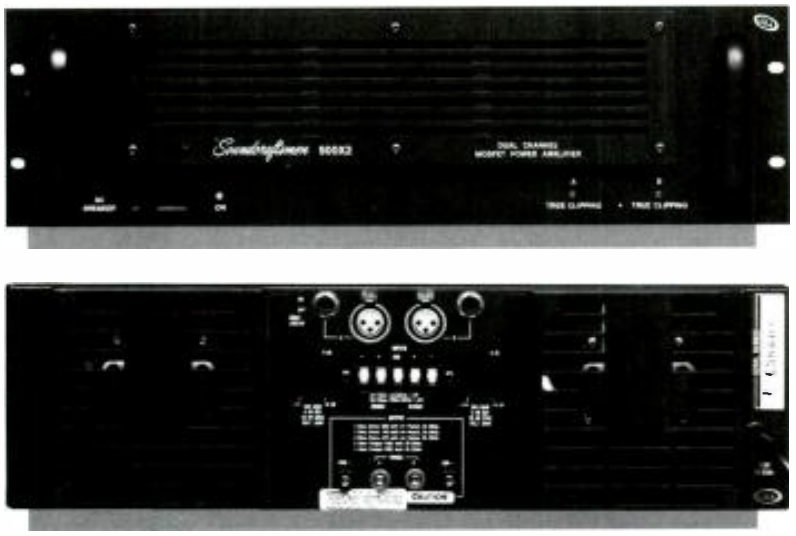

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SPECIFICATION	MFR'S CLAIM	db MEASURED
Power Output/ch.at 1 kHz		
4 ohms	675 watts	700 watts
8 ohms	375 watts	400 watts
2 ohms	900 watts	Not Measured
8 ohms mono (bridged)	1350 watts	Confirmed
Rated THD	0.05%	0.03% (see text)
Frequency Response	20 Hz to 20 kHz +/-0.1 dB	(See text)
S/N (re: 1 Watt)	N/A	-78 dB
S/N (re: rated output)	-105 dB	-106 dB
Slew Rate	50 V/usec	Confirmed
Input Sensitivity,Rated Output	1.22 V	1.20 V
Weight	59 lbs.	Confirmed
Dimensions (WxHxD, inches)	19x5.25x16.5	

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as a guitar mic during these segments, so we had the option of a contrasting guitar sound for contrasting musical styles. This involved a quick change in channel EQ and level from vocal to guitar; we also killed the guitar amp. I had the option of also using the DI; unless I needed extra gain to compensate for a weak system, I never did. The mic, with a touch of reverb, sounded gorgeous. Charlie's beautiful tone and sensitive playing during these solos never failed to enrapture the audience; volume was so tasteful you could hear the audience sigh.

Bassist Joe Byrd played an Ovation hollow body electric bass with a fretless, short-scale neck; he used D'Addario ½-round strings. Joe eschewed the hassles of traveling with an amp by requesting that one be provided for him at each concert. A Polytone Mini Brute was his preferred choice, but I didn't expect we'd find one too often in Asia. Our audio rider requested an amp with 50-75 watts power, preferably with a built-in speaker instead of a separate component system. Joe preferred a smaller speaker, like a 10 in. or 12 in., for a more concise sound. A 15 in. woofer was the largest he'd accept; 18 in. woofers were deemed unacceptable. When he did use a 15 in. speaker, he wanted all frequencies below 100 hz attenuated at least 4 dB, using amplifier tone controls. I quickly discovered that Joe played softly, with respect to both amp volume and touch on the strings. An instrument-level DI wouldn't give me the kind of gain I needed, so I used a preamp-output DI off our bass amp.

Drummer Chuck Redd decided to carry only certain "personal" parts of his drum kit. These were a 1960s era Slingerland 14 in. × 5 ½ in. chrome snare drum and stand; drum stool; Drum Workshop bass drum pedal (chain and sprocket type); high hat stand; and cymbals, including Zildjian New Beat high hats, an 18 in. K. Zildjian medium ride with rivets, a 20 in. new K. Zildjian medium ride, and an 18 in. Istanbul thin crash. The bass drum, tom-toms and cymbal stands for each concert were procured locally. Our audio rider made very general references to overall kit makeup; the only specific request on individual drum size was the bass drum be no larger than 22 in. in diameter. Redd wasn't looking for a massive kick sound; in fact, he was most concerned about keeping the level of the drums more in line with the volume of Charlie's slightly amplified guitar.

Redd used brushes about 60 percent of the time, and when he played with sticks he would only open up for flourishes at the end of songs or during his drum solos. There were several concerts where I didn't even mic the drums, due to the small size of a venue or its lively acoustic properties. When the kit was mic'd, I kept it simple. An E-V RE-20 was used on the bass drum, positioned just even with the front head (if there was a hole cut in it), or a few inches off the front head (if there was no hole). I always placed the mic off-center to insure better pickup of the drum's even harmonics. A Shure SM-58 handled the snare; I positioned it slightly parallel to the rim of the snare so I could get some of the high-hat sound as well. Two E-V ND-457 mics were positioned as overheads; if venue acoustics were unusually absorptive, I would cheat one of these slightly forward over the rack toms, the other slightly over the floor tom.

STAGE MONITORS

Ask a group to play without monitor speakers these days? Musicians and production people will question your sanity. In the rush to embrace technology, many of us forgot that simplicity can be functional *and* beautiful. Charlie's trio used no monitors, electing to do it the "old-fashioned" way for reasons that made a lot of sense to me: since stage volume was so quiet, it wasn't a question of competing levels, but one of group dynamics. The guys set up physically close to each other on stage so they could hear each other. We spent part of each sound check adjusting the level of bass and drums to compliment guitar level. Since Redd played mostly with brushes, drum level on stage was usually comfortable; however, in some horribly reverberant halls, Redd was advised to "lay back" on how hard he played the drums. It was a distinct pleasure to work with musicians who were actually willing to adapt their stage volume to venue conditions, in the interest of good sound, without copping an attitude.

At large venues or halls with dead acoustics, we sometimes positioned another S-200 next to Redd; this was powered by Charlie's amp as a guitar extension speaker. With Charlie on the opposite side of the stage, Redd couldn't hear the guitar properly at our normal volume. The extension speaker solved this problem without the need for added level off the guitar amp, something which would have made Charlie uncomfortable.

WAYNE TOUPS & ZYDECAJUN

Wayne and I became friends during our first USIA tour together in 1987; I'd stayed in touch with him during the past three years, mixing several of his appearances at the New Orleans Jazz and Heritage festival and other spot dates. Zydecajun progressed from a local Louisiana attraction to a national touring club act with a major label (Polygram) recording contract during this time. The "Blast From The Bayou" album attracted even more attention, leading to a spot as opening act on the Carol King "City Streets" tour and the inclusion of a song on the "Steel Magnolias" movie soundtrack. The group's latest Polygram recording, "Fish Out Of Water," is scheduled for release in early 1991.

Wayne's music was heavily amplified; it had the urgency and power to compete for the attention of pop music fans. The group was most concerned about preserving this power: from their perspective, Zydecajun was a rock band with Cajuns in it, and it had to be mixed as such. Wayne was particularly interested in a heavy drum sound, and the music included many unison lines between accordion, guitar and keys that demanded careful voicing. The group's approach required the extensive use of reverb and delay effects; outboard limiting of the vocals, accordions, bass and keyboards was desirable. The electronics package for Toups would have to be substantially beefed up to meet these needs.

THE ACCORDION

How many rock/pop bands are fronted by full-time accordion players? This band had a great one: Wayne is considered by most Cajun musicologists to be the finest player of his generation. Wayne learned to play the diatonic accordion at traditional Cajun dances, studying with his father and other traditional Cajun musicians playing acoustic music. His development of Zyde-

cajun, while based on this traditional Cajun music, resulted in the creation of an amplified Cajun fusion music, more accessible to a younger generation raised on rock 'n' roll. The inclusion of Zydeco and rock/pop elements into this music, however, placed new demands on the musician and the accordion. The notes available on a diatonic accordion are limited, so the instrument can only be played in certain keys. Modulation of key within a song, a typical rock/pop device, required the use of several accordions during a single song.

Wayne inspired the creation of specialized diatonic accordions, designed and built by Randy Falcon, a noted accordion manufacturer from Louisiana, to help alleviate this problem. These instruments could be played in two different keys, by changing a set of stops on the top of the accordion. Wayne no longer needed to switch in mid-song; he used C/D and E/F Falcon accordions on our tour. Both accordions incorporated a mounted Shure SM-98 mic coupled with a Samson Broadcast Concert Series wireless transmitter. Both transmitters used the same frequency. Since only one was turned on at a time, a single DI off the receiver handled both accordions. The wireless gave Wayne the freedom to perform the way he'd always wanted; the dynamic Toups cut quite a figure dancing, spinning, and running all over the stage and, quite often, into the audience! I used an E-V ND-457A for his vocal, without a blast filter, positioned downstage center (see *Figure 4).* There were a few occasions, where we used a different monitor system or had to cut back on ours, when I used an SM-58 as his vocal mic.

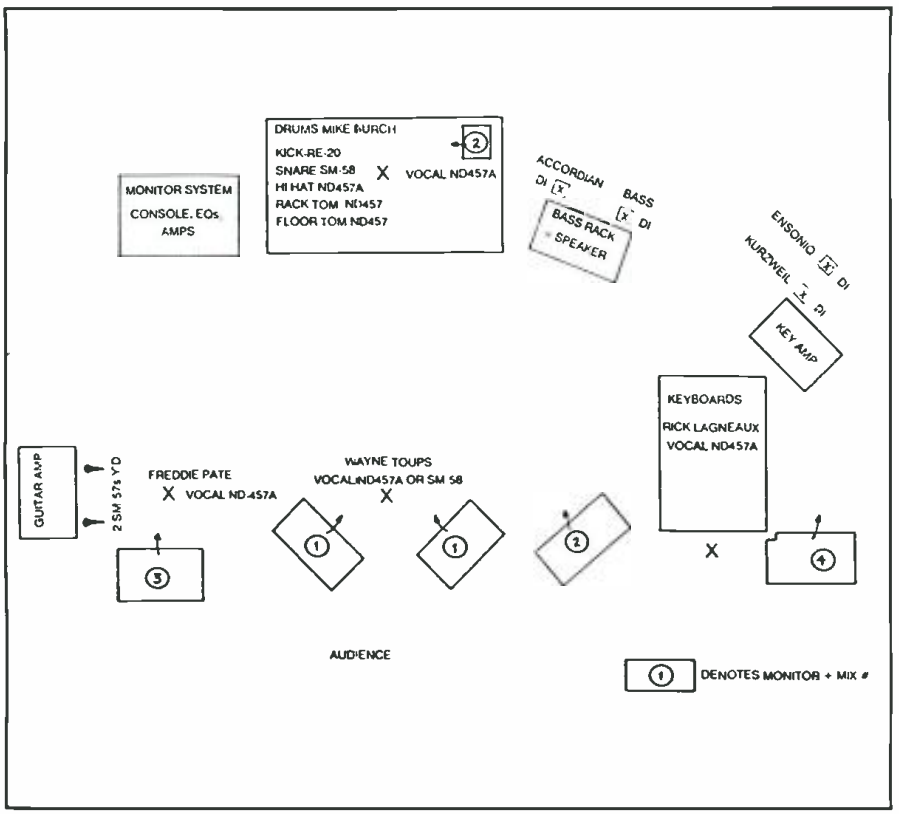


Figure 4. Stage layout for Wayne Toups.

THE GUITAR

Guitarist Freddie Pate played a Robin Rival Series guitar, using Dean Markley medium-gauge strings; this was run through another Samson Concert Series wireless rig. For effects, he used a DOD FX90 delay, DOD compressor, Pro-Co Rat and D'Armand volume pedal. Freddie's amp, a Peavey 400 stereo guitar amp, was placed downstage right, elevated to ear level on a case lid, firing across the stage. We found this enabled everyone to hear the guitar off the amp; we didn't need much in the monitors. It also helped isolate the guitar sound onstage: since the amp didn't bleed into the house, I didn't have a problem with stage guitar levels interfering with the mix. Pate was also able to hear what he needed without the need for excessive volume. This really helped in reverberant halls. Another E-V ND-457A was used for Pate's backing vocals, this time with a blast filter. The guitar amp was mic'd with a pair of Shure SM-57 mics Y'd together into a single channel. I placed these mics right up against the grille cloth of the amp, pointing just off-center of the dome of each speaker.

Rick Lagneaux, the band's keyboardist, was also a significant contributor in another area: he wrote or co-wrote many of the group's original compositions. Lagneaux used Kurzweil K-1000 and Ensoniq VFX keyboards; these were amplified via a Peavey KB-300 amplifier.

His keyboard position was downstage left; we placed his amp behind him on a case lid, angling it slightly to cover the center stage area. We took the same approach here as with Pate's rig, and achieved the same positive results. The VFX was used exclusively for organ sounds, while the Kurzweil handled piano and string sounds.

AC CONCERNS

AC power for the keys was an area of some concern: a Furman AR-117S voltage regulator was used on the keyboard in an attempt to minimize the effects of voltage fluctuations on the temperamental keyboards. For house amplification, I used an individual DI off each keyboard output, so I'd have some flexibility in dealing with the differing levels and tones of each instrument. I incorporated a dbx 166 2-channel limiter/gate, inserted on the keyboard inputs of my house console, so I could better control Lagneaux' keyboard levels, which changed radically from song to song. He also handled the major share of backing vocals in the group. I used an ND-457A with windblast filter here as well, mounting the mic on a boom stand mounted as an attachment to Lagneaux' keyboard stand.

Miller played a Peavey Dyna Bass, using GHS Boomer medium-light strings. He also used a Samson wireless on his bass; the receiver was mounted in the bass rack, which also

housed his Peavey Alpha bass amp, Wayne's accordion receiver and the Furman voltage regulator. The Alpha Bass powered a Peavey 1516 speaker enclosure, which contained a 15 in. and two 8 in. woofers, passively crossed. This speaker was placed on top of the rack, elevating it slightly so Miller could hear it better. A built-in xlr line output off the Alpha Bass had fed the house mix.

Drummer Mike Burch played a basic Pearl set, with assorted hardware from several different manufacturers: a 22 in. × 16 in. bass drum with Camco chain pedal; 14 in. × 3 ½ in. brass piccolo snare with Tama snare stand; 12 in. × 10 in. mounted tom; and 16 in. x 16 in. floor tom. He carried a standard high hat stand, using Paiste Colorsound 5 high-hats, and also used a second set of 14 in. Zildjian Quickbeat high-hats, mounted on the bass drum via a closed hat attachment.

The cymbal compliment was an 8 in. Zildjian EFX splash cymbal, 18 in. Zildjian medium crash cymbal, 16 in. Zildjian medium crash cymbal and 20 in. Paiste 3000 ride cymbal.

For the kick, we used an E-V RE-20, positioned just inside the front head hole, off center. The snare was tight mic'd off the upper rim with a Shure SM-58. The high-hat got an E-V ND-457A; the rack and floor one ND-457 each. These were placed just over the rim of each respective tom and angled downwards at a sharp angle in an attempt to reduce bleed from the snare (see *Figure 5*).

Burch's vocal mic was another ND-457A, with a blast filter. We used a special mic cable for this that had a rotary on/off switch at the male end. Burch could turn his vocal mic on and off as needed; I never had to worry about missing a cue, and drum bleed through an open vocal mic was greatly reduced.

The group included a Peavey MD Monitor console, 16 × 6, as part of their band gear; this was the heart of our on-stage monitor system. I provided 16 channels of monitor Y-s; these provided a parallel split of our stage channels to both the monitor desk and the stage box via a Switchcraft in-line connector and a 4 ft. male XLR extension. I used two Yamaha 2031 stereo graphic equalizers to provide four channels of EQ;

Figure 5. Drummer Mike Burch. Note the placement of mics on the tom-tom.

two of these were then run into an S-200 stereo active EQ box. This box provided electronic compensation for the S-200 cabinets, resulting in extended bass response and a slight increase in gain. I elected to assign these two mixes to Wayne, Burch and Miller, as those were the mixes which required the most "weighty" kick drum.

Two Carver PM-1250 stereo amplifiers provided four channels/mixes of monitor power (see *Figure 6*). I used six E-V S-200 cabinets for our monitor system: two for Wayne, two for Miller and Burch, and one each for Pate and Lagneaux; the Carvers could put 650 watts through the two cabinet mixes, 325 through the singles. The high power output carried the day; after our first sound check, everyone raved about "the level we can get out of those tiny plastic boxes!" Despite the varied requirements of each musician, the S-200 cabinets proved capable of satisfying everyone's needs; I could breathe a little easier.

In the next issue, after a discussion of mixing techniques for the two groups, we'll cover both tours on a country by country basis. We'll visit Thailand, Singapore and the Philippines with both groups; Indonesia, Malaysia, South Korea, Sri Lanka, New Zealand and Fiji individually. db

Figure 6. Wayne Toup, bassist Mark Miller, and drummer Mike Burch. The monitor system is at the back left.

JIM PAUL

Breaking into Concert Sound: Getting in the Door at Maryland Sound

Every industry has its movers and shakers, pillars of industry which shape and change the course of events. In computers it's the seemingly omnipresent IBM and the ubiquitous Apple Computer Corp. Professional sports has the Los Angeles Lakers basketball dynasty of the 80s, and the San Francisco 49ers, going for four Super Bowls in a row.

THE CONCERT SOUND FIELD IS NO EXception to this rule, with power companies like Clair Brothers and ShowCo, their huge mega-systems covering the largest touring entourages in the world.

It is also true, however, that there are smaller companies in each of these industries which come along and make a big splash with an amazing product or service. The home computer market, for example, was nearly cornered by the lowly Commodore 64 during the 80s. The Houston Rockets shocked the Lakers with elimination in the 1986 NBA playoffs. And in sound reinforcement, there is Maryland Sound Inc., a bright, efficient and well-managed sound company with a reputation for 100 percent customer satisfaction, a long client list of major superstars, and a bit of an image as an upstart underdog.

In this third and final installment of our series on breaking into live sound, we will spend the afternoon at the West Coast operation of Maryland Sound, learning about the company's history and getting the inside story from Michael Stahl, general manager of Maryland Sound West Coast. We will then visit with two of MSI's employees, Stephen Zelenka, concert production manager, and Carla Hixson, a relative newcomer who is moving up fast, and one of the few women active in concert sound.

THE COMPANY

Maryland Sound was founded in 1970 by Robert Goldstein, a former employee of Clair Brothers. Goldstein, a man who believes that customer service must be the number one priority of a sound reinforcement company, founded his company on the precept of quality. He committed his company to three important concepts. The first was to never compromise the sound of a concert system. This meant a great deal of research and extra labor to insure that only the highest quality components and engineering were used in his systems. The second concept was that each and every employee, from the secretary to the front-of-house mixer, is important to the company and is in essence an ambassador to the world for Maryland Sound. The third concept was to have the right people in place, with the skills and experience to do each job right the first time.

These three concepts still permeate each and every job for which Maryland Sound is contracted, whether it be a permanent installation such as the Universal Amphitheatre, or a large touring system like Pink Floyd or Neil Diamond might require. The outstanding quality of Maryland Sound systems is well-documented and the loyalty and satisfaction of their employees is obvious from all the smiling faces one encounters upon entering the unassuming red brick building in North Hollywood, far from its more humble beginnings.

The mid to late 70s was a busy time for the young company with tour dates and reinforcement jobs. Acquiring his first major account, Frankie Vali and the Four Seasons, during this period, Goldstein concentrated on client retention, building his inventory of equipment and strengthening his position in the industry. He made many contacts and enriched existing relationships with other sound mixers.

The 1980s was a period of rapid growth for Maryland Sound and saw the acquisition of several medium-sized sound companies complete with equipment and clientele. The biggest turning point of this period came when Maryland Sound acquired Northwest Audio, out of Portland, OR. This provided the company with headline acts such as the Eagles, Neil Young, and Crosby, Stills and Nash.

Around 1983, Goldstein began to do permanent installations on the East Coast under the leadership of Will Perry, another Maryland Sound engineer. These smaller installations were the forerunners of the large installations at venues like the Greek Theatre in Los Angeles and Universal Studios in Florida. Today, Maryland Sound is at the forefront of the permanent installation field, with major contracts in theme parks and clientele worldwide.

In late 1988, Maryland Sound made two extremely important acquisitions. The first purchase was the assets of the bankrupt Stanal Sound, whose client list included Neil Diamond. Industry interest in Stanal was high, and included such sound companies as ElectroTech and Clair Brothers, but Maryland Sound prevailed. This acquisition was a big boost to its West Coast operation. The second acquisition was the purchase of Audio Techniques, which was providing sound for the group Chicago. Audio Techniques had developed an excellent propri-

Figure 1. Maryland Sound technician Bryan Nemecek performing a console modification.

etary sound system and this equipment and technology became the sole property of Maryland Sound, which continues to expand on it.

A quick tour of the facility revealed stacks of high-tech sound equipment of every variety: Digital reverbs from $300 units to top-of-the-line $5,000 units; hundreds of speaker cabinets stacked to the ceiling; thousands of watts of power; every conceivable microphone; and a very well-equipped lab, where all incoming equipment is thoroughly checked out. Even major modifications to the consoles can be and often are performed here in this high-tech wonderland.

In 1990, Maryland Sound continues to be a major force in the sound reinforcement industry. Reviews of the sound quality of Maryland Sound systems have been extremely positive and several concert reviewers stated it was the "best they have heard." This stands as a testament to the commitment to quality that drives this company.

THE WEST COAST MANAGER

Stahl began his career at about the same time Maryland Sound was getting started. After graduating with a degree in Political Science, Stahl started his own 8 track recording studio and a small sound reinforcement company. His system consisted of 16 Perkins boxes and a variety of 16 horns per side, with a 16 channel Tascam console. He did some work at this time for Stan Miller of Stanal Sound and for Clair Brothers. When the fuel crisis of 1972 hit, Stahl was unable to get the fuel for his trucks and was practically put out of business. He decided to look into working for someone else and was immediately hired by Clair Brothers, who

also purchased much of his equipment.

Stahl remained at Clair for the next 12 years, rising rapidly through the ranks, to mix shows like the Beach Boys, Chicago, Queen, KISS and finally ending his career at Clair in 1984 on a triumphant note with the ten-month-long Jackson's Victory Tour. After many years on the road, and in particular the extremely arduous Victory tour, he was somewhat disenchanted with the life of a touring engineer and his position at Clair Brothers. Stahl felt it was time for a change, so he said his goodbyes to Clair Brothers and the rigors of the road. After a brief stint with Mountain Productions who staged the Victory Tour, Stahl moved to Los Angeles to seek employment as a "non-touring" sound engineer.

To Stahl's surprise and chagrin, the only job offers forthcoming were to go back out on the road. This was contrary to the purpose of his coming to Los Angeles, so he turned down all offers. A point of irony in his story is that he unsuccessfully applied at both Stanal Sound and Audio Techniques, both of which were acquired by Maryland Sound and whose assets Stahl now controls.

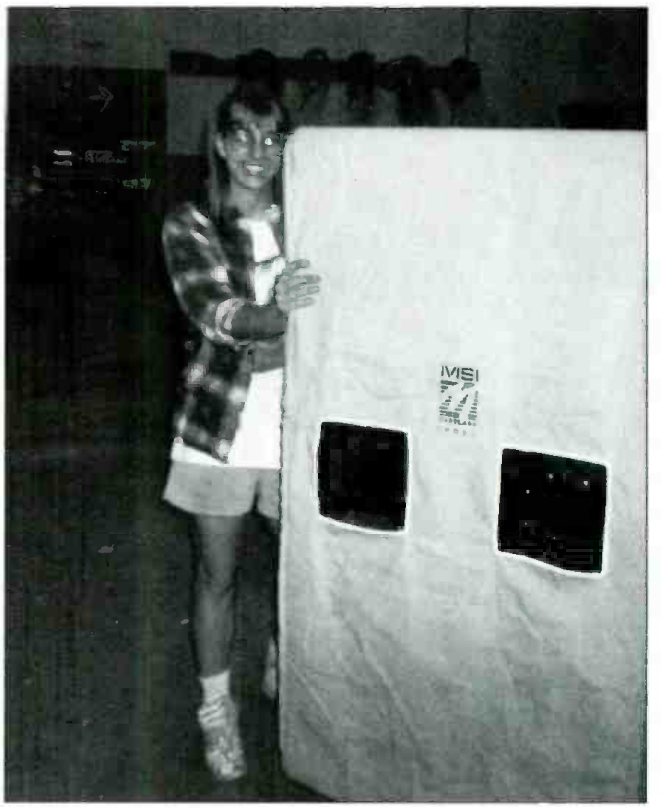


Figure 2. Carla Hixson demonstrates that she can keep up with the best of them.

Finally, out of necessity, he began to look for employment elsewhere. This led him to a three year stint in the construction field where his skill as a crew manager served him well, but the audio engineering story

Figure 3. Michael Stahl makes a point to the author about getting into the concert sound field.

being written here, might have ended there.

When an old friend, Leo Bonamy, former production manager for Chicago, became production manager at the Universal Amphitheatre, he called on Stahl to do some work for the Universal Studios Tour. Stahl soon found himself working part-time as stage manager at Universal Studio's Screen Test Theatre, as well as doing occasional shows at the Amphitheatre.

It was this work and Stahl's continuing contact with Bonamy that opened the door to Maryland Sound. Bonamy told Stahl that Goldstein was looking for a West Coast manager and recommended that Stahl apply. It took some time for Stahl to decide if this was something he wanted to pursue, and he let several months go by. While Stahl was in Boston during a family illness, Bonamy called to urge him to call Goldstein, and he did. Goldstein suggested they meet and talk about the West Coast position—which they did. He was favorably impressed and persuaded Stahl to take the position as the new West Coast manager of Maryland Sound.

A most interesting and ironic point of Stahl's rise to the top is that years before, as a mixer on the road, he met Goldstein at a show where both were mixing for different acts, and now years later, Goldstein was in the position to offer Stahl an incredible career opportunity. This underlines the concept that one should never burn bridges, because one never knows where a person or band will end up. Remember that bands like U2 and The Beatles were once opening bands for someone else.

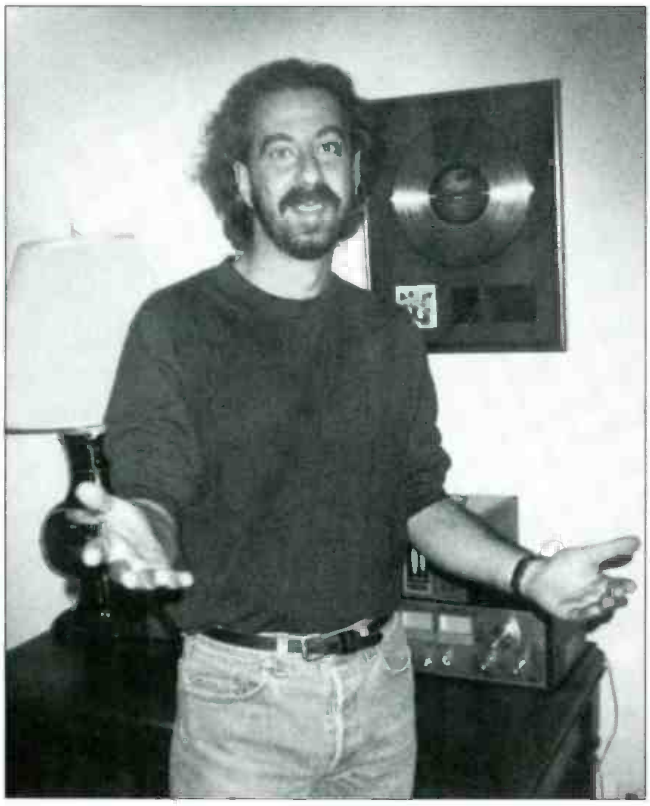


Figure 4. Stephen Zelenko stressing the importance of bringing enthusiasm to the job.

THE STAFF

The saying goes that a chain is only as strong as its weakest link. So, too, a company is known by the employees it has. This is one area where Maryland Sound really shines. The company seems to have a deep commitment to fairness towards each employee and a real respect not only for their skills and abilities, but respect also for who they are as people. During the course of the afternoon, we were able to speak with several Maryland Sound employees about their history and feelings about the company.

CARLA: A FRESH FACE IN PRO SOUND

Carla Hixson is a new face on the pro sound scene. Only 23, she is very excited to be involved with Maryland Sound. Hixson started her career in her home town by running sound for small local bands in Illinois, and began to develop an interest in sound and electronics. This led her to attend a technical trade school in Arizona to study electronics. Upon graduation, she put together a resume of her education and experience and sent it to several large sound reinforcement companies.

"Maryland Sound responded within a week," Hixson said. "Michael Stahl called me in Arizona and asked me to FAX a copy of my re-

sume out to Los Angeles." Because of time constraints, however, the position she applied for was filled by someone else, but Stahl encouraged her to stay in touch.

"I made a follow-up phone call about a week or two later and Mike said that they were looking for someone to work out here in the lab. He wanted to fly me out that day!" she said. Maryland Sound eventually did fly Hixson out to Los Angeles for a week-long trial run which gave her the opportunity to be evaluated 'under fire', and to meet the other Maryland Sound staffers. "About a week after I got back, and after they interviewed several other people, they called me back and offered me the job. I accepted," she said smiling.

Hixson worked for a year in the lab fixing, tweaking and learning the equipment from the inside out, but had her sights set on eventually doing mixing for shows. "I figured that knowing how to fix equipment would help me in the long run," she said. "If I go on tour and something breaks down, it's one less thing I would have to send back if I can fix it there."

After Hixson's year as a lab-tech, Stahl talked to Geep Parker, shop foreman and equipment manager, and they decided to give her the chance to move up. Now she is working in the shop and doing set-up for smaller shows. Hixson is closer than ever to her coveted mixing position.

There are not a large number of women active in live sound, and Hixson responded to a question about being female in a male-dominated industry, as well as the attitudes she has had to cope with. "It's never been 'You can't do this because you are a female', but it's an attitude that you sense," Hixson said. "The men will brush you aside or select other men to do certain jobs, as if all you could do is wrap mic cables or some simple job." When asked how she handles the situation, she smiled and said, "I try to be assertive and sort of stay in their face. I'm not naturally an aggressive person, but to make it out there you've got to be!"

Asked what her goals are, Hixson was quick to respond. "I want to go out on the road. I want to be the front-of-house mixer for a major tour!"

A smiling Stahl quickly added, "And I see no reason why she can't attain that goal. No reason whatsoever."

STEPHEN: BRINGING IN NEW BUSINESS

Stephen Zelenka is the person responsible for getting new acts onto the Maryland Sound bandwagon. His career began as a bass player in his native London. After buying himself a top quality bass rig, he found that others wanted to rent his equipment. Tagging along on the more interesting rentals, he made many contacts in the music business. Finally, he purchased equipment from a band called Gentle Giant and became friendly with the band. He was soon offered a job as third man on the PA, and with his acceptance, Zelenka's career in concert sound was launched.

I think one of the things I look for the most is enthusiasm. If someone has enthusiasm for the job, that is very infectious and represents the company very well to others.

Early in his career, Zelenka was given the nickname 'Zoomy' by his peers because of the way he worked. "Sometimes I was like a wild man, trying to do three things at once and running around at top speed, so they started to call me Zoomy," he said. "It helped me get more done and the name still sticks today!" As he grew in knowledge, his determination to move into the upper echelons of concert sound also grew, but he found the desire easier to come by than the next job.

"I wrote letters of introduction and sent them all around. Unfortunately, over a period of time, I got no positive responses," he said. "The main complaint was that I did not have enough experience. That old catch-22!" Not being a quitter, Zelenka laughingly related a story where his determination and creativity finally landed him a job with a major touring company which was doing sound for Rod Stewart.

"I got in by being persistent and gutsy. I literally crawled in under a receptionist's desk, and waited all day outside the hiring person's office," he said. "When I finally got to see him as he was leaving for the day, he hired me on guts alone!"

Zelenka's career also had some elements of luck which helped him rise even faster. He was asked to assist on a production of The Who's rock opera "Tommy," and consequently met Pete Townshend. Because of technical problems, Zelenka and Townshend had to work closely together and Zelenka's natural enthusiasm for the job impressed Townshend so much, he hired Zelenka to run his private sound company.

Zelenka's career now spans over fourteen years and has included tours with major world-class acts such as The Who, Bob Seger, and Deep Purple. He was employed at Stanal Sound when it was acquired by Maryland Sound and stayed to take a less road-oriented position as production manager. He now finds himself in the position to give input on hirings and firings.

SUGGESTIONS TO THE UP AND COMING

When the subject of getting in the door for aspiring engineers and sound people came up, each of the three had some good input about attitude, education and getting started.

Important Attributes of Beginning Sound People

Michael Stahl: The three most important things I look for in a new employee are attitude, attitude and attitude! I would rather train a total beginner with a great attitude than some know-it-all who's impossible to work with. We are a team. We work together toward the same goal. If a person doesn't want to be a team player, then get off the team.

Stephen Zelenka: I think one of the things I look for the most is enthusiasm. If someone has enthusiasm for the job, that is very infectious and represents the company very well to others.

Michael Stahl: If you want to make it, you've got to be where it's happening. That means you might need to relocate to Los Angeles, New York, etc. Also, never lose the attitude of learning your craft. If you are flying 20,000 pounds of equipment over patrons heads, it better be *perfect* the first time!

Stephen Zelenka: I would suggest latching on to a local band that has a

future and mixing for them. Also, you can get a job in club where touring acts come through and be as helpful as you can. They might need someone and they will remember you if you are very helpful.

On Education in the Audio Field

Carla Hixson: It was my interest in electronics that led me to ITT Trade School in Arizona to study it. This was one of the things that interested Mike on my resume. That knowledge has helped me a lot in the lab and out in the field.

Michael Stahl: I'm a firm believer in education, but it's important to remember that a degree in audio won't necessarily get you a job. There are many other attributes I look for in a candidate but education will never hurt you. You never stop learning.

Stephen Zelenka: If someone comes in here and says he's put in four years at say, Berklee School of Music and now he knows everything, I'm really put off by that.

I don't buy the line that women can't do the job because of the lifting or living arrangements

It's a catch-22 that experience often counts more than education, because how do you get experience if no one will hire you?

On Women Getting Into Audio

Carla Hixson: If you are a woman, don't get discouraged. There are places you can work and people who will hire you. If I can make it, so can other women!

Michael Stahl: I don't buy the line that women can't do the job because of the lifting or living arrangements. I believe that is used as an excuse for not hiring women. One of the best engineers I ever worked with was Cathy Sander who was my second on the Chicago tour. Cathy caused far less problems than the men, and always found a way to get every job done.

As the clock was showing nearly 2:00 p.m., it was obvious the Maryland Sound staffers were gearing up for another night's show. The trucks were being loaded, and the air was charged with excited anticipation.

These people obviously love their job, and it was with a bit of lingering regret that I shook hands all around, said my goodbyes, and prepared to leave. As I watched Maryland Sound's busy loading dock fade in the rear view mirror, I couldn't help feel a bit of envy for Carla, Stephen, Michael and all the gang there. It was obvious from their smiles and anticipation that as my day's work drew to a close, the excitement of their day was just beginning! db

ROBYN GATELY

The Makings of an Engineer

The following interview with Randy Weinholtz took place at the author's home outside Princeton, NJ. The interview, conducted over a two-day period, gives insight into both the difficulties of getting started in this business and traveling on the road.

• **RG: How did you get started in this business?**

RW: Well, I started as a roadie for the band "Bing" in 1980, basically setting up guitar amps, learning how to set up guitars and drums and being the general go-fer. You know, go-fer this, go-fer that. Then I became an apprentice at (Modular Technologies in Morrisville, PA) starting in early '81, January or February. After spending several months learning about sound, I started working with a band called "Boy's Room" in May '81 basically doing the club scene with a cover band using a small PA from Modular.

Then I got my first real experience when I was third man for Sammy Davis Jr. for a string of shows in May '82. Then it was back to the clubs and occasional 'real' shows until I worked my first Festival, the New York City Bluegrass Festival in June of '84. There I did monitors, a 16x4 mix (16 mic inputs and 4 outputs for 4 different mixes at different locations on the stage).

My next major step forward was the Silver Cloud Folk Fest in August of '84. This was where I first used 24x8 monitors. It was also the site of a tremendous rainstorm before Arlo Guthrie's set. The rain and lightening caused havoc, and put the pressure on, allowing me to prove my ability under fire. The storm passed and we got Arlo on within the 20 minute allotted stage change. It turned into a gorgeous clear moonlit night, with Arlo playing an incredible set at a site less than 15 miles from Woodstock, NY on the 18th anniversary of the event.

The next big step was the first Festival I ran myself—"Rockarama" in Philadelphia in July of '87. Three days of three stages, 12 bands a day with an audience of 25,000 per day. Since then, some of the people I've worked with include Duran Duran, David Bromberg, The Lettermen, Judy Collins, Arlo Guthrie, the Dead Kennedys, Peabo Bryson, Budfest (Washington D.C.), Cinderella, Savoy Browne, Dr. John, etc.

RG: If you have a choice, which do you prefer—to mix House or monitors?

RW: I definitely prefer to mix House, if I have a choice, mainly because the House mixer controls the whole situation. If you are having an "ON" night, and the band is too, then it can be a great experience.

RG: What has been your favorite House experience?

RW: I don't know that I could single any one out as the best—there have been too many great ones. I could tell you that I try to avoid being House man at Festivals because I don't like babysitting other engineers.

RG: What about Studio experience?

RW: I certainly don't have any, and I'm not sure I really want any, because the studio seems like a really boring place to be. I'm not sure I want to be there when Take #33 is going down. I have noticed that very few studio engineers have a good feel for how it should sound 'Live'. There's a certain feeling that has to be there when you're dealing with a band on-stage. The Kick Drum should shake your leg, the instruments should be in your face, etc.

I'm an active mixer. By that I mean that I feel your hands should be on the board. You should always be listening and reacting to what's going on on-stage. I have encountered many people who feel that once a mix is together, that the band should provide the dynamics and provide the level changes. I disagree. A band may know what changes they need to play properly, but they have no way of knowing what might be necessary to make the music happen for the audience.

Building a good mix is like construction. It's important to realize that a live mix must be based upon a solid foundation of Bass & Drums. The vocals are the first thing in the mix, but the rhythm section is the foundation on which you are building. The instruments in the band come next, and the effects (reverb, echo, etc.) are the highlights or bright colors you paint on a house. It doesn't matter how brightly you paint the house if you never built a good foundation.

RG: You obviously understand and enjoy mixing House, but what about Monitors?

RW: Well, actually, I mix monitors quite a bit. I like it too, mainly because it's a spontaneous thing. You're right there on stage with the band, so you can really get caught up in the energy of the thing. A good monitor mixer can help the band put on a much better show.

RG: What's your favorite monitor experience?

RW: I would have to say Festivals, because of the variety of the acts. If they are organized well, Festivals can be a hell of a good time. That's the key to Festivals, good organization. It is absolutely paramount that you clearly organize your stage and monitor system before you ever ar-

rive at the concert site. If you take the time to get riders and talk to the bands, you can save yourself a lot of headaches at the show.

RG: What about your recent experiences on the road? How have the systems been that you've encountered?

RW: Well, on this last "A Flock of Seagulls" tour, I was given everything from a poor passive 3-way system to a nice Meyer system. I was amazed as I traveled throughout the country and Canada at how many people have good equipment that was poorly set up. Fortunately, a lot of club soundmen appreciated my help in setting up proper gain structure. Of everything I've observed, gain structure is the single most misunderstood aspect of running a sound system.

I was taught that the signals should be kept as 'hot' (close to 0 dB) as possible until the last possible stage. This means that even if your main output is going to be running at –20 dB, you want to keep the input gains and submasters reading as close to 0 as you can without overloading. Of course this requires a console that has plenty of headroom, preferably +24 dB. It's also important to patch things like EQs and limiters in their proper place instead of just 'daisy-chaining' them onto the output of the console.

One thing I have really noticed that has changed in the club scene is that most people now fuse their speakers instead of just hoping that the limiter or underpowered amplifier will provide enough protection for the precious drivers.

A really disconcerting thing about any club tour is how many clubs put the mixing booth in a very bad place. Bad sightlines and poor acoustics can put a soundman in a position where he mixes too loud or too bassy/trebly simply because he cannot get an accurate picture of what the audience hears. A couple of examples are the Cotton Club in Atlanta, GA, where the sound booth is in a poor place acoustically, while at Tranca's in Malibu Beach, CA, someone had the idea that the sound booth should be 'out of the way', so they put it in the balcony.

RG: You mentioned the use of limiters and EQs; as you traveled, how well did people make use of these devices?

RW: Limiters and EQs are really a problem on the road. It's amazing how little is really understood about the advantages and disadvantages of these two devices. In most cases, both units are used entirely too much.

A little bit of limiting (3 to 6 dB) at a high ratio (6:1 or higher) can enable a small PA to seem as loud as a system with no limiting that is four times larger. However, 6 dB of limiting is about as far as you can go without the limiter starting to remove whole sections of the sound. For example, a mix that has a lot of kick drum will be helped by some limiting, because that will even out the volume of the Kick; however, once you start limiting your mix heavily (more than 6 dB), you will notice that the instruments and vocals seem to disappear ("duck") every time the kick hits the limiter.

Over the years, I've learned that a little bit of limiting goes a long way. A ratio of 6:1 or higher is useful for PA protection, but when you are looking to keep various instruments from getting too loud, then a few dB of limiting at 2:1 or 3:1 will sometimes help your mix. Vocals, Horns and Bass guitar can be especially helped by this. Personally, I really like to gate the kick drum, and then let the PA limit it so that it's always out front in the mix.

RG: And what about EQs?

RW: Equalization is always a tough thing. The first problem is that there is no total agreement on what sounds good; some people like to hear things a little brighter than others, some like low-end you can 'feel', so we're in a situation where personal preference enters heavily into the picture. In addition, the type of act is a determining factor, too. Heavy Metal acts obviously require more bass than MOR (middle of the road) acts that are more dependent on their vocals.

The most important factors in using an EQ are memorizing which faders affect which frequencies (learned only through great amounts of time playing with the faders), and learning how not to use EQ.

RG: Considering this is a subject that I have discussed for years with you and other soundmen, please elaborate.

RW: The goal of using EQ is to make something that works well work even better. If when you turn it on your system does not already sound reasonably good, then you need to examine the parts of the systems to find the problem. For instance, are the crossover points reasonable? It doesn't make a whole lot of sense to cross over from 18- to 12 inch speakers at 800 cycles; this should be done in the range of 150 to 250 cycles. In addition, there must be adequate power for each of the speakers. Also, the speakers must all be in phase with each other and hopefully aligned. Most importantly, the various speakers must be properly balanced—the volume controls for the lows, mids and highs should be set so that you hear enough of each before you ever touch the EQ.

Choosing the right microphone is important, too. You're never going to get the right sound if the chosen mic is noted for its great highs and you need lows out of it. I know that you use AKG 451 microphones with Judy Collins because of the superhighs it brings out in her vocal, whereas, when I'm out with The Lettermen, I use Shure SM-87s because of the lower midrange 'meat' in their vocals. So, mic selection can save you a lot of unnecessary EQing.

Additionally, improper impedance matching can cause a great PA to sound like tinny garbage. So, it's important to know about anything that will affect the 'color' of your sound.

RG: What about actually using graphic and parametric EQs?

RW: Well, these days most parametric EQs are on the input channel of our board for adjusting the sound of the input. Graphic EQs, on the other hand, tend to be used to either fix the sound of the PA or get rid of feedback. You are the person who first taught me how not to use an EQ. In fact, I know a few soundmen who are still in awe of the fact that you can do a three-day Festival without ever touching an EQ.

RG: Well, (author blushes) there are some advantages to properly setting up your system...

RW: Yes, well, I feel well-taught. But, what I see out on the road is equalizers that are often in the shape of a giant U.

RG: The infamous U-EQ.

RW: Exactly. As we have both proved, this is the result of either an improperly set-up system, or the result of a massively over-EQed PA.

The concept of not utilizing more than 1/3 of the faders on a graphic is just not adhered to by enough people.

I also encounter many systems that are severely hampered by the taking of the first two or three faders and turning them completely *off*. The explanation is usually that this eliminates Bass overexcursion, or gets rid of the rumble, but these problems are much better fixed in other ways.

RG: Moving on to a different subject, I know most of the readers work in clubs or smaller environments, but what about band volumes?

RW: Band volumes can be a problem sometimes, so you have to learn to mix against it. The only solution is often to just drop the instruments that are too loud out of the mix; what we call 'mixing against the instruments.' However, it is extremely important to get away from the sound booth and listen to the sound elsewhere. Often what is a problem where you are is not a problem elsewhere. So get around in a club the first few minutes.

Although I have a preference for the Academy of Music in Philadelphia because of my familiarity with it, I would also have to mention Carnegie Hall in New York.

Of course, it's important to have a system powerful enough to get up and over the band, but at the same time always realize that being too loud can result in your never working somewhere again. On the club circuit, having a good relationship with the owner and patrons is your source of work, so don't destroy it by being too loud. Therefore, it becomes crucial that everyone in the band realize that volume can destroy the band's reputation as quickly as bad playing or choice of material.

RG: Let's talk about some of your favorites here. First of all, do you have a favorite venue?

RW: Several, actually. Although I have a preference for the Academy of Music in Philadelphia because of my familiarity with it, I would also have to mention Carnegie Hall in New York. Despite some peoples' opinion that the 'old' Carnegie was better, I would have to say that despite the minor changes, it still ranks as one of the best halls in the world. Although those are two of the best sounding venues in the world, my personal preference for venues to mix in has to be outdoor venues with or without roofs such as the Mann Music Center in Philadelphia, or the Greek Theatre in Los Angeles. Of course, venues with roofs (or sheds) have to have delay stacks for the people sitting on the lawn.

RG: What are the most inputs you've ever used?

RW: Forty inputs is the most I've ever actually used, although I've had boards with more inputs. I specifically like the DDA Q-Series, TAC Scorpion and Harrison, but my favorite, without a doubt, would have to be the ATI Paragon. I was very impressed by the quality of the sound.

RG: Did you ever encounter any nightmares out on the road?

RW: I encountered one console in San Francisco that had just NOT been maintained. This brings up the most important aspect of sound systems—maintenance. If you don't fix and replace, it can become impossible to achieve decent results. Even connections that remain plugged in for years should be unplugged, cleaned and eye-balled every once in a while. This console had originally been decent, but was now noisy and the cause of many headaches when I came through the club on the Flock of Seagulls tour.

RG: What about speaker systems?

RW: Well, you are aware of my preference for Modular's speaker systems, but there's also a manufacturer in Canada who makes a very fine product, Brock. Both systems employ many of the same design goals, resulting in a very clear-sounding system that 'rocks' when you need it to.

Everything that could have gone wrong did. On the way to the gig one of our people, Beep, said, "I'll bet that guy's stealing that tire out of that car."

The problem with some of the processor-based systems I've encountered is that although they sound great at moderate volumes as soon as you hit them hard, the deep bass gets swept away. So far, Modular Technologies is only available in the States, and as far as I know, Brock is only available in Canada.

RG: What about favorite effects?

RW: Well, if you are familiar with the act and using the same system all the time, there are several multi-effect units that are very nice. ART and Alesis each make nice units. Lexicon equipment usually sounds excellent, but they're not very flexible without their control units. When traveling throughout the country using many different systems, I find the Yamaha units are probably the easiest to get around on.

RG: Have you found that you have some favorite acts after the last 10 years?

RW: Well, after seeing this much great music, there have to be some pretty unforgettable experiences and acts. There's a rock guitarist in Trenton, NJ, I go see no matter what band he's in, Ernie White. He always has something to say, either on his guitar or through his songs. I really like Wynton Marsalis when we work with him, though I'd like to see Harry Connick, Jr. Additionally, I think the Neville Brothers and Dr. John are great. The Righteous Brothers put on a show that was very impressive.

A large part of survival in this business is personality, how genuinely nice are you to work with? The consumate master was Sammy Davis, Jr. I don't know how he was all the time, but when we worked with him at Modular, I know every single engineer was impressed.

RG: What was the worst gig you ever worked?

RW: You should know, you got me into it! Lillo Thomas was in a small club in Brooklyn, NY. We were given directions from the band, told it was a 6 o'clock show and that there were no stairs. Additionally, there was supposed to be a load-crew, no opening acts and dinner.

Everything that could have gone wrong did. On the way to the gig one of our people, Beep, said, "I'll bet that guy's stealing that tire out of that car." Well, the directions were backward, every left was supposed to be a right, every right a left. When we turned around, sure enough, there's this guy on the side of the road yelling, "Tire, $5.00!" This was most certainly an omen.

I could never fit all of the little stories that make a show a nightmare, but some headlines include: when we got there, there was a flight of 20 million thin stairs with two 18-foot trucks to unload, and a load-in crew that was unwilling to work and never showed up for load-out. The show finally started at 2:45 a.m. with the first of three opening acts, and we finally started load-out at 6 a.m.—up the stairs with no crew, no dinner and 36 total feet of truck to load. Anything worse than that I've blocked out of my mind.

How do you react when you are asked "Please turn the fish in the box?" You turn (up) the Bass (fish) in the monitor speaker (box).

RG: Lastly, what makes a good engineer?

RW: Well, I could go on for hours, but ability to listen is of paramount importance. But this is not just the ability to hear the different parts of the music—it's also the ability to listen to what's said to you and interpret it. This means everything from taking all criticism (positive or negative) with a grain of salt, to being able to interpret the artist's request in French.

Even an interpreter can screw you up. How do you react when you are asked "Please turn the fish in the box?" You turn (up) the Bass (fish) in the monitor speaker (box).

How do you know to turn the fish up? How often has a musician ever asked to turn something down? It is rare, so it's an educated guess.

One of our monitor engineers actually went through this exchange with a band from Senegal this past summer.

Finally, be open-minded to advice. I've encountered a decent number of engineers over the years who have shared information with me. You just never know where the next great idea is coming from. db

JOHN BARILLA

THE ELECTRONIC COTTAGE

Promoting Your Studio: Part I

●Let's speak frankly. The new year is upon us, and recording studios (both large and small) are bracing for an extremely competitive period in the months ahead. Sure, there is still money to be made and somebody will be making it, but will it be you? Many studios are now feeling the leading edge of a recession. Some will survive and perhaps even prosper, but others will, undoubtedly, fail. Economists can give us a list of causes: runaway government spending, mounting consumer debt or the apocalyptic undertones of the Middle Eastern conflict, but these are factors beyond our reach. The upshot is that a dark cloud is hovering right now, but it will not stay forever. Eventually (if history does indeed repeat itself) the cloud will disappear, and when the sun of economic prosperity again shows its face, it will be a brand new ball game.

How can a studio make it in these uncertain times? There are no pat answers here, but one thing is obvious: the competition for pieces of an increasingly smaller pie is going to be stiff. Studios will either become motivated to succeed or simply fall by the wayside, and it seems to me that the effective use of promotional tools is going to be a key factor in survival. Let me state out front that I am not offering this advice as a person who has already cornered the recording market, but rather as one who is vying for a share, just like you. So let's examine the arsenal of promotional tools available to a studio owner.

DEFINING YOUR MARKET

It should be clear that electronic cottageers have a unique profile in contrast to the larger professional studio. This requires unique strategies. Promotional techniques that work for larger studios are not always applicable. The electronic cottage (as defined in this magazine), while capable of turning out professional broadcast quality products, is typically more specialized in scope, furnished with much less expensive equipment than the larger pro shops, occupies a much smaller space, and in general, does not focus on the posh amenities which are often expected. Hence, the overhead is much lower, and the market more circumscribed.

While there are some exceptions, realistically, electronic cottages are not big contenders for major label recording budgets or glitzy advertising clients. This is not to say they don't turn out hit records or national commercials, for they do; but the main draw is for independently financed masters, demos, regional commercials, a/v projects and the whole parade of "wanna-be" songwriters and vocalists seeking an affordable representation of their musical concepts. Most of these clients are interested solely in sonic value per dollar; they will not pay extra for cushy furniture or an attractive receptionist. Whether your target market is the mid-sized ad agency, the independent record producer, or the young songwriter, the point that must be transmitted in any promotional campaign is simply this: value.

PROMOTIONAL CATEGORIES

All promotional efforts fit into two basic categories: things you pay for (otherwise known as advertising), and things you get for free (otherwise known as public relations). There can actually be a lot of *cross-pollination* between these two categories, but it is nonetheless a useful distinction. For example, public relations is a relatively cost-free pursuit, unless of course, you hire a professional PR person; then, PR can cost as much as advertising. Still, the kind of promotion you get from PR can be different than that achieved through advertising. Both angles must therefore be covered.

Besides the out-of-pocket costs, what is the major difference between advertising and public relations?

Well, advertising can get you in the public eye right away. If you can afford to buy advertising, you can pretty well say anything you want about the service you offer and people will know of your claims very quickly. This could possibly translate into some immediate business. The downside is this: if you stop advertising, the general public will forget about you quickly.

Public relations, on the other hand, is slow, but enduring. It builds an opinion in the public eye of precisely what your business is. This dissemination of information must occur steadily over time, and results in an image that will not quickly fade away. Consistent, good PR speaks a message of assurance to a potential client. It says, "this is a reliable studio" or a "hot studio" or whatever it is the audience wants to hear in order to give you their trust.

Even if you know very little about advertising and public relations, it's easy to see from the above descriptions the clear benefits of both types of promotion, and how they can most effectively be used in conjunction with each other. To put some flesh on these general descriptions, we will now look at some specific types of advertising and PR that are appropriate for promoting a recording studio business.

TYPES OF ADVERTISING

For the purposes of this article, the discussion of advertising will be limited to print advertising, rather than broadcast advertising. Why? Not only are radio and television ads expensive, but no one has found a way to use them for studio promotion without smacking of hucksterism. TV and radio have great emotional impact, but fall short when it comes to transmitting hard information. Studios generally have found a more conservative print ad to be most effective.

There are three types of ads: space ads, classifieds and direct mail—all of which can be effective vehicles when properly targeted. Let's examine some of the factors involved in deciding which type of print advertising might work best for your studio.

SPACE ADS

These are the box-like ads that literally take up space in magazines and newspapers. They are sometimes sold by the fraction of the page they occupy (such as 1/8, 1/4, 1/2 page) or, more commonly, by the column-inch (how many standard columns wide by how many inches long).

Large professional studios have traditionally favored big space ads because they convey an aura of success and of course, cater to the vanities of their well-heeled clients. Don't forget that big studios with big investments have to spend big bucks on advertising in order to attract the big clients. I'm sure you've all seen the blown-out full color vanity ads in Billboard magazine saying something like this (to cite a fanciful, but nonetheless typical example): "Thank You Elvis Presley For Letting Chartbuster Studios Make Hound Dog The Biggest Hit Of The Year." This kind of approach will probably not work for you, since no modern-day Elvis has recorded at your studio. Scaling down the approach by thanking the local hero of the bar band circuit for recording at your studio doesn't quite cut it either.

Another approach big studios use to good advantage is the equipment sell: a sizeable ad positively glutted with the names of top shelf equipment manufacturers (i.e. Neumann, AKG, Lexicon, UREI and so on). You probably can't do that without sounding stupid either, and the bottom line is this: as an electronic cottage, you are selling a service, not an equipment list. People will come to you because they can relax and perform uninhibited in a relaxed atmosphere, and get a good product at an affordable price. That is probably what your ad should focus on.

To craft an effective ad, you must define your audience and be able to motivate them to give you a try. A friend of mine (Jim Becher of Ariel Music Design) has a yellow page ad that claims he renders "The Most Complete Songwriter Service Available." Young songwriters searching for a good studio and producer will undoubtedly call him to see if his claim is true. Such a simple ad has resulted in more business than any of his more elaborate ads in the local music and entertainment newspapers.

The point is that in a space ad, simplicity works best. After you have carefully crafted a few phrases describing the essence of your service (your niche in the market place), you should review a few more points before laying out your ad. First, remember to leave ample white space. People today have the attention span of a fruit fly; they will not spend a whole lot of time trying to read a cluttered ad. Second, get to the heart of the matter in your copy. What is it you do best? Trying to be everything to everybody is not credible. A few well-placed words will motivate people; a confused parade of boastings will probably saturate readers' minds and turn them off. Third, choose the journal you advertise in carefully. If, for example, you are going after the singer/songwriter type, why advertise in a publication that appeals primarily to rock 'n' roll bands? If they call you, they will probably be disappointed unless you have the space to do live music efficiently, whereas the singer/songwriter will be only too happy to carefully program his song one track at a time.

To capture this audience, it might be beneficial to search out more specific avenues for reaching your market, such as the newsletters from local songwriters' associations. Finally, once you decide on a particular journal, carefully monitor the placement of your space ad on the given page. If there are lots of similar-looking ads on the page, figure out a way to make yours look different. A good graphic artist can be of immense assistance here.

CLASSIFIED ADS

According to many market researchers, the classified ad is one the most cost-effective ways of promoting a well-defined service. These ads are little, but powerful. They don't draw a lot of attention to themselves, but they do sort of weed out the casual reader. Usually, people that pour through classifieds are seriously shopping for something, and will respond to an ad that strikes a resonant chord. Beyond this, classified ads are amazingly affordable compared to space ads; you can actually afford to experiment with your format over a period of time, and once you begin to get results, you can undoubtedly afford to keep the ad in print forever.

The trick, of course, is writing an ad that doesn't make you sound like

a huckster selling snake oil remedies. We've all chuckled at the type of classifieds from some out-of-state mail order production company that offers to "put music to your song lyrics for only $60 a song." When you use the classifieds, it's important to distance yourself from that kind of disreputable advertising. You must assume your audience will pursue you if given a legitimate opportunity, so don't resort to hyperbole.

Suppose your goal was to market a musical soundtrack production service to ad agencies who do industrial and corporate audio visual presentations. First, you must select a trade journal which services your potential audience. Then, you must write a classified ad that will encourage them to contact you. Perhaps you can offer to send a free brochure of your services and a rate card to those who request it, or for a nominal charge, a short sample cassette of your work. Let's face it, anyone who takes the time to write you a note or send you $3.00 for a sample cassette is likely to be seriously looking for a new vendor for the kind of services you provide.

DIRECT MAIL

I've become a great fan of direct mail advertising over the past few years for one reason: I know it works, because it works on me. I've been induced to buy numerous items and services, donate to some worthy charities, get involved in political activism—all because of some letters somebody sent me. There's so much more you can say in a letter than in either a space ad or classified ad. You can really open up and make a total case for the product or service you are trying to sell. When marketing the intimacy of a small studio or production company, this can be an excellent way to go.

There is, of course, one major proviso: you need to develop an accurate mailing list of the audience you are attempting to reach. Your research needs to be current and scrupulously targeted, else you will throw your money away in postage and envelopes. Going to a commercial mailing list company may not be the best thing to do; it is expensive and may not be narrowly focused enough for a studio doing local or regional business. It is probably best to gradually compile a list yourself from personal references or perhaps purchase a roster from a local organization (like an advertising club or a songwriters' guild). This is the tricky part. Once you've compiled a viable list you can add to it, update it and keep hammering away at the same central core of potential clients until they yell "uncle" and give you a shot at their next project. All you need, to do a direct mail campaign, is a PC and a program that will allow you to compile a list and print it out as labels.

Obviously, finding the right advertising format requires a bit of experimentation and a few dollars to invest. Still, advertising can be what makes the difference between a studio that is well-booked, and one that's stalled in its tracks. The question we must constantly answer is this: can we afford not to advertise? Advertising—especially in today's market—needs to be seen as part of our equipment; it's almost as fundamental as studio monitors.

In the next issue, we'll concentrate on the kind of promotion you can get for free: public relations for the smaller studio. db

1991 Editorial Calendar

JAN/FEB

The Professional Electronic Cottage.
Winter NAMM Show issue.
• GUIDE: Speakers: Performance & Monitor.

MAR/APR

The Broadcast Picture in the U.S.— Applications of the Electronic Cottage to broadcast.
NAB show issue.
• GUIDE: Consoles and Mixers.

MAY/JUNE

Audio in Houses of Worship/Sound Reinforcement In Fixed Venues.
NSCA show issue.
• GUIDE: Power Amplifiers.

JULY/AUG

Concert Sound—Producing it and/or Recording it.
Summer NAMM show issue.
• GUIDE: Tape, Tape Recorders and Accessories, Microphones.

SEPT/OCT

The Recording Studio—What's happening, what's ahead for the 90s.
AES in N.Y. Show issue.
• GUIDE: Signal Processing Equipment, Part I.(delays, reverbs, crossovers, equalizers.)

NOV/DEC

The World of Post-Production—Television and Film. *SMPTE Show issue.*
• GUIDE: Signal Processing Equipment, Part II, (noise gates, noise reduction, limiters, compressors), Spectrum Analyzers.

BRENT HARSHBARGER

AUDIO FOR THE CHURCH

0101010101000001 audio, or digital, is this issue's topic.

• Digital is where audio, video and communications will be in the future. Digital audio, video and communication, in general, are already in digital format, but you need to know the basics of digital audio so you won't be left behind.

Digital audio is all around us: in telephone answering machines, voice-mail boxes, camcorders, and yes, even our churches. CD players are already being used by many churches for choral and other accompaniment tracks, while Christian recording artists are including DAT (digital audio tape) machines on their riders for concerts.

Word Music Inc., one of the leading music producers for the Christian market, plans to increase their CD accompaniment tracks for their choral music by 76 percent, this year over last. The advantage is increased sound quality; the clarity and definition of the music can't be touched by analog media in mass duplication.

There are additional advantages as well. For example, Word Music Inc. has added a feature to their choral CDs that allows the choir director to cue the music at different sections. Suppose the choir starts with a verse and has trouble going into the chorus. The director can instantly go back to the start of the chorus with a few key strokes of the CD player. This is accomplished by noting each section of the song with its own track number, and it is also marked in the music. Consequently, the verse would be track 32, the chorus track 33. In this case, the song is track 32; track 33 and other track numbers in that song are called cue points. What this means is if you want to play the entire song, the director would only select track 32 and play it until ending, while for rehearsal purposes, the director would choose the track for the particular section of the song to be practiced.

There are disadvantages, however, to being able to cue each section. If you want to play the song that is on track 32 and then play it on track 1 via the CD player's memory selection, the CD would only play the section attached to cue number 32 (which, in this case, is also the song number), and then play song number 1, while only playing that section attached to cue point number 1. This is a perfect case for a DAT machine with digital outputs because you can record the two songs in the order you want, much the same way you would change the order from an LP to cassette. The exception is you can transfer the information out of the CD player's digital outputs and go into the DAT machine's digital inputs while losing no sound quality.

This brings us to my favorite way of using digital audio relating to church worship—putting the analog to digital converter on a computer...

Personally, I would buy my accompaniment tracks on CD because it is a much better long-term storage medium. I would put my working copy on a DAT machine (tape). For this reason, DAT machines are a natural for a church because they come available with recording tape standard in 46, 90 and 120 minutes, with no need to "turn" the tape over.

DIGITAL AUDIO

After audio is converted from analog to digital, it's digital data, the same data used in your computer. Suppose you plug a microphone into a DAT machine; the mic takes the acoustic sound and changes it into an electrical AC voltage (which is still analog). It then goes into an analog-to-digital converter which changes the analog AC voltage into digital data. Therefore, the DAT machine is not recording analog audio, but data.

Because the audio is now data, you can do various things with it and virtually never lose any quality in the audio as you would with analog duplication. With an analog signal, you have to process the sound by going through another circuit which increases noise and otherwise degrades the signal. With digital, you change the data, or the arrangement of the bits of data, but not the audio signal itself.

This brings us to my favorite way of using digital audio relating to church worship—putting the analog to digital converter on a computer, having the computer record the service, editing the program material on the computer and storing it on a DAT machine (which will be your master for duplication). By using a

computer for editing, you can actually see the audio on the computer screen (providing you have the appropriate software), and have the ability to edit out a word, noise, or any unwanted sound while leaving the program material you want intact. If you make a mistake, simply *undo* the edit and start over.

DSPs

Digital audio and video capabilities are moving faster and faster every day, due to the development of DSPs (Digital Signal Processors). DSPs let you purchase a card for your computer to make it a complete multitrack recorder, editor and editing system for just a little more money than a similar analog system. It's even less expensive if you use the computer for accounting or other functions, when not recording. You would now have the all-in-one workstation—office by day, recording studio by night.

Our next topic is digital control. With money for community centers diminishing, churches are becoming more than a place to worship by adding education, health and reception/dining facilities to their property. As the facilities grow, the demand for audio becomes greater. This presents problems, such as having people that are dedicated, or have the time, to operate the different sound systems. I know from experience that churches use their facilities simultaneously from Wednesday night on through Sunday. This creates a second problem as this requires multiple sound systems, which can be very costly, besides having someone to make sure they are set up and running properly. When dealing with volunteer labor who have other jobs and families, the time needed to be devoted to the sound systems can add up to virtually that of a second full-time job.

INTEGRATED SOUND SYSTEMS

The answer, however, is within reach—using integrated sound systems with digital control. There are two companies making great headway into these types of systems: IED of Louisville, KY, and Intelix of Madison, WI. IED manufactures turnkey computer-based systems, including automatic mic mixers, processing equipment and amplifiers that can run the audio for a complete facility in one- or two-track frames in a single location. Intelix provides similar control and interfaces with your everyday off-the-shelf equipment. IED interfaces with non-IED equipment via the PA-422 serial computer interface, making it useable with other equipment besides IED.

Intelix' system, MIND (Master Integrated Network Device) Control System, is used as a central information and control center for the facilities manager. These systems include audio, video, HVAC, fire, security and computers that can be operated by a single computer from the facilities manager's office. This enables him, for example, to select a room to be used for a meeting and have the heat and audio systems turned on for use 30 minutes before the actual meeting starts.

... its best feature is that it can provide precision automatic system operation without an operator, without someone plugging in a mic at the time of the conference.

IED has introduced a system named UDAPS (Universal Digital Audio Processing System) which is capable of taking up to 504 inputs, changing the mic or line from analog to digital, and then processing each input, such as EQ and digital delay, with a different setting to any or all of the 504 outputs in groups of eight. IED's turnkey audio systems enable you to combine rooms, automatically mix mic and line inputs, and raise and lower the output level according to the ambient noise level of the room(s) being combined. The computer screen IED provides will display an architectural layout of the facility, and show the status of each room.

For example, suppose you have four rooms next to each other, divided by some sort of folding walls, each room with its own color. The rooms you want to "combine" will be the same color on the computer screen, and the computer system will automatically change the configuration of the inputs and outputs to make all mic jacks in the combined rooms active within that configuration. If you were to combine rooms 1 and 2, then all mic jacks in both rooms will be active, and no matter which room the mic is plugged into, it will play through the speakers in both rooms.

The IED system can combine rooms and turn on or off any input or output at any time in the future. If the pastor decides he wants to hold a conference in rooms 1 and 2 on July 6, 1995, the audio person can set the time and date in the computer and program it to turn all mic inputs off except mic input No. 6, combining the rest of the audio. In four years, the system will automatically combine the amps and speakers in rooms 1 and 2 while turning on mic No. 6. The mic will be raised or lowered, depending on how loud the pastor talks into the mic, and the output will get louder or softer depending on how loud or soft the room is at any particular time during the conference. If the pastor tells a joke and the audience laughs, the sound system will raise the level in that room only, while the level of the system will go down accordingly after the laughter dies down.

An advantage to this type of system is that conferences can occur simultaneously, but its best feature is that it can provide precision automatic system operation without an operator, without someone plugging in a mic at the time of the conference. The IED system also has an alarm that sounds when a component of the system fails, and it will tell you exactly what failed, thus eliminating down time for troubleshooting.

More systems like IED and Intelix will come about in the next few years, so if you are planning a new facility, it would be worthwhile to find out which of these systems would be optimum for your church. Systems like these can only be found either at electronic systems companies or with sound contractors. db

LAB REPORT

LEN FELDMAN

Soundcraftsmen's Model PM860 Stereo Amplifier

GENERAL INFORMATION

• If you have always thought of Soundcraftsmen as a maker of solidly-built, well-designed but somewhat bulky power amplifiers, you'll be in for a surprise when you see (and lift) their new Model PM860. Oh, it's still solidly built and, from a circuit point of view, extremely well-designed, but it is one of the most compact amplifiers for its power rating that we have ever seen. The PM860 is so small, in fact, that Soundcraftsmen is promoting the idea of using two of them, side by side, in their available PCX-2 rack-mount, should you require more than the 200 watts-plus per channel into 8 ohm loads (300 watts per channel using 4 ohm loads) provided by a single amplifier. The use of a pair of amplifiers in this mode will also require a stereo bridging adaptor (Soundcraftsmen Model AB-1) available for under $90.

When two amplifiers are used this way, in bridged mode, each amplifier delivers 600 watts into 8 ohm loads which is perfectly matched to a 70 volt distribution line without the need for a matching transformer. Of course, two units mounted in this adaptor can also be used as four 300-watt basic amplifiers in such applications as bi-amping, multi-channel systems, etc.

Figure 1. Frequency response of the amplifier.

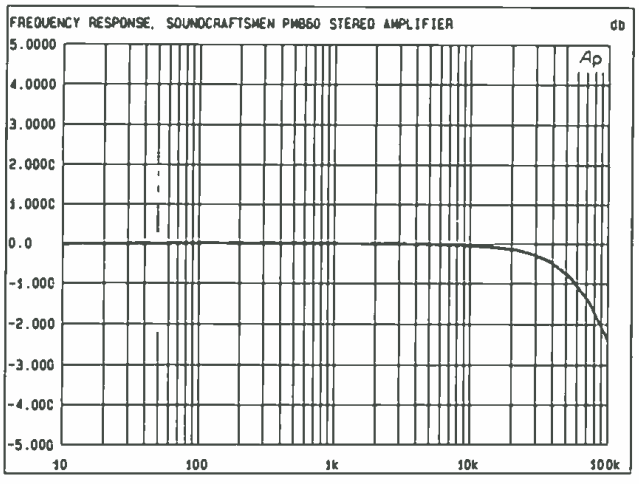
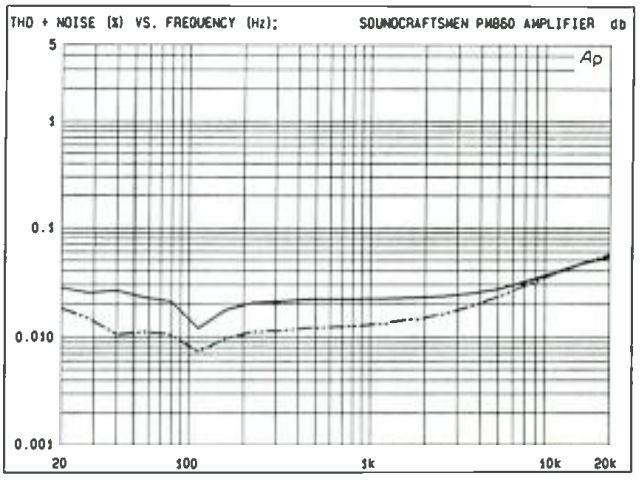


Figure 2(A). Harmonic distortion plus noise versus frequency at rated output of 205 watts/channel, 8–Ω loads.



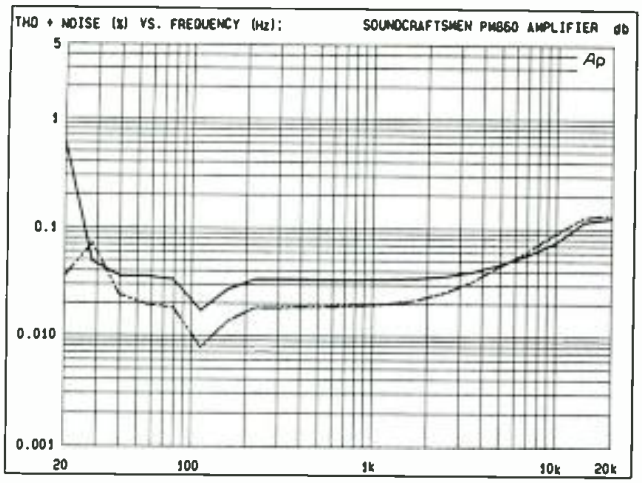
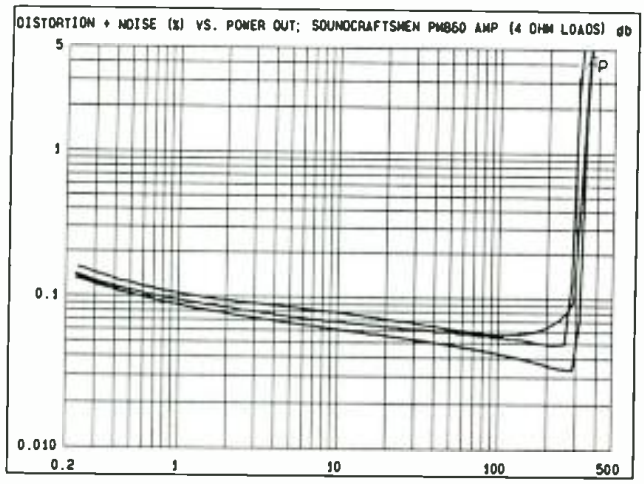


Figure 2(B). Harmonic distortion plus noise versus frequency at rated output of 300 watts/channel, 4–Ω loads.

In our tests, however, only a single stereo amplifier was evaluated. It stood only 5-½inches high, was 8-½ inches wide and 13 inches deep. It is this configuration that allows the use of two units, side by side, without exceeding the limits of a standard 19-inch rack panel. Had we wanted to mount this single amplifier in a rack, this, too, would have been possible, using Soundcraftsmen's PCX-1 rack-mounting kit available for under $50. The amplifier itself weighs a mere 20 pounds.

Unlike most high-powered amplifiers, the PM860 employs a fully regulated power supply. That means that full power is available even under low voltage conditions.

Figure 3(B). Harmonic distortion plus noise versus power output per channel (4-W loads). Best curve is 1 kHz, next best power is 20 kHz, lowest power before clipping is 20 kHz.



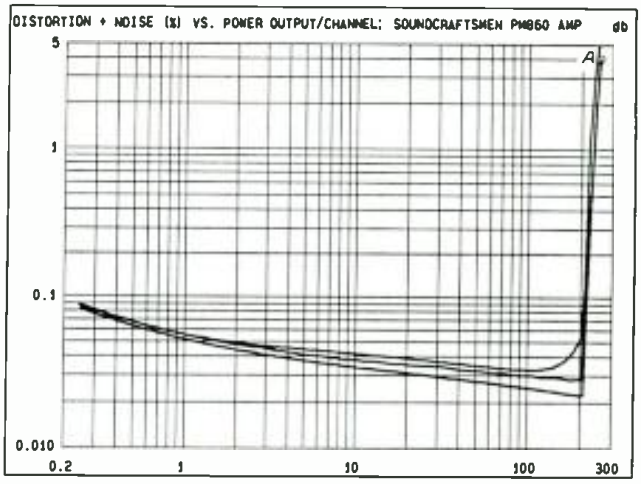
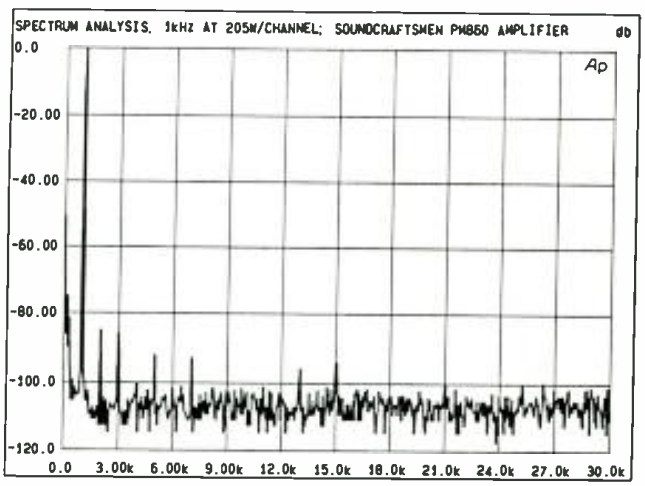


Figure 3(A). Harmonic distortion plus noise versus power output per channel (8-Ω loads). Best curve is 1 kHz, next best power is 20 kHz, lowest power before clipping is 20 kHz.

As for the electrical features of the PM860, the output devices are power MOSFETS in a fully complementary circuit design. An aluminum heatsink utilizes a special multidirectional surface area designed for maximum heat dissipation. Cooling is provided by a fan that is governed by thermal sensors built into the transformer, output stages and other sensitive areas of the amplifier. During normal operation, the two-speed fan is very quiet, switching to its higher speed (and more audible operation) only during extreme demands such as those imposed when the amplifier ran at full rated output for some of our tests.

Unlike most high-powered amplifiers, the PM860 employs a fully regulated power supply. That means that full power is available even under low voltage conditions. Rated power was available from this amplifier even when line voltage dropped to slightly more than 100 volts. At this low voltage supply level many other amplifiers would provide as little as one-half to two-thirds of their rated power output. The Soundcraftsmen PM860 does not employ current-limiting, a design approach that, in some amplifiers, causes distortion even as clip-

Figure 4(A). A spectrum analysis of a 1 kHz signal at 205 watts/channel output. (8-Ω loads.)



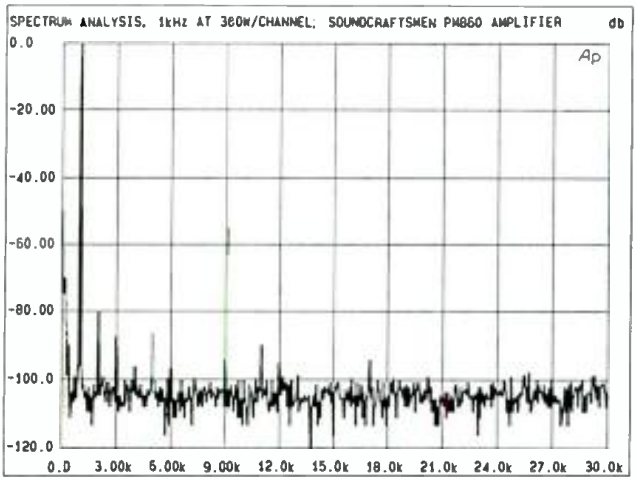


Figure 4(B). A spectrum analysis of a 1 kHz signal at 300 watts/channel output. (4-Ω loads.)

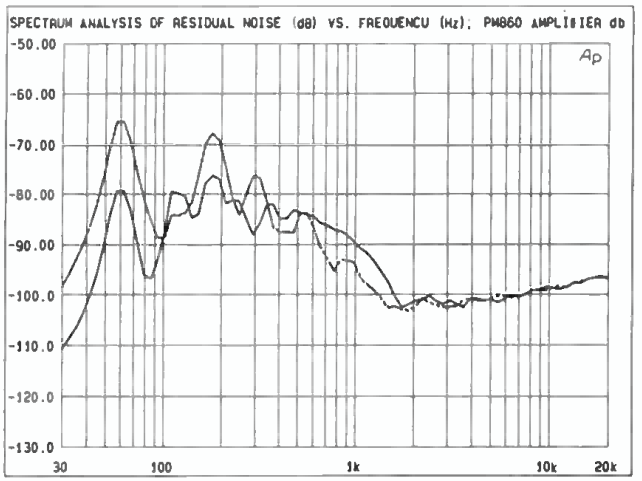


Figure 5. A spectrum analysis of residual noise at 1-watt reference level.

ping is approached. The clipping indicators on the front panel of this amplifier are waveform sensitive, and illuminate only when actual waveform distortion occurs—in other words, only under conditions of true clipping.

CONTROL AND PANEL LAYOUT

The only user control found on the front panel of the PM860 is an on/off power switch. Nearby is a green power indicator light. Further to the right are separate red clipping indicator lights, one for each channel. A major portion of the amplifier's rear panel is devoted to the air intake area of the built-in two-speed cooling fan.

Alongside this area are two pairs of color-coded 5-way binding posts for connection of speaker cables, while further to one side are ¼-inch phone jacks used for the unbalanced inputs to the amplifier. No provision has been made for balanced input connections.

Anyone who maintains that there is no audible difference between amplifiers having the same power rating would do well to audition the Soundcraftsmen PM860 against competitive amplifiers.

LABORATORY MEASUREMENTS

While Soundcraftsmen specifies the frequency response of this amplifier only from 20 Hz to 20,000 Hz, our sample did much better than that. It was virtually flat down to 10 Hz (the limit of our signal generating equipment) and was down 1 dB at 58 kHz and less than 3 dB at 100 kHz. Frequency response test results are shown in *Figure 1*. We measured distortion at rated output versus frequency for both 8-ohm and 4-ohm load conditions. For the 8-ohm load tests, input was regulated so as to maintain a constant 205 watts per channel output (both channels driven) into resistive 8-ohm loads. Results are plotted in *Figure 2A*. At mid-frequencies, total harmonic distortion plus noise (THD+N), measured 0.022 percent for the left channel and 0.013 percent for the right channel. At 20 kHz, THD + N increased to 0.05 percent and was identical for both channels.

The measurements were repeated for 4-ohm loads, this time with input regulated to maintain a constant rated 300 watts per channel. Mid-frequency THD + noise was substantially the same as before, as shown in *Figure 2B*, but THD + N at 20 kHz increased to slightly over 0.1 percent. *Figures 3A* and *3B* were plotted for THD + noise versus power output for frequencies of 1 kHz (lowest curve in the graphs), 20 Hz (middle curve in each graph) and 20 kHz (uppermost curve in *Figures 3A* or *3B*), and good correlation was noted between these results and those of *Figures 2A* and *2B* as rated power levels were reached. At low output levels, the increase in THD + noise is largely a function of residual noise which, relative to lower output, appears to be a greater percentage.

In order to separate the THD from the residual noise, we employed the FFT spectrum analysis function of our audio test system to examine the actual harmonic components produced at rated output. Results are shown in *Figure 4A* for 8-ohm loads (with 205 watts delivered by each channel) and in *Figure 4B* for 4-ohm loads (with 300 watts per channel delivered to the loads). The significant harmonic components generated by the amplifier are all more than 80 dB below rated output for the 8-ohm condition, and calculating actual harmonic distortion contributed by the second, third, fifth and seventh harmonic component yields a true overall THD figure (exclusive of noise contributions) of only 0.0082 percent! In the case of 4-ohm load conditions, the net actual THD (exclusive of noise) calculated from the most significant harmonic contributions was only 0.0122 percent.

Overall SMPTE-IM distortion at rated power, with 8-ohm loads, measured only 0.022 percent for one channel and 0.013 percent for the opposite channel. Signal-to-noise was measured first, relative to 1 watt output, in accordance with the standards of measurement developed by the Electronic Industries Association. Using that method, A-weighted S/N was 78.03 dB for one channel and 75.2 dB for the other channel. To obtain closer correlation with the figures published by Soundcraftsmen, we also measured S/N with respect to the full rated output of

the amplifier (205 watts per channel into 8-ohm loads). Under those conditions, we measured an A-weighted signal-to-noise ratio of 101.7 dB for one channel and 100 dB for the opposite channel. Input sensitivity for 1 watt output into 8 ohm loads was 91 millivolts. That translates to an input requirement of 1.3 volts for rated output of 205 watts per channel. A summary of the manufacturer's published specifications and, where applicable, our measurements, appears in the *Vital Statistics* table at the end of this report.

CONCLUSIONS

Anyone who maintains that there is no audible difference between amplifiers having the same power rating would do well to audition the Soundcraftsmen PM860 against competitive amplifiers. Sound was as clean as any we've heard from so-called audiophile stereo amplifiers. During normal use, which extended for several hours of listening, the internal fan's high speed was never invoked, nor did the clipping indicators illuminate. The loudspeakers we used were not the most efficient, but the high power rating of the amplifier (and its ability to drive impedances even lower than 4 ohms) enabled it to deliver sound levels that were louder than I would have expected from such a small sized, lightweight amplifier.

Perhaps even more amazing than its small size and light weight is the very "small" suggested price for this amplifier. At $599 it is as much as $400 less than some of the more expensive competition in the same power output class. db

VITAL STATISTICS

	MFR'S CLAIM	db MEASURED
Power Output/Channel		
Stereo, 8 ohms	205 Watts	205 Watts
Stereo, 4 ohms	300 Watts	300 Watts
Mono, 8 ohms	600 Watts	N/A
Mono, 4 ohms	900 Watts	N/A
THD, 20 Hz to 20 kHz	0.05%	0.012% (1 kHz)
IM Distortion	0.05%	0.022%
Frequency Response,	±0.1 dB 20 Hz to 20 kHz	Confirmed
Hum and Noise	–105 dB	–100 dB
Rise Time	2.2 microseconds	N/A
Input for 1 Watt Out	N/A	91 mV
Input for rated output	N/A	1.3 V
Dimensions (HxWxD, inches)	5-¼ X 8-½ X 13	Confirmed
Weight	20 lbs.	Confirmed
Price:	$599.00.	

NEW PRODUCTS

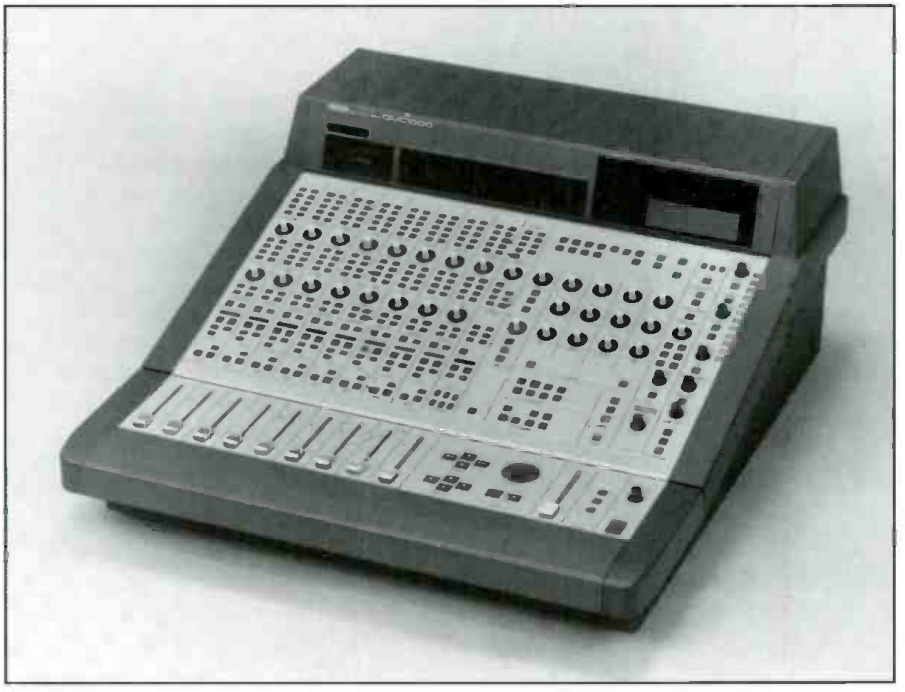
SPL MEASUREMENT

• Packaged in a male-female inline-XLR tube, the AC-10 requires 12-48V phantom power for operation. A two-position slide-switch selects between the two curves. Both curves conform to the appropriate national and international standards. A-weighting filters are usually used to make a sound level meter approximate the sensitivity characteristics of the human ear at 70 dB SPL. The C-weighting curve approximates the ear's sensitivity at high SPL's. Typically, A-weighting is used for noise-annoyance studies, but is now the standard for most noise-survey work, regardless of SPL.
Manufacturer: AudioControl Industrial
Price: $44.00

Circle 70 on Reader Service Card

DIGITAL MIXER

• The DMC1000 has fourteen input channels (8 mono, 3 stereo) and eight monitor input channels which can be mixed onto the stereo bus. All channel parameters are automated. This includes real-time automation of EQ pan, aux sends and buss assignments. The on-board time-code referenced computer stores its automation data to an internal 3.5 in. floppy disc drive. Additionally, static "scenes" of all console parameters may be stored onto a ram card and instantly recalled. A flexible equalizer with a "virtual" control section is included. The DMC1000 offers 4 bands of fully-parametric equalization with identical frequency range (20 Hz-20 kHz) on all four bands. Bands 1 and 4 are switchable for either peak or shelf, while bands 2 and 3 are "peak." High and low pass filters are also provided. Each channel's equalization response curve may be displayed graphically on the LED screen.
Manufacturer: Yamaha Corporation of America
Price: Under $32,000



Circle 71 on Reader Service Card

TOBY COHEN

Problem-Solving at International Post

"The people who are interested in selling programs overseas are interested in selling programs overseas. They're not as interested in producing them or becoming technically involved with them. They want them to be what their clients want them to be, obviously. But I think they feel very, very comfortable in just sending us the elements and saying 'Go do it.' We do, too. We solve problems for a lot of people without them knowing that there are problems to solve."—Rob Schuman, general manager, International Post.

With film and video's global impact expanding dramatically, United States distributors and overseas producers and broadcasters alike are inundated with material to be modified for international distribution. Such inundation has proven to be a lucrative venture to an industry-established company with the insight and foresight to position itself within that market and fill the void.

Several years ago, according to Schuman, the staff at Northvale, N.J.-based Audio Plus Video International, Inc. (APVI), a leader in international videotape services, recognized the demand for much more sophisticated work to be done for international clients, rather than "a straightforward 'Here's a videotape, convert it to PAL, make a bunch of dubs and ship it overseas,'" says Schuman. "So they installed a film chain (because there was a lot of film-to-PAL work to be done) and planned to build a much more sophisticated facility," he said. As a result, International Post was born last June. The facility provides a broad range of international services for clients, including multi-standard editing, film-to-tape transfers, multi-lingual audio laybacks and voice-overs.

With parent company APVI (one of fourteen independent companies owned by Video Services Corp.) situated right across the street, International Post's operations are connected to the facility via fiber optic lines going both ways, "so that we can do jobs rolling in both facilities simultaneously," Schuman says. Housed in the audio suite is a control panel for a Grass Valley 128 x 128 routing switcher, which, said Schuman, allows the audio engineer "control of anything in the house." He adds that the system had to be flexible because the entire house runs in PAL and in NTSC. "One day, Scott (Delaney, chief audio engineer) may be laying audio from ¼ in. to NTSC, and another day, he may be laying audio from a mag dubber in 35mm to a PAL 1-in. tape or PAL Betacam. Whatever format or standard our clients want, we've got," Schuman said.

The basic thrust of the work is mixed frame-rate synchronization. Delaney, an Institute of Audio Research graduate whose background spans both engineering and MIDI programming, explains his position.

"There's nothing magical about what I do. When doing a layback, I remix the audio M & E tracks from mags, and EQ when necessary," he said.

Delaney is currently working on the Old Captain Midnight shows for the Museum of Broadcasting in New York City by taking those optical tracks and laying them down to PAL 1 in. or NTSC 1 in.. He explains that he's basically doing an audio layback from different sources to yet another source.

"It can be any frame rate, basically. We can lock up a mag dubber," he says, "at 25 frames/second, to a PAL machine at 25 frames/second or an NTSC machine going at 29.97 or 30 frames/second. So, let's say I'm doing an audio layback for a film that's been transferred to 1 in. PAL or 1 in. NTSC. Without changing the time code, I'm able to take the audio from the mag dubber and lay it back to something that's running at a different frame rate."

A CASE STUDY

Delaney admits that the work he does "is a case study in itself—namely because we get a lot of tapes that come from different origins. People come to us because we're able to solve a lot of problems," he says. "We get things from all over the place, and (other facilities) just haven't been able to lock them up. I mean, (other employees) just haven't had any success with them. Many times we'll sit there wondering 'What has happened to this tape that has caused it not to run at the speed it's supposed to?'" According to Delaney, there could be many factors involved, one example being different conversion rates.

"The fact of the matter is," he says, "that there are so many things I get that are out of the ordinary in terms of lock-up and synchronization." Working with a Soundmaster synchronizer (the heart of the International Post Audio Suite), Delaney says he's often able to use some of the algorithms he's worked out over the past few months in order to "deter-

Figure 1. The audio suite.

mine what frame rate I can use to lock something up. It's a correction factor I've been able to put together, just for the Soundmaster.

SPECIFIC MACROS

"The Soundmaster enables me to make specific macros so I can perform many operations with just one keystroke. That's been very helpful," Delaney said. "We also have a Lexicon time-compressor-expander which enables me to fit things into a certain time-slot, such as a 30-second commercial, for example. Say we have edited three seconds off. I'll be able to take my material, run it through the Lexicon, and make it all happen within that time frame. It's a real handy tool."

Also included in the equipment configuration is an Otari ½ in. 4-track ATR with center-track time code and pilot tone, as well as 16.35mm film mag dubbers with 16mm and 35mm optical heads. Other equipment in the Audio Suite are JBL monitors. "I usually listen off of the smaller near-field monitors, simply because I'm a low-level listener," Delaney explains. The suite is also equipped with Dolby A and SR. "Rather than put Dolby carts on our videotape machines," says Schuman, "we have outboard Dolby encoders and decoders. So while Scott's working on different projects, we can patch right through and encode or decode Dolby from other rooms."

Figure 2. The edit room.

"Basically," concludes Delaney, "we're saving them money, in the fact that they can do one conversion, and I can then lay back audio from all sorts of different sources."

The smaller monitors are driven by a Symetrix amplifier while the larger monitors are driven by a Yamaha amplifier. There is also a Soundcraft Delta 200 board. Euri parametric equalizers, dbx single-edit noise reduction, Aphex aural exciters and dbx DSRs are housed in a "modular-type" rack along with a dbx 900B system. Electro-Voice RE-20 microphones are used in the announce booth, which can accommodate up to two announcers. Such a setup is ideally-suited to the type of work that infiltrates the suite.

"ESPN was in here the other day, and we were working on the Davis Cup Classic," Delaney said. "We had (ESPN Commentators) Kim Prince and Cliff Drysdale doing the overdubs. In this particular case, I had a number of source tapes in NTSC, and we were doing (the tapes) for both PAL and NTSC. What I did was lock up three audio machines together and mix the audio while they were doing the overdubs. So we'd have background sounds from the tournament and things that the umpire would say, while mixing in what Kim and Cliff were saying. We get a big demand for this type of relay stuff, from people like ESPN, ABC, the Museum of Broadcasting and Viacom.

Figure 3.The film-to-tape suite.

"Basically," concludes Delaney, "we're saving them money, in the fact that they can do one conversion, and I can then lay back audio from all sorts of different sources."

FOREIGN LANGUAGES

Delaney works on an abundance of foreign language re-lays, "especially for Viacom. They have a lot of French material that they ship over to France, and then that which goes up to Canada. The French Canadians understand English," he muses, "but they just like to see it in French!" On a more general note, he points out that a lot of M & E tracks have come through International Post's doors, already worked on by companies in the United States and Canada, that the French have not been too happy with. "They need a little punching up," Delaney says, "so we've been looking to purchase equipment to lay in sound effects and add music." To that end, Delaney has recently gathered up a group of equipment that will be needed, "and some of the bigwigs at VSC and APVI are shopping the idea around in France at the moment." He adds that International Post will also add to the Soundmaster equipment with what they hope will be the purchase of a Syncram 2-track digital recorder, which will "enable us to do random-access editing," Delaney said.

Schuman remarked that there are three markets that International Post is aiming for in the quest for business—the first being current APVI clients, many of whom are the major distributors of American programming out of New York—that is, anyone doing international distribution.

The second market is comprised of producers overseas who need a United States-based post production house able to operate in PAL. "This is sort-of a new concept here," reflects Schuman. "There is a tendency, if you're shooting in a foreign country, to take all of your raw material back to your home base and edit there. But we're finding that it's actually cheaper," he says, "to shoot and edit here in PAL—to finish the programs and then send them overseas."

The third target area is the corporate market. "As more corporations become multi-national, they now have to use conversions. In some cases," Schuman says, "we're actually re-editing things for their international distribution and converting them to PAL, as opposed to what used to have to be done, which was to edit overseas and spend a fortune on hotels and everything else, while converting 20 to 30 hours of raw footage to NTSC to edit over here."

Crucial to International Post's success has been the ability to be of full service to clients—and clients' clients—over time. Schuman notes the concern that clients have about getting their product out and getting their clients (the people they've sold the program[s] to) the best quality they can, for the least amount of money.

"We've had a number of people come out and supervise the first audio session with us," says Schuman. "And after they see what we can do, the rest of our work is unsupervised. We'll send our trucks into the city, pick up what we need, work on it and give it back, or work on it and send it overseas. As long as our clients' clients are happy, we're happy."

International Post takes several steps to expedite service that runs smoothly and efficiently. One is the VSC-operated courier service which enables APVI free pick-up and delivery service into midtown Manhattan every day. Another is APVI General Manager Andre Macaluso's travel overseas (he's conversant in French, Spanish and Italian) to get feedback from broadcasters abroad and find out what they really want "because they're our clients' clients, the 'final' people, so-to-speak," says Schuman. "And they know that if they have a problem with a tape, and they see an APVI label on it, they'll sometimes call us directly instead of taking the usual route which would be to call a distributor and say, 'I have a problem', at which point the distributor would call us and say 'I have a problem.' And by the time the tape gets back here and we get to analyze it and figure out what it is, weeks have gone by. We can speak their language, find out what they need, and then go back to our client and say 'This is what they need, this is what you'll have to give us," he said.

With a master's degree in radio and television from Syracuse University and an M.B.A. from New York University, Schuman says his training and field experience (in video operations and on-air promotions production management) has sharpened his expertise in "three areas—people, equipment and money—which is what you need to run a facility these days. It's a unique opportunity." db

BRUCE BARTLETT and JENNY BARTLETT

A Guide to a Home Studio

IT'S EVERY MUSICIAN'S DREAM—SETTING up a home recording system that has good-quality sound, yet is affordable. With today's easy-to-use sound tools, you can do just that. This article is a guide to equipment for a home studio: what it does, and what you get at different price levels.

We'll focus on tape recording equipment, rather than MIDI recording equipment (synths, samplers, sequencers and drum machines). MIDI users should find this information useful, as a MIDI home studio requires most of the equipment mentioned here.

Although tape recorders are available with 8, 16 and 24 tracks or more, most musicians start with a 4-track system. The following equipment is used in a 4-track home studio.

- A 4-track cassette recorder-mixer
- A 2-track recorder to record the final mix (usually a cassette deck from a stereo system)
- Microphones
- Mic stands
- A monitoring system (two speakers and a power amplifier, or headphones)
- Effects (reverb, delay, compression, etc.)
- Cables
- Blank tape, optional rack and patch bay (miscellaneous goodies).

Let's look more closely at each of these components.

4-TRACK RECORDER-MIXER

This is a small, portable unit combining a mixer with a multi-track cassette recorder. You plug mics and electric musical instruments into the mixer, which amplifies their signals and routes them to tape tracks. The multi-track cassette recorder can record up to 4 tracks, each with a different instrument on it. After recording the tracks, mix or combine them to 2-channel stereo and record the mix on a separate 2-track recorder. The recording made on that machine is the final product.

Recorder-mixers currently on the market are made by Fostex, Tascam, AMR, Yamaha, Vestax, Akai and Sansui. Their prices range from $339 to $2,500 suggested retail.

You might prefer to master on a 2-track open-reel recorder. Open-reel is the preferred master-tape format for commercial record and tape duplication.

As prices increase, you get cleaner, crisper sound and more features. If you don't understand the features offered in recorder-mixers, please see the sidebar for more information.

You should expect different features for different price ranges. In recorder-mixers costing under $500, you can expect two mic inputs, either no effects send or one effects send, Dolby B or dbx noise reduction, pitch control and 1-7/8 inches per second tape speed. You'll see one of three types of equalization: none, bass and treble, or overall graphic. You can record one or two tracks at a time, building up to four tracks for later mixdown to 2-track stereo. For example, you might first record a keyboard part on one track, then add bass, drums and vocals one at a time on the remaining tracks.

In units costing between $500 and $1,000, typical features include two-to-six mic inputs, bass and treble EQ, one or two effects sends, dbx or Dolby C noise reduction and 3-3/4 ips tape speed in most models. Some have a dedicated sync track for synchronizing the multi-track tape to MIDI instruments; some also have an autolocate feature. You can record up to four tracks at a time.

Recorder-mixers costing between $1,000 and $2,500 offer 4-to-8 mic inputs (perhaps with XLR-type balanced inputs for less hum), sweepable (semi-parametric) EQ, one or two effects sends, dbx or Dolby C noise reduction and 3-3/4 ips tape speed. Most units have a sync track and some have an autolocate feature. One model (the Sansui WS-X1) even has a built-in 2-track cassette deck for recording the final mix.

At any price range, all 4-trackers permit overdubbing and bouncing tracks. Most allow punch-ins.

Some blank cassette tape is needed with your recorder-mixer. Brand-name metal or chrome tape is recommended for best sound quality.

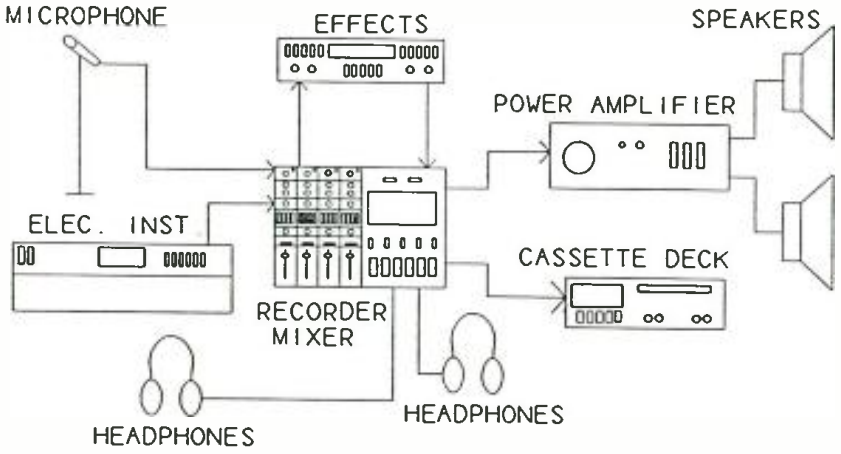


Figure 1. A typical 4-track home studio from input to output.

Use the tape suggested by the cassette-deck manufacturer.

STEREO CASSETTE DECK

Here's another major part of your home studio. You connect this deck externally to your recorder-mixer. The stereo cassette deck records your final stereo mix of the four tape tracks. You'll still have your 4-track tape, which could be remixed at a later date. Good cassette decks cost about $200 and up.

You might prefer to master on a 2-track open-reel recorder. Open-reel is the preferred master-tape format for commercial record and tape duplication. Compared to a cassette deck, the open-reel deck costs much more, but has higher sound quality and permits editing. *Editing* is the cutting and splicing of recording tape to remove unwanted noises, to change the sequence of songs, or to combine parts of two or more different takes.

DIRECT BOX

This is a useful accessory for recorder-mixers with balanced XLR-type mic inputs. A direct box is a small device that connects between an electric instrument (guitar, bass, synth) and a mixer mic input which lets you record electric instruments directly into your mixer without a mic. You can buy a direct box for as little as $50.

Most 4-trackers have ¼-inch phone jacks for inputs. In this case, simply use a short guitar cord between your instrument and mixer input.

A direct box or guitar cord picks up a very clean sound, which may be undesirable for electric guitar. If you want to pick up the distortion of the guitar amp, use a mic instead, or try a direct box that plugs into the external speaker jack on your guitar amp. It will pick up the amp distortion and filter it (reduce the treble) to make it sound more like a guitar speaker.

MICS

Although synthesizers and direct boxes have reduced the need for mics, you'll still want some to record vocals and acoustic instruments.

Good mics are essential for quality sound; you get what you pay for. If you can experiment with various types of mics, you'll find big differences in fidelity among them. Quality mics are made by AMR, AKG, Audio Technica, Audix, Beyer, Conneaut Audio Devices, Countryman, Crown, Electro-Voice, Fostex, Neumann, Sanken, Schoeps, Sennheiser, Shure, Sony, Teac, Toa and Yamaha.

Two mics costing at least $100 each are recommended. Although $100 may seem like a lot of money for a mic, you can't skimp here and expect to get quality sound. Any distortion or weird tone quality in the mic may be difficult or impossible to remove later on. It's false economy to use a cheap mic.

You may be able to borrow some good mics, or use the ones you normally use for P.A. Your ears will tell you if the fidelity is adequate for your purpose. Some people are happy to get any sound on tape, while others settle for nothing less than professional sound quality.

The number of mics and mic inputs needed depends on the instruments you want to record. If you want to mic a drum set, you might need 8 mics and 8 mic inputs. You would mix those 8 mics to one or two tracks. On the other hand, if you use a drum machine, you might need only one good mic for vocals and acoustic instruments. You can use one mic on several different instruments and vocals if you overdub them one at a time.

The most useful mics for home recording are probably the cardioid condenser and cardioid dynamic.

Let's take a minute to explain mic types and characteristics. There are three basic types of mics for recording: condenser, ribbon and moving coil (usually called dynamic).

The condenser mic is commonly used on cymbals, acoustic instruments and studio vocals. The dynamic mic is typically used on drums and electric-guitar amps, while the ribbon mic is delicate and should not be used in a kick drum, but usually provides a warm, smooth sound.

The condenser mic requires a battery or *phantom power* to operate. A phantom power supply is a circuit that supplies DC powering to condenser mics, using the same cable wires the audio signal uses. Phantom power is built into more-sophisticated recorder-mixers. The mic simply plugs into the mixer to receive power.

Mics also come in different polar patterns or directional pickup patterns: omnidirectional, unidirectional (cardioid), or bidirectional. An *omnidirectional* (omni) mic picks up sound equally well from all around. A *cardioid* mic rejects sound from the rear, room acoustics and sound from other instruments, resulting in a tighter, clearer sound. A *bidirectional* mic picks up from the front and rear, but rejects sound approaching the sides of the mic.

The most useful mics for home recording are probably the cardioid condenser and cardioid dynamic. You can make realistic recordings of a wide variety of instruments with these mics. Also consider a minia-

ture omnidirectional condenser mic; you can record a drum set with just two or three of these. Another popular mic for grand piano is a boundary mic, such as one of the Crown PZM series. You tape it to the underside of the raised lid.

For best sound quality, get a mic with a wide, smooth *frequency response*. This is the range of frequencies a mic reproduces at an equal level (within a tolerance, such as ±3 dB). Listed below are three quality levels of frequency response:

80 Hz to 12 kHz is good;

60 Hz to 15 kHz is very good;

40 Hz to 20 kHz is excellent.

Studio vocals and acoustic instruments often sound best if the mic has a *flat* response (±3 dB variation or less). If the mic is meant to record drums or electric-guitar amps, the response can have a "presence peak": a rise in the frequency response around 5 kHz. This is a suggestion, not a rule. If a mic sounds good to you on a particular instrument or voice, use it.

MONITOR SYSTEM

This lets you hear what you're recording and mixing. You can use a pair of high-quality headphones, or a pair of loudspeakers and a power amp. The speakers should be accurate, high-fidelity types, costing at least $100 each. Your home stereo might be good enough to serve as a monitor system.

A speaker cable goes between your power amp and each loudspeaker. This cable is zip cord or lamp cord, 12 to 16 gauge

Two typical studio-quality monitor speakers suitable for home use are the Yamaha NS-10M and the Digital Designs LS161. These are close-field monitors, which you place about three feet apart and three feet from you to reduce the influence of room acoustics. Also available are powered mini-speakers with built-in amps. Mini-speakers lack deep bass but take up little room.

If you're recording only yourself, one set of headphones is enough, but if you're recording another musician, you both need headphones. Many recorder-mixers have two headphone jacks for this purpose. If you want to overdub several people at once, headphones are needed for all. For example, if you're overdubbing three harmony vocalists, each one needs headphones to hear previously recorded tracks to sing with. To connect all these headphones, you could build a headphone junction box: an aluminum or plastic box containing several headphone jacks. These are wired to a cable coming from your mixer's headphone jack.

Figure 2. The Tascam Porta Two is a practical all-in-one mixer/recorder.

EFFECTS

Now we come to the fun little boxes. Effects such as reverberation, delay and chorus can add sonic excitement to a recording. They are produced by devices called signal processors.

The most essential effect is *reverberation*, a slow decay of sound such as you hear just after you shout in an empty gymnasium ("HELLO-O-O-o-o-o..."). Reverberation adds a sense of space—it can put your music in a concert hall, a small club, or a cathedral. This effect is usually produced by a digital reverb unit, available for $200 and up. One example is the Alesis Microverb II.

Another popular effect is *echo*, a repetition of a sound ("Hello hello hello"). It's made by a delay unit, which also provides other effects such as chorus, doubling and flanging.

Still another signal processor is a *compressor*, such as made by dbx. It's normally used as an automatic volume control for vocals. A compressor keeps the vocal track at a more-even volume, making it easier to hear throughout a mix. Home-studio units start around $125.

A multi-effects processor combines several effects in a single box. These effects can be heard one at a time or several at once. You can even customize the sounds by pushing buttons to change the presets. Some examples are the Yamaha SPX1000, Alesis Quadraverb and Digitech 128 Plus.

CABLES

Once you have all this hardware, cables are needed to carry signals from one component to another. Four types of cables are mic cables, guitar cords, patch cords and speaker cables.

A mic cable is usually 2-conductor-shielded, which means it has two wires to carry the signal, surrounded by a fine-wire cylinder or shield that reduces hum pickup. On one end of the cable is a connector that plugs into the mic, usually a female XLR-type. On the other end is either a ¼-inch phone plug or a male XLR-type connector that plugs into your mixer.

Rather than running several mic cables to your recorder-mixer, you might consider using a *snake*: a box with multiple mic connectors, all wired to a thick multiconductor cable. A snake is especially convenient if you're running long cables to

Figure 3. The Fostex R8 gives you a full eight-tracks on quarter-inch open reel.

recording equipment in a separate room.

A guitar cord is made of 1-conductor-shielded cable with a ¼-inch phone plug on each end. You use it to record instruments direct: the electric guitar, electric bass, synthesizer and drum machine.

Patch cords connect your recorder-mixer to external devices: an effects unit, stereo cassette deck and power amp. A patch cord is made of 1-conductor-shielded cable with either a ¼-inch phone plug or an RCA phono connector on each end. A stereo patch cord is two patch cords joined together.

A speaker cable goes between your power amp and each loudspeaker. This cable is zip cord or lamp cord, 12 to 16 gauge.

RACK PATCH PANEL

You might want to mount your signal processors in a *rack*, a wooden or metal enclosure with mounting holes for equipment. You also may want to install a *patch panel* or *patch bay*: a group of connectors wired to equipment inputs and outputs. Using a patch panel and patch cords, you can change equipment connections easily. You also can bypass or patch around defective equipment.

Miscellaneous equipment for your home studio includes a power outlet strip, masking tape and a pen to label inputs and cables, head-cleaning fluid and cotton swabs to clean the tape heads, and paper and pencil to keep track of what you're doing.

THREE STUDIO SETUPS

Now that we've gone over the necessary equipment, we're ready to combine it into a complete recording system. Let's put together three different home studios, each at a different level of price and sophistication. We'll assume you're using your home stereo for monitoring and cassette mastering, and you borrowed some mic stands from your sound-reinforcement system.

•A personal studio

4-track recorder-mixer	$449
2 mics ($100 each)	$200
Total	$649

(Optional effects add $200 or more.)

If your band has simple instrumentation, you might even be able to record commercial tapes and albums.

This budget system can be used to document your ideas, work out musical arrangements, or to play your song ideas to your band. It's good enough to make audition tapes for club owners and music publishers, but not good enough to make a demo tape to send to a record company.

If you want to learn the basics of multi-track recording without spending a lot, this is the way to go.

•A good-quality 4-track studio

4-track recorder-mixer	$840
4 mics ($150 each)	$600
1 digital reverb	$200
Total	$1,640

This setup is good enough to make audition tapes for club owners and music publishers, but is not quite good enough to make demos to send to record companies (although some would disagree).

•A high-quality 4-track studio

4-track recorder-mixer	$1,500
4 mics ($250 each)	$1,000
4 headphones (for overdubs)	$160
1 multi-effects processor	$400
Total	$3,060

This system is good enough to make demo recordings to send to record companies. If your band has simple instrumentation, you might even be able to record commercial tapes and albums.

All the prices given above are suggested list price; you can save money by shopping for discounts. Consider buying used equipment, too.

As we've seen, putting together a high-quality home recording system needn't cost much. There's always better equipment being produced at lower prices. That dream of owning your own studio is within reach.

RECORDER-MIXER FEATURES

Overdubbing: All 4-trackers have this feature. While listening to tracks you've already recorded, play along with them and record a new part on an unused track. For example, suppose you already recorded bass and drums, and you want to add guitar. You listen to a headphone mix of the bass track, drum track and your guitar signal. While the bass and drum tracks play, you play your guitar along with them, and record the guitar on an unused track.

Simultaneous recording on all tracks: This is especially useful for recording a live performance. Not all units permit this.

Punch-in/out: This function is used to correct mistakes. As the tape plays, punch into record mode just before the mistake, play a new correct part which is recorded and punch out of record mode when you're done. Most recorder-mixers accept a footswitch so you can punch-in with your foot while playing your instrument.

Bouncing tracks: When bouncing tracks, mix two or three tracks together and record the result on an unused track. You can then erase the original tracks, freeing them for recording more instruments. In this way, you can record up to nine tracks with a 4-track machine.

Tape speed: This is the rate at which tape moves past the record/playback head. Two speeds are available: 1-7/8 inches-per-second (ips) and 3-3/4 ips. On machines running at 1-7/8 ips, you can play standard commercial cassettes, but recordings made at 3-3/4 ips sound more crisp and clear than those made at 1-7/8 ips.

Pitch control: This adjusts the tape speed up or down slightly so you can match the pitch of recorded tracks to the pitch of new instruments to be recorded.

EQ (equalization): This means "tone control." The simplest units have no equalization; you're stuck with the sound you get from your mics. Others have a single 3-band graphic equalizer: sliding controls that affect bass, midrange and treble. Most inexpensive units include a bass and treble control, one set per input. Fancier recorder-mixers have *sweepable* or *semi-parametric EQ*, which lets you continuously vary the frequency you want to adjust. This type of EQ offers the most control over the tone quality of each instrument you're recording.

Effects loop (aux loop): This is a set of connectors for hooking up an external effects unit, such as a reverb or delay device. Effects add a professional polish to your productions.

The effects loop includes a *send* section and a *receive* section. The send section is a row of aux-send knobs and an aux-send connector on your mixer that controls the signal you send to the effects device. The receive or return connectors in your mixer receive the processed signal back from your effects unit. Inside your mixer, the processed signal (say, reverb) combines with your stereo mix to enhance the sound.

Any track on any multi-track recorder can record the sync tone, but a dedicated sync track has its own input connector for the sync tone, and allows noise reduction to be switched off for more-reliable recording of the tone.

If your recorder-mixer has no effects sends (aux sends), you can still record music, but without any effects. It will sound rather dead and plain. A unit with one effects send lets you add one type of effect; a unit with two effects sends lets you add two for even more sonic interest. A stereo return lets you hear effects in stereo, if your effects device is a stereo unit.

Some recorder-mixers have digital reverb built in, so you don't need to buy an external reverb unit.

Noise reduction: This circuit reduces tape hiss, a rushing sound like wind in trees. Dolby C and dbx work best; Dolby B is less effective, but all help you make clean, noise-free recordings.

Autolocate: Also called memory rewind or return-to-zero. With this feature, the tape rewinds to a point that you marked "000" on the tape counter. It's convenient for repeated practices of mixes or overdubs. No more searching for the right spot on tape! Elaborate machines can move between two memorized points, say, at the beginning and end of an overdubbed section.

Solenoid switches: When you push one of your tape-motion controls, the action can be either mechanical or solenoid operated. Solenoid switching is gentler to the tape, and often includes logic which protects the tape from rapid changes in tape motion.

XLR-type balanced inputs: These mic input connectors look like three small holes arranged in a triangle. If your mixer has such an input, you can run long mic cables without picking up hum. This type of connector is found only in high-end units. Most recorder-mixers use 1/4-inch phone jacks for mic inputs, which is adequate for small studios.

Insert jacks (access jacks): These connectors let you plug in a compressor (or other signal processor) in line with an input signal. They make it easy to modify the sound of a single instrument or vocal. Only the more-expensive units have this feature.

Sync track: This is a track (usually track 4) used to record a sync tone from a MIDI sequencer. The tone synchronizes tape tracks with sequencer tracks. In this way, you could have your sequencer play synthesized bass, drums and keyboards, while your multi-track cassette deck plays vocals and acoustic instruments—all in sync.

This is a great way to get extra tracks for not much money. Plus, when you do your mixdown, all the synth tracks play "live" (from the synth outputs) rather than from tape. The result is a cleaner-sounding mix.

Any track on any multi-track recorder can record the sync tone, but a dedicated sync track has its own input connector for the sync tone, and allows noise reduction to be switched off for more-reliable recording of the tone. db

RICHARD DEL MAESTRO

The All-In-One Electronic Cottage

In the January/February 1989 issue of **db Magazine**, *Corey Davidson interviewed Richard Del Maestro about his work in the article "The Electronic Cottage Moves Upscale." Here is an update by the composer about his activities and experiences.*

THE REASON I SET UP A RECORDING studio was to have a facility for my personal use. The projects I do, whether they are albums, jingles or post-production, are handled, at least primarily, at my facility. I can do better work for clients for five main reasons: 1) I can work on the project at any time; 2) I have total familiarity with the equipment; 3) my settings in the studio stay as I leave them (zero set-up and breakdown time); 4) I am able to acquire the equipment that best serves my needs; and 5) I can afford to work as long as necessary (or as I feel inspired to) without watching the clock.

INTERACTIVITY

Having a 16-track 1 in. 30 ips machine (a non-standard format), means that interfacing my studio with a larger studio takes more energy than if I had a 24-track 2 in. machine, and I could just grab a reel and go. When I built my studio, the consultant I worked with never mentioned this point of interfacing with other studios; in fact, he downplayed it.

(Even three years ago, the proliferation of this kind of facility was not what it is today. The experience of pro audio consultants with this kind of facility had not really matured yet, so it was hard to get much better advice than I got at the time. In fact, the field is still maturing, because so much depends on the kind of equipment available, and the collective feedback that can only occur after significant time with that equipment has elapsed.)

In my case, because of its performance, I opted for a machine that is too heavy to move easily (the Tascam MS 16). Had I opted for a lighter analog machine, like those using a narrower format tape, it would be easier to take my work to another facility, by just lugging the machine there, but the quality would suffer with that kind of machine. It's a double-edged sword for the smaller studio.

My advice to anyone building a new project studio is to either go with a 24-track 2 in. (perhaps still the optimal choice), or get a SMPTE syncable DAT machine, so you can do transfers between your non-compatible machine and the world of outside studios while remaining in sync. It will be interesting to see the developments in portable digital multitrack units over the next few years.

BUYING QUALITY

Another point I feel is worth considering: When I built this studio, I wanted to be able to grow into my console, so I purchased a Trident Series 65 desk, and I'm really glad I did. I've got many years of excellent service to look forward to on a desk still being manufactured (better than feeling unhappy because of a compromise on the quality of your desk, and replacing it after just a few years).

I often see articles on producers with fairly large project studios and mediocre desks, and it always surprises me. Not only has the Trident desk never failed me, but it's a fantastic console, benefiting from much of the technology developed for some of Trident's largest consoles. It's a substantial tool for the engineer, allowing for the producer's creativity, and the audio quality is excellent. If you're thinking of going with a new console, check out the manufacturers of Trident Audio's caliber before settling for a lesser mixing console.

A GREAT ENGINEER

Much has been said about the lack of human contact we producer/studio owners experience by doing everything. This can be a problem. Fortunately, the first policy I established was that I would never do my own mixes, and I have been strict with myself about this.

I'm fortunate to have found an engineer as excellent as the man I've worked with for over three years, Mike Harris. It's worth sharing my experience with him, because it serves to show what a contribution the right engineer can make in this context.

I'm in relative seclusion in this electronic cottage, since I spend an enormous amount of time working on projects. The ambiance in my space is very quiet and focused, and it would be very easy for that kind of psychic space to be violated by an insensitive engineer. Even my wife Barbara is not allowed to sing elsewhere in the house when I'm working. (That's a lot to ask a singer, and bless her heart that she actually puts up with this.)

Figure 1. The author sits among his many creative tools.

Who needs an engineer with no understanding of your personal space to come in and make you wish you were alone again? Enter my engineer. I remember reading an interview with Roger Nichols (if memory serves me) in which he said that a great engineer is not just a good technician, but also a good person with humility and a willingness to serve the producer instead of his own ego. When I found that article, I said, "Hey Mike, look at this article—it's about you." He said, "You're being too generous, thanks anyway, though." Just goes to show you how the real McCoy responds!

Harris comes in and quietly works on the mix. I like to leave him completely alone and let him do his own mix first, and when he's done, he calls me back in. Here are my reasons:

1) He's great;

2) he learns the music fastest that way;

3) he gets a chance to express himself artistically and experiment;

4) he inspires me either by showing me something I didn't imagine I'd want to use or by creating a contrast I don't want to use, thereby cementing my original vision in place; and

5) he is as willing to let go of his ideas and let me produce, as he is to try out his own mix.

If I tell him to change the whole mix and start over, rather than making me feel guilty for asking for what I want, he is right there, making me feel I can have what I want. There is no competition or sense of disappointment that I have to anticipate or endure. Harris is a great engineer, and because of it, I find our working relationship to be very inspiring.

Which brings me to my point: having a fine engineer here works at both ends of the project. It not only adds greatly to the final product, but it gets me out of that project studio rut in advance, by setting up my expectations about how the project will ultimately turn out. I cannot overemphasize what a difference it makes to have the right engineer, especially in such an intimate setting.

The head of the department that handles royalties told me, to my utter amazement, that my first check was higher than the royalty checks of some artists who get to the top 100 of Billboard's country chart!

Of course, it is important to know you've got someone whose engineering technique is excellent. In my case, I confirmed my opinion about Harris (keep your eye on this rising star) with Bernie Grundman at a mastering session for *Language of the Heart*.

EXPANSION RECORDS

Having a record company has been an incredible learning experience. I have grown to understand more about the dynamics of promoting an artist and the nitty-gritty of bringing an album to market than I could have ever imagined. I've also made good friends, including Larry and Elaine Zide at **db Magazine** and Davidson (who not only heads Davidson Electronics, the top music electronics repair firm on Long Island, but has also privately tutored me via long distance telephone calls on how to properly demagnetize the multi-track heads—now there's a true friend!).

GETTING AIRPLAY

In 1988, I released my new age album *Language of the Heart*. Since the article about me in **db Magazine**, *Language of the Heart* has been on more than 1500 radio stations here, in Europe and Japan. I've lost count of the number of stations, but the ASCAP checks keep coming in. In fact, my first check was so high I called ASCAP (in a state of shock) to thank them for doing such a great job of monitoring the airwaves. After all, new age instrumental music is not exactly the easiest thing to identify on a radio log! What do you think the ASCAP monitors refer to, the gong that happens at 02:53 in the music?

The head of the department that handles royalties told me, to my utter amazement, that my first check was higher than the royalty checks of some artists who get to the top 100 of Billboard's country chart!

He seemed even more surprised than me. The radio play has been tremendous, despite the fact that I didn't have the budget of a Windham Hill (the premier new age music label) to get me there. However, doing all that radio promotion myself has taken its toll; it was very draining to work the phones for months to the exclusion of producing music.

DISTRIBUTION

In addition to promoting the album, I had to create the machine to make sales, and I realized that building a record company is like building a locomotive; if you've got cars to pull, it's worth the expense. Without a large roster of artists, a record company is like a locomotive without a payload. It's not economical to establish distribution with the large industry record distributors unless you can give them a line of products.

It takes an enormous amount of money to manufacture and ship thousands of CDs and cassettes (not to mention the promotional copies and posters) even on just one title. Imagine my chagrin when those thousands of copies didn't produce a cent for months on end. And that's how it works; unless you can afford to front a lot of product, and wait, the lack of cash flow can kill you.

Lastly, you must have your major distribution channels already open. (I only had new age distributors on line at release time.) In my case, it was the astounding airplay that convinced the big distributors to pick me up. Coordinating a radio hit with retail distribution to get it on the shelves simultaneously was impossible. The distributors took too long to decide, and they missed the peak of my airplay. By the time the song was in the stores, it had been released for almost a year. Now that the major stores (like Tower Records and Wherehouse) no longer stock it, we get many letters from people who say 'I've searched and searched for your album, and I finally called the radio station that plays it to get your address. How can I get it?' It has been really frustrating.

STICKING TO MUSIC

Now that I know what I've been missing, I've decided to stick to music and let the people who have always aspired to own a record company do that end of the business.

There are several record companies interested in picking up my next album, and I must say the publicity and airplay will do me a lot of good in the long run. There's nothing like having a track record. For that gain alone, I'd have to say my record company venture has been worthwhile.

THE NEXT ALBUM

I am currently working on another new age instrumental album, and this time I'm using more percussion. The *Language of the Heart* album is quite contrapuntal, so the melodic focus is somewhat softer than it could be. Nevertheless, it has exhibited tremendous longevity (on the air at some major stations for three years now). I have often heard from fans that they listen to the album over and over and always hear something new. Perhaps that counterpoint has been a key factor in keeping it interesting to radio as well.

One of the more inspiring projects I've done recently, for the prestigious Reuben H. Fleet Space Theater in San Diego, is the story of the Voyager 2 Spacecraft.

My new goal is to establish a greater melodic focus on my next album, so at the very least, I expect to down play the use of counterpoint. I also want to experiment with much more percussion, as may be obvious by the working title of my next release, which I'll probably call "Wagnerian Samba."

The new age sound has been impressive in its ability to not only grow in popularity, but to appear in everything from car commercials to feature films. I believe it will continue as a distinctly identified style for a long time, perhaps another twenty to thirty years. In fact, the more speed and stress our society picks up, the more I expect new age music to grow in its relevance and acceptance. Of course, it will evolve and grow, and its content will deepen and broaden with time.

I am particularly excited about producers using more dreamy and experimental sounds and styles. To a certain extent I feel we can thank new age music for inspiring the movement towards more experimentation, not just in sounds, but in form itself.

OTHER PROJECTS

Some of the other projects I've been doing include composing and producing "The Incredible Land of Wow!" an instrumental children's album. I wrote it in the spirit of the Disney Studios tradition of composition (very orchestral), and it was quite enjoyable to do. Unfortunately, the executives who commissioned the work never released it.

I produced the title track on an album called *Coming Home* by songwriter Dennis Gersten. The assignment was interesting because the song is based on Pachelbel's canon and I think we succeeded in making it inspiring rather than trite (a danger with music that widely performed). I tried not to violate the integrity of the original piece by Pachelbel, while arranging and mixing the orchestrations so it wouldn't compete with the vocal line.

One of the more inspiring projects I've done recently, for the prestigious Reuben H. Fleet Space Theater in San Diego, is the story of the Voyager 2 Spacecraft. I really enjoyed working with Writer/Producer Dennis Mammana and the talented staff, who are responsible for the Space Theater's national reputation for innovation in their field. They have promised, however, not to continue innovating time schedules like the one they gave me for this project; they needed fifteen minutes of music and gave me seventy-two hours to do it start to finish. It would have been much harder to pull off without my own facility.

Even though I probably slept three hours during those four days, having my bedroom at hand for a nap, and the kitchen at hand for a meal, was great. Of course, those cold showers were the best help of all. And when I did finally finish, the theater's Engineer, John Young, was kind enough to meet me at the facility at 4 a.m. so he could mix the final music into the sound track in time for the Press to view it later that morning. Whew!

Most recently I produced an album of devotional music for the Sathya Sai Baba organization. There were some interesting problems, however. We recorded thirty songs over an eighteen hour period, deciding the best songs would be used for two albums. The songs were sung in a

leader-response fashion, and we didn't have individual mics and enough headphones for each of the 20 musicians who participated. In order to coordinate the music, the lead vocalist was in the same room as the response group.

On top of that, we had finger cymbals, a tambourine and an Indian drum (mridungam). Naturally, Harris was there to save the day, but separation was still quite difficult to maintain. The lead vocal retakes were quite a challenge. Due to the original lead vocalists bleeding through on the other mics in the room, the original takes could never quite be lost.

After that was done, I then decided to sweeten it with synths, and at the time, Performer was not yet able to sync its wonderful tap tempo feature with SMPTE, so I had to play everything live. Because these musicians were not all pros, this was a fairly loose production rhythmically, and it was tough to anticipate their unintentional rubato during the sweetening sessions, in order to stay reasonably in sync with the music. I am pleased with how the album turned out in spite of everything, and look forward to doing the next album using the new sync feature that now allows Performer to be programmed with a tempo map while syncing to SMPTE.

Soon, I believe, we'll see the larger studios interfacing regularly with the many project studios that are cropping up. It's the next logical revolution in our industry.

THE FUTURE

One of my future goals is to do more charity work. I've contacted a good number of charities, offering to contribute original music, a narrator and the recording time for their national PSAs or for important documentaries. I've been quite amazed at the lack of response to my offer thus far. The only one to take me up on this was The Red Cross for the Armenian Earthquake tragedy (I produced a spot narrated by my father, actor Bill Del Maestro).

I'm also experimenting with Performer's new soft-console mixing features for my next album. It's a challenge to use those powerful features to control dynamics via MIDI without impinging on my engineer's important job—doing the mix. But that's a subject that deserves a separate discussion.

FRIENDLY USER

The advent of the large number of project studios is inspiring a wonderful new dialogue in our industry. As musicians are getting more intimate with equipment, technicians are receiving better and more musical feedback. There is a greater partnership developing between those who produce and manage the hardware and those who create and produce the music.

Until now it was the tech's job to find language that musicians could relate to, but now it's becoming a two-way street (user friendly meets friendly user).

Soon, I believe, we'll see the larger studios interfacing regularly with the many project studios that are cropping up. It's the next logical revolution in our industry. Things like portable digital multi-tracks and multi-user interfaces like New England Digital's MultiArc all seem to be leading us towards establishing a basis for such a practice. When that collaboration becomes the norm, the excitement will be unstoppable and everyone will benefit. What a future! db

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DON RUSHIN

Hi-Fi to High Definition: Five Decades of Magnetic Tape

The place: London, England. The date: Sunday, Feb. 25, 1940. Twilight comes early to London at that time of year, and on this particular Sunday, it mixed with fog and smoke from thousands of fireplaces to wrap those unlucky enough to be out of doors.

INDOORS, IN FRONT OF HUNDREDS OF thousands of hearths, Londoners relaxed with their Sunday newspapers and the wireless. World War II had been a fact of life for nearly six months, but the first bombs had yet to fall. It was the era of the Phoney War, when Hitler still believed it possible to form an alliance with right-wing forces in Britain and end the war.

Suddenly, listeners who hadn't tuned their sets quite properly heard the familiar strains of "God Save the King," and an upper-class English voice announced the inauguration of the New British Broadcasting System. What followed was an evening of popular and concert music, interspersed with "news" programs designed to convince listeners that Germany and England shared the same interests and ideals in the upcoming struggle.

The New British Broadcasting System probably would have come into being anyway, but what really made it work was magnetic tape. Magnetic tape had existed in Germany on an experimental basis since 1920 and commercially since its introduction at the Berlin Radio Exhibition in 1935. What made the NBBS broadcast remarkable was the development by two *Reichs-Rundfunk-Gesellschaft* engineers. Drs.. Otto von Braunmühl and Walter Weber found that by mixing a very high frequency signal with the audio signals during recording, the results were so good it became difficult to tell them from the live performance. NBBS, which used captured commercial transmitters in Luxembourg, Belgium and Scandinavia, relied on tape for virtually all of its programming, making it possible to air the same concert at the same hour from all of them. British listeners wondered how it was being done.

Don Rushin is the Marketing Director, 3M Audio/Video and Specialty Products Division

MEANWHILE, BACK IN THE U.S.A.

Germany, however, was not the only country in which experiments with magnetic tape were being conducted. In September of 1944, the Minnesota Mining and Manufacturing Co., St. Paul, known today as 3M, already producing precision-coated "Scotch" pressure-sensitive tapes, received a request from the Brush Development Co. of Cleveland, OH. The Brush Co. was "interested in obtaining tapes coated with an emulsion containing a uniform dispersion of ferromagnetic powder." The Brush Company, under a special Navy Department Research Contract which called for a coating of iron powder on very thin backing, was, along with 3M, about to launch the era of magnetic tape.

Brush agreed to supply the powder if 3M would apply it to a sample strip of backing so that it could be tested. The task was handed over to Dr. Wilfred Wetzel who was unaware of the work which had been done in Germany. One of the first problems he faced was that the oxide supplied by Brush turned out to be nothing more than iron, and that once applied to a paper backing it continued to rust, changing its chemical and magnetic properties. Another problem was that 3M had no recorder, nor even a recording head. Furthur, Brush was being somewhat secretive about what the end product would be used for. Whatever the purpose, Wetzel realized that the coating would have to be smooth if it were not to wear out anything it came in contact with. So the 3M scientists tried a number of techniques for gluing the particles onto quarter-inch strips of paper eight to ten inches long. As fast as they did so, the samples were mailed to Brush.

In 1944, no one in the United States had yet made a magnetic tape recorder. Wire recorders, using the principals of magnetic recording, patented in 1898 by Danish telephone engineer Valdemar Poulson, were being used by the U.S. Army Corp of Engineers and our Allies (these were Armour SO wire recorders with Brush making them under licence.), but even greater interest was shown by the United States Navy Department, which was using them to record what they could intercept of German U-Boat radio messages. Much better quality recording was needed, and that was the source of the Navy Department research contract with the Brush Co.

AT THE WAR'S END

By the end of the war, the Allies were aware of the magnetic recorder developed by German engineers, a recorder that used an iron oxide-powder-coated plastic tape, which achieved much better sound quality than was possible with phonograph disks. A young Signal Corps technician, Jack Mullin, became part of a team assigned to examine materials left by the retreating German army and to pick up items of electronic interest. He found parts of recorders used in the field, and working tape recorders and ¼-inch tapes in the

Figure 1. At a WWII Radio Stuttgart installation, an operator threads a Magnetophone tape recorder. Photo courtsy The Pavek Museum.

studios of Radio Frankfurt in Bad Nauheim as well as elsewhere.

Almost simultaneously, 3M physicist, chemists and lab technicians were developing for Brush and the Navy, a magnetic-coated tape with a smooth surface and a uniform dispersion of ferromagnetic powder that would withstand being drawn over a magnetic head to record clear electromagnetic signals. The goal was to produce a tape for high-fidelity magnetic recording. By 1945, the first American workable magnetic tape product came into being.

At war's end in August of 1945, the Brush Co. informed 3M that its Navy Department contract work was finished, and that further development work on the magnetic tape was to be conducted directly with Brush. The previous year's research had proved costly for 3M and, as yet, had produced not a cent in revenue with prospects for any future return seeming remote. But 3M elected to finance its own research based on the potential for extensive post-war application.

At first, 3M management considered being a contract supplier of finished product to Brush, and perhaps others. But the prospects of being merely a producer, with huge development costs and growing awareness that others were experimenting with tape and many more beginning to show interest in building recorders, turned their decision towards eventual inclusion of a magnetic tape in the 3M tape products line.

As months added up and scores of experimental magnetic tape constructions were worked through the labs, funding questions became serious; 3M considered putting the whole project in abeyance since no further orders were forthcoming from Brush. Fortunately for 3M, and, indeed for today's multi-billion-dollar magnetic recording industry, there were farsighted men in 3M who, by force of argument and enthusiastic evidence, kept the project alive and advancing. 3M physicist Wetzel foresaw a broad magnetic tape potential in "pulse recording, to

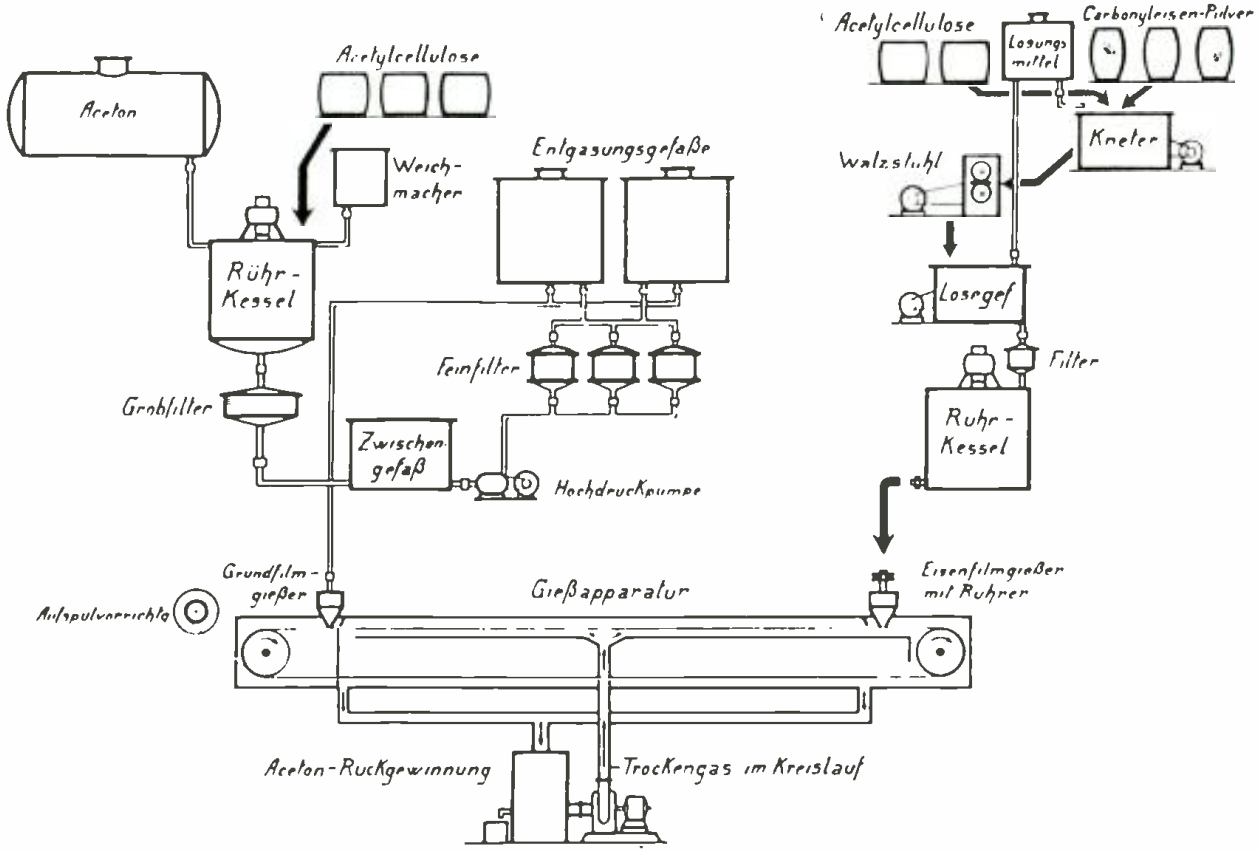

Figure 2. This coating process for tape was used in Germany as early as 1933.

apply to all kinds of handling." He also concluded that since sound could be recorded magnetically, the step to magnetic television pictures would be highly practical. He saw both requiring tape, which had potential for much higher signal density than wire or steel ribbon.

In January of 1946, 3M learned that Brush was developing a tape recorder to show in New York. The project at the 3M laboratory accelerated with binders and backing improvements progressing rapidly. By May of 1946, large usable quantities of paper-backed tape were already being produced.

THE IRE MEETING

On May 16, 1946, Jack Mullin was scheduled as the speaker at the regular meeting of the San Francisco chapter of the Institute of Radio Engineers, held at the studios of radio station KFRC. A demonstration of the German tape recording equipment had been promised, and the room was packed. Mullin played recordings of an orchestra, vocalists and a pipe organ that he'd made on some of the tapes he brought back with him, and the reaction was little short of a sensation.

One of those who heard about the demonstration was Frank Healy of Bing Crosby Enterprises. Healy believed that Mullin and his machines might provide the solution to a ticklish problems for the singer. In the 1940s, all programming, at least on the "prestige" networks (NBC, CBS and the fledgling ABC), was done live. Broadcasters and sponsors alike believed that transcribed shows—those recorded in advance on 16-inch discs which revolved at 33 ⅓ rpm—sounded inferior and audiences would resent their "canned" quality. But Crosby, one of the highest-rated performers in the NBC stable, had insisted on freeing himself from the weekly grind of appearing live at the microphone. He sat out the 1945-46 season entirely, and came back only when third-ranked ABC promised to let him pre-record the (now called) Philco Music Hall—but only as long as the ratings remained high.

To Murdo McKenzie, Healy and Crosby's technical director, that meant recording bits of the show on a series of discs, then re-recording from one to another to produce a finished show. It was expensive, time-consuming, and most of all, sounded bad—particularly when one section had to be re-recorded two or three times.

Accordingly, one day in August, 1947, Mullin was called in to record the first Crosby show of the upcoming season on his German equipment, while Healy and McKenzie recorded it on disc. "The result of the demonstration was that the Crosby people wanted me to stay right there and go through an editing process, to make a broadcast out of it. I did, and they saw how easy it was with tape. The next thing I knew, I had a job recording the Bing Crosby Show for the rest of the season."

The problem was that Mullin had only his two rebuilt German recorders and fifty reels of German recording tape for the task—luckily for him by 1947 3M could provide replacements with a commercial product on a backing of acetate film rather than the earlier paper samples they had made.

HIGHER COERCIVITY

Mullin also faced another problem—the 3M tape was incompatible with the German machines, which couldn't handle the tape's higher coercivity. Wetzel and his associates went back into the lab to come up with a tape which would work on

them, and on the 12 audio recorders Ampex Corp. was rushing to complete for the American Broadcasting Company. Crosby had been instrumental in persuading the network to buy the machines, copied from Mullin's German originals.

It's worth noting that when the Philco Music Hall aired on the night of Oct. 1, 1947, it was broadcast from a 16-inch disc rather than from the tape Mullin had recorded in August. McKenzie and his crew, after having assembled just the show they wanted from Mullin's master tape, put it on a disc for the purpose. After one or two shows, they decided to gamble on broadcasting directly from the tape—but just in case the tape should break there was a musician standing by in a little studio ready to go on the air with a piano recital.

That practice persisted not only at network studios but also in the studios of larger stations around the country for a year or two, until broadcast engineers discovered that tape simply didn't break. Once ABC began to switch to tape, it made two copies of each program and started them simultaneously on two different playback decks. If one were to fail the engineer had only to switch to the backup, missing hardly a syllable.

TAPE USE SPREADS

ABC's love affair with magnetic tape soon spread to the other networks, who planned to use it to facilitate the switch from standard to daylight time at the end of April, 1948. It wasn't until Program #27 of the Crosby show that 3M began delivering tape, and then in very limited quantities. Everybody wondered whether the tape supplier would be able to meet the April deadline.

Somehow they did—but just barely. Mullin, in order to make his 50 reels of German tape last until reinforcements arrived, saved every scrap, every edit, and spliced them together for reuse. Splicing tape at the time meant "Scotch" sticky tape with a dusting of talcum powder. Mullin remembers checking each splice on a just-broadcast reel, then reassembling the tapes for use again in the next week. (Mullin also recalls that 3M came out, whle the Crosby tapings were going on, with true splicing tape essentially similar to what is used today, thus ending his sticky-tape-with-talcum routine.)

Very much the same thing happened at the ABC studios in Chicago when the network got its first recorders. When the network signed off after midnight, a pair of 3M technicians got busy checking every splice in every tape so they could be reused the next day. Somehow, they managed to finish just in time for sign-on the following day. During the 22 weeks that went on, the station lost only three minutes of air time due to tape or splice failure. A historical footnote—although ABC had been the first network to embrace recording tape, it was one of the last to put full confidence in it as an archival recording medium. When Lee Harvey Oswald fired at President John F. Kennedy in Dallas, TX, on Nov. 2, 1963, ABC engineers realized that history was being made. They dusted off the transcription turntables and captured all of the events of that long weekend on a series of discs. Other networks recorded their coverage on tape. It was the last hurrah of the electrical transcription.

Fear of tape breakage was ever-present in those early days—not because it actually did, but because of a history of breakage with some tape forerunners. Even Mullin, who knew the medium better than anybody, was never sure how his splices would hold up to the high tensions of those early recorders.

In the 1930s, the British Broadcasting Corp. had acquired several Blattnerphones, recorders which used ribbons of steel as the recording medium. Editing was done by cutting the ribbon with tinsmith's shears and soldering it back together. Occasionally the soldered joints would come apart and engineers dove for cover as the steel strip thrashed about. And one of the problems with the paper tape used on the early Brush Sound mirror recorders was that it couldn't stand up to fast braking on the machines.

Gradually, the musicians hired to stand by lost sinecure, and transcription turntables began to gather dust. Tape moved form the control room to the recording studio, where it was to have a profound effect on all forms of music and on the nation's listening habits. And just as 3M and Ampex had met the Crosby and ABC deadlines, they were able to meet the Daylight Saving deadline of 1948, if just barely.

VIDEO TAPE

While 1948 was audio tape's year, it was also the year when 3M Engineer Bob Herr proposed the idea of recording pictures as well as sound by using a wide tape at a speed of 15 inches per second past a rapidly-rotating head assembly. Nothing much came of it just then; when Bing Crosby Enterprises' Jack Mullin and 3M's Wetzel demonstrated the first black and white video recordings in 1950, it was with a fixed-head brute-force recorder which consumed 7,000 feet of tape in 15 minutes.

However, videotape really dates from April 15, 1956, when the 31st annual convention of the National Association of Radio and Television Broadcasters opened at the Conrad Hilton Hotel in Chicago. Ampex planned to show its first commercial video recorder, the VR-1000, which recorded at a head-to-tape velocity of 2,000 inches per second and a tape speed of 15 inches per second. 3M had supplied instrumentation tape as the recording medium.

The day before the show was to open, one of the Ampex staffers decided to try out the new tape. With horror, he discovered that it just wasn't up to the high-frequency demands of the VR-1000 and placed a phone call to Wetzel in St. Paul. Ampex had been cagey about what kind of machine the tape was to be used on, no doubt fearing that 3M might jump into the video recorder business on its own. Because Wetzel had been doing his own research on video tape, he had a pretty good idea what Ampex was up to. Nonetheless, the Ampex engineer, out of desperation, was forced to outline in detail exactly what the new tape was supposed to do. Could 3M do it—and in time for the debut the following day? Wetzel thought so, and put a team of technicians on the job. They worked through the night, coming up with sample after sample.

OFF TO THE AIRPORT

Finally, by 6:00 a.m., they'd produced a sample that worked, and coated two five-minute reels worth of it. But Wetzel had already left for the airport. Vic Mohrlant, a technical services engineer grabbed the samples and dashed to the airport hoping against hope that Wetzel's

flight had been delayed. For once, it had not. It was out on the runway waiting to take off. Mohrlant dashed out onto the tarmac, found a member of the ground crew who had a pole long enough to reach the cockpit, and persuaded the pilot to stop. Fastening the package onto the end of the pole, he shouted that it was an emergency package for Dr. Wetzel aboard the flight. The pilot, no doubt concerned about a medical emergency, pulled the pouch off the pole and passed it back to his passenger.

The video-tape demonstration by Ampex on April 15 caused the same kind of sensation that Mullin's IRE session had ten years earlier. Hardheaded engineers and front office men were on their feet cheering as they rolled those first two reels. Many rushed to the stage to get a closer look. And orders for both tape and recorders piled up.

THE FIRST VIDEO TAPED BROADCAST

This time, the honors went to CBS, which bought the first commercial reel of Scotch 179 videotape. The network used it to record *Douglas Edwards and the News* the night of Nov. 30, 1956, for delayed broadcast in the Central, Mountain and Pacific time zones.

History was about to repeat itself. All three networks had decided to make the change-over to Daylight Time on April 28, 1957. Again there was a mad rush to produce enough recorders and enough tape to make this possible. In fact, by April 28, the networks had no more than 50 useable reels among them, each with a price tag of $248.95.

This time, there was no concern among professionals about the possibility of tape breakage—but there were other worries. What would happen if a reel of the stuff containing an important program were placed in a magnetic field, or stored on top of a radiator or warm studio console? What effect would it have on unionized jobs?

What they weren't concerned about, according to some engineers, was the effect of dust and dirt. One of 3M's biggest problems in meeting the April 28 deadline had been in coming up with perfect reels of tape. The smallest scratch, a wayward speck of dust or dirt in the coating, microscopic damage to tape edges were enough to reject a reel of videotape; in early runs, two-thirds of those produced had to be thrown away. To keep dirt out and reduce the effects of humidity, 3M packed its videotape in sealed transparent polybags. Yet stations and networks, used to handling film, asked for a return to the foil-lined black paper wrapping which had been used for film instead. Eventually, they learned the hard way that when it comes to videotape, cleanliness is more than just a fetish.

Once ABC began to switch to tape, it made two copies of each program and started them simultaneously on two different playback decks.

Videotape spread rapidly for transmission and in delayed broadcasting of programs. But it was slow to catch on in program production and the shooting of commercials, despite its very obvious advantages and economies. One reason was the editing process which was different than film, and electronic editing still lay a few years in the future.

A more important reason lay in human reactions to the new medium. One of the perks in the production of some of the more elaborate commercials was the sending of everybody—camera crew, director, performers, account executives, etc., to exotic locales for two or three weeks of shooting. "For many of them, it represented a mini-vacation, and they didn't want to give it up for two or three days' work in a New York studio," one old-timer recalls. Another complaint involved the sponsor's or client's representative at the shooting. He'd always been there, but with the appearance of tape he could see results immediately. Directors and producers resented "outsiders" second-guessing them, calling for just one more take.

TAPE IS NOW RECORDING HISTORY

Nonetheless, by the summer of 1959, video tape had become as accepted a part of television as audio recording was of radio and the music industry. That summer, the United States Information Agency had set up an exhibition in Moscow which included, among other things, a model American home complete with well-appointed kitchen and a color television studio, with its own video recorder. On July 24, Vice President Richard Nixon invited Soviet Premier Khrushchev to visit it with him. Khrushchev found the TV studio fascinating and readily agreed to step before the color camera to make a few remarks, then see himself played back on tape. Nixon joined him and before long the subject had turned from lighthearted pleasantries to a full-blown debate on the relative merits of capitalism and communism.

Oblivious to the red eye winking at them from the front of the camera, the two progressed to vigorous thrust and parry. An Ampex official in attendance reminded them of the tape, which continued to run. Khrushchev, shown how to operate the controls of the recorder, rewound the tape and played it back. Nixon persuaded him to agree to let it be seen in the United States, but Khrushchev insisted that it be translated in full and played unedited. To make sure that it got out of the Soviet Union, Ampex International President Philip Gundy rushed back to his hotel with it, wrapped it in a dirty shirt and booked the first flight home.

By the time it was broadcast the next day, American newspapers had reported the event as an exchange acrimonious enough to start World War III. What the viewers actually saw, however, was the two leaders in earnest and sometimes animated discussion, but by no means ready to launch the missiles. The tape has been hailed as a milestone in communication as well as an historical document in its own right.

During the late 1950s and early 1960s, ad men and program producers learned not only all of the economies possible from shooting on tape, but a variety of electronic tricks which simply can't be performed on film. With the launching of high definition TV, at least for the production of programs, commercials and rock videos, technicians will be mastering a whole new portfolio of techniques and stunts as well as adopting what works from existing formats. One thing the history of magnetic tape teaches us: the more things change, the more they stay the same. db

MUSICIANS' NOTEBOOK

MARK MAULUCCI

Practical Guitar Synthesis

• This month's forum is about guitar synthesis. It's here to stay and it's invaluable because it opens doors previously shut to guitarists. It's our key to MIDI City and enables us to harness today's technology for our music.

Guitar synthesis has been around for well over a decade. Both the Roland GR-5000 and the Arp Avatar were introduced in the mid-70s. In fact, Roland's pitch to voltage Hex pick-up has remained virtually unchanged to this day. What has changed though, are the conversion and sound modules and the advent of MIDI in all its splendor. MIDI has become a universal and sophisticated binary musical language and what's more, sound technology has made digital synthesizers, samplers and sequencers affordable to many.

Like many guitarists, I held out for years before buying a guitar synthesizer. I bought a keyboard synth first! I tried guitar synths out in music stores and even took some home. I remained interested, but skeptical. I knew I'd recognize the right one when it came along.

The right one for me was the Roland GM-70 which came out in 1986. We haven't parted since. The beauty of this piece is that it allows me to use my own guitar while controlling the many aspects of MIDI. I just attach the GK-1 pick-up on my Telecaster with putty (!) and it works like a dream. Many people worry about having to mar their instrument with a synth pick-up installation. A more permanent set-up is certainly possible with the screws and springs provided, but I opted not to put holes in my guitar. I preserve the beauty of my instrument and play the axe of my choice!

The GM-70 has since been discontinued by Roland, being replaced by the GR-50 which is probably a better package all around. It's a multitimbral sound module as well, based on the same L/A (linear arithmetic) synthesis as Roland's D-series synths. The GM-70 was a MIDI converter and controller only. It was necessary to have external sound sources. I did and still do, so I'm hanging on to it.

There are many guitar synthesizers on the market at many price points. The first thing the prospective customer must realize is that there is no such thing as perfect. The very attributes that make guitar the wonderfully expressive and individualistic instrument it is also serve to render it a less than ideal MIDI controller. Unlike a keyboard, it will not register perfect note on note off commands. The vibration and pitch variation of the strings, the resonant harmonics, characteristics of body materials, scale length and actual playing technique are all factors that enter into this equation. There is no right or wrong in choosing a guitar synthesizer. You can spend hundreds or thousands of dollars.

PICK YOUR OWN

Individual preference and budget requirements hold sway here. There are several different approaches utilized, each with its own set of advantages. Various technologies have included laser, light, sonar, mechanical and pitch to voltage, among others. In addition to Roland, Yamaha, Casio and Korg, all have existing models. The Casio is self-contained with the sounds and MIDI implementation inside the actual guitar. Ibanez, Steppe, Pitchrider, SyntheAxe and a few others have come and gone. Some guitar controllers have been rather unorthodox in their shapes and sizes, not to mention their string configurations. Some folks take to these because they may "track" faster, while others do not. Personally speaking, I thought they made guitar synths so I didn't have to learn to play a new instrument.

All the various guitar synths have their merits and you should choose the one that's right for you. Many guitarists seem to view the synth as one big effect. On the surface it might seem so; in the hands of a jazz player, playing BE BOP lines with a horn patch could be quite effective. The finger picker can control an entire ensemble with the different strings set to different instruments and pitches. String velocity (how hard you pick) can control mixes or layers of tones for staggering effect in a live situation.

The guitar synthesizer allows the player to add the colors he's always wanted to his palette of sounds. This in itself is very exciting and was long held exclusively in the domain of the keyboardist. For authenticity, I'd suggest the player approach each sound in the spirit in which it has evolved. The bar chording and finger-tapping of flutes just doesn't make it for me. Then again, that's an individual's choice and art is freedom of expression. Undoubtedly, the guitarist will come up with sounds and approaches. Also, many synth and sample patches such as piano and drums will sound more realistic and will track faster when plucked instead of strummed.

There is another aspect of guitar synthesis that is just as important as the control of sound—control of MIDI performance data. We can actually sequence a composition for live or studio performance from the guitar controller. I'm not good enough on keyboards to be considered a bad player. Other than programming percussion and playing three voice chords, my keyboard chops are virtually nil. Imagine my

past frustration in not only representing keyboard production for a manufacturer, but not being able to utilize this great technology for my music in my studio. I felt like I was on the outside looking in, a second class citizen. That all changed when I could control MIDI from my guitar. Now I can write bass lines, horn parts and more into my sequencer. I can edit out mistakes and glitches which is one of the great advantages of sequencing. I tend to play solos "live" on a recording or in a performance with my backing tracks sequenced.

THE TECHNICAL SIDE

I haven't spent much time on the technical side of guitar synthesis. "Tracking" and "glitching" are the buzzwords and phenomena you'll encounter in this arena. Tracking refers to how long it takes for the synth to sound a note played on the guitar. Depending on the technology used, there will always be a certain amount of delay time between the actual picking of the string and its resultant sound from a sound source. Glitching is the occurrence of undesirable blips and bloops along with the notes we intended to play. Cleaning up our technique will go far in alleviating this problem. Many of the organic slurs and slides that we rock and blues guitarists spent years cultivating have no place here. The guitar converter is only interested in accurate note information. This is not to say that bending and other techniques won't work. (Speaking of bending, save yourself a lot of grief and turn the bender information off when you're sequencing. You can't believe how fast you'll run out of memory on your sequencer.)

PITCH TO VOLTAGE

I think pitch to voltage is the most practical in terms of least dollars invested and playing adjustment. You have to deal with the fact that the thicker the string and the longer the scale length, the slower the tracking will be. Using thinner strings (some controllers use all B strings) can help track faster. I take my chances with the standard 0.010-0.046 gauge. Again, I want to play my guitar and it's handy to switch from guitar to MIDI or blend the two without having to change instruments.

For most patches like flute, strings and brass, tracking is not a problem. There can be a noticeable delay in patches that have fast attack times like piano and drums. Again, I recommend plucking instead of picking. In the case of long scale length impeding the tracking of bass sounds and sequencer data, I utilize the trick of playing the bass lines up past the twelfth fret. The scale length is shorter and it tracks great. I transpose the pitch down an octave or two for the notes I want.

I could never sequence my songs without my guitar converter. The longer you wait, the longer you're locked out of MIDI City!

Next time: The Guitarist in the MIDI Studio. db

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db magazine

serving: recording, broadcast and sound contracting fields

Buyer's Guide—Speaker Systems, Performance and Studio Monitor

- On the pages that follow, you will find a Guide to speakers, both studio monitors and performance/stage types, each treated separately. The Guide is in chart form and is immediately followed by manufacturers' adressses.
- As usual, be aware that we attemp to contact every manufacturer but not all are prompt or cooperative enough for our necessary deadlines.

MONITOR SPEAKERS

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
ALTEC LANSING															
M600	26 22 17	black	black	8	60-20k	16	cone					1.5	66	$1,714.00	Full range sound; highly accurate sound reproduction contains famous Altec 604.
APOGEE SOUND															
SSM		black epoxy	black foam	16 4	280-21k	4.5	cone			1					Designed for linear, high power output.
AE-3M	16 12.5 12	black epoxy	black foam	8	70k-18k	1-10	cone			1	horn		44		same
AE-4M	14 14 23.25	black epoxy	black foam	8	55-16.5k	1-12	cone			1	horn		78		same
AE-6	14 23 15.5	black epoxy	black steel	8/8	53-17k	1-12	cone			1	horn		78		same
AE-6B	14 23.25	black epoxy	black foam	8/8	53-17k	1.12 14	cone			1	horn		78		Designed for linear, high power output.
CELESTION INDUSTRIES															
C 3	12 8 9	black Ash	black cloth	8	75-20k -3	5	cone			1	dome	5k	8.4	$280.00	Has open uncolored sound and low price favorite with studios and sound contractors.
CERWIN-VEGA															
CM-8	20 11 10	black vinyl	black cloth	8	30-20k	8	cone			2.25	horn	3k	49	$150.00	Ideal as main speaker system in a small room or console mounted for nearfield listening.
CM-10	23.5 14 10	black vinyl	black cloth	8	30-20k	10	cone			2.25	horn	3k	34.5	$200.00	Ideal as main speaker system in small rooms.
CM-12	23.5 14.25 14	black vinyl	black vinyl	8	32-20k	12	cone		6	cone		3.5k	44	$350.00	Can generate 112dB in a medium-sized control room.
COMMUNITY LIGHT & SOUND —See our ad on page 22															
CSX28M	14 15 22.25	black carpet	black steel	8	70-18k	12	cone		1		horn	300		$355.00	2-way 12 in. woofer wedge stage monitor.
CSX38M	17.5 17.5 25	black carpet	black steel	8	60-18k	15	cone		1	horn		2500		$411.00	2-way 15 in. woofer wedge stage monitor.
ELECTRO-VOICE															
FR12-2	25.5 41.9 22.2	veneer		8	80-18k 3	12	cone			1.5	dome	1.5k	28		All Sentry series monitors
PI100	61 38.1 21.6	vinyl		8	80-18k 3	15	cone			1.5	dome	1.5k	23.7		
FR15-2	72.1 80 42.2	veneer		8	50-15k 3	12	cone			90x 30	horn	1.5k	43.5		
FR200	25.5 41.9 22.2	veneer		8	50-18k 3	12	cone			1.5	dome	2	51		Sentry series
FM-1502ER	28.7 13.8 24.4		black grille	8	65-20k 3	15	cone			90x 40	horn	1500	72.2		
FOSTEX —See our ad on page 11															
LS-2		wood veneer	optional				12	cone		comp		horn			All custom-made and installed reference models. Individualit tuned for each installation.
LS-3		wood veneer	optional				2-15	cone		comp		horn			same
LS-4		wood veneer	optional			1-112	2-15	cone		comp					same
JBL PROFESSIONAL															
Con-trol 1	9.25 6.25 5.63	black	black metal	4	120-20 3	5.25	cone			.75	dome	6k	4	$250.00	
Con-trol 5	15.25 9.88 9	black	black metal	4	75-20k	6.5	cone			1	dome	3k	10	$395.00	
4435	35.25 38 17.13	oiled walnut	blue fabric	8 3	30-16k (2)	15	cone				horn	1k	240	$2,395.00	
4406	15.38 9.38 8.5	oiled walnut	blue fabric	8	55-20k	6	cone			1	Ti dome	3k	17	$250.00	

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
4408	17.25 12 11.63	oiled walnut	blue fabric	8	50-20k	8	cone			1	Ti dome	2.5	26	$325.00	
4410	23.5 14.25 11.25	oiled walnut	blue fabric	8	45-20k	10	cone	5	cone		Ti dome	800 4.5	43	$495.00	
4412	14.25 23.5 11.25	oiled walnut	blue fabric	8	45-20k	12	cone	5	cone	1	Ti dome	800 4.5	47	$750.00	
KLEIN & HUMMEL (GOTHAM AUDIO CORP.)															
098	15 10 7.25	gray	black cloth	4.7	50-16k 2.5	8	cone	1.5	dome	.75	dome	800 6k	26.4	$1,400.00	Active, tri-amplified, 2 electronic X-overs with location dependent equalizer. (amps:1-100W, 2-50W).
096	20.7 12.4 11.4	gray	black cloth	4.7	50-20k 2.5	10	cone	2	dome	.75	dome	600 4k	48.4	$2,400.00	Active, tri-amplified (3-60W), 2 electronic X-overs with location dependent equalizer.
092	31.5 17.3 11.8	gray	black cloth	4.7	50-17k 2.5	10 (2)	cone metal	3.5	cone	1	dome 3k	500	66	$4,500.00	Active, tri-amplified (1-120W, 2-60 W), 2 electronic X-overs with location dependent equalizer.
MARTIN AMERICA															
YRS 1000	22.5 51 26	black	black metal	8B 8M 16H		18						220 1.5	238		3-way all horn loaded. Vertical format. One box system.
F2	22.5 42 25	black	black metal												2222 lbs. is unloaded weight. Can accept variety of horn and driver comb.
F2 Bass	22.5 42 36.5	black	black metal	8	15								235		
MEYER SOUND LABORATORIES INC.															
833	32 20 14.75	black satin/ walnut	cloth	8	35-18k 3	15	cone				rad horn		115	$6,300.00	Ultra-low distortion with high continuous output.
834	38.5 24.13 20.13	black satin/ walnut	cloth	System Load 4R	30-18k	18	cone						127	$1,800.00	Subwoofer for 833 system.
HD-1	16 12 16	Black satin			32-22K 40-20k 1	8				1 dome	silk		51	$4,135.00	Self-powered near field reference monitor corrected for amplitude and phase accuracy. (Biamplified) system
PANASONIC/RAMSA															
WS-A10	8 12.5 8	black resin	black metal	8	80-16k	6	full-range cone						6	$120.00	Compact full-range, near-field monitor. Magnetically shielded. Accessories opt.
WS-A10	6.1 6.1 9.8	white black mold	white black metal	6	80-16k 5	4.7	cone						5.7	$120.00	
PROFESSIONAL AUDIO SYSTEMS															
SM-1	25 19.5 18.5	oak black	black cloth	8	37-20k 3	15	cone			7.25 4.25	horn	1.2	100		Biamplified 2-way studio monitor designed for midfield applications, horn and the ability to play at high levels.
SM-2	25 19.5 18.5	black paint	8	35-	20k 3	15	cone	7.25 4.25	cone	2	horn		190	$10,500	3-way studio monitor with time offset correction.
SM-3	36 36 24	black paint		8&4 ohms	27-20k	15	cone	15	cone	7.25 4.25	horn	100 1.2k	210		The SM3 is a 3-way triamplified studio monitor system for very large control rooms wanting high levels, and extremely low bass.
STUDER REVOX AMERICA INC.															
2706	12 15.1 13.5	dark gray nextel	black anod alum	4	42-20k 3	12	cone	2	dome	1	dome	720 5k	48	$825.00	Compact. Can be installed on floor stands or suspension brackets. High power dome transducers.
A723	22.9 12.7 16	wal-nut	black cloth		40-20k 3	12	cone	5	cone	1	dome	300 27k	68	$1850.00	Each crossover has dedicated 100w amp. Useful in small to medium sized listening environments.
TANNOY NORTH AMERICA INC.															
PBM 6.5	11.88 8 8.5	pewter gray	black material	8	57-20k 3	6.5	poly cone			.75	dome	2.6	10 pair	$350.00	High sensitivity and power handling, rear firing tuned. Portable, compact-sized enclosure, ferrofluid cooled polyamide dome, five-year warranty.
PBM 8	15 10.13 10.63	pewter gray	black material	8	47-20k 3	8	poly cone			1	dome	2.4	18.5 pair	$500.00	High sensitivity and power handling, extended low frequency response, Polyamide dome, five-year warranty.
System 2	15.8 8.8 9.4	gray vinyl	steel mesh	8	55-25k 3	6.5	poly cone			1	dome	3k	28.8	$550.00	Bi-wired gold-plated terminals, hard-wired crossover network, energy control enclosure.
System	18.1 9.1	lami-	black	8	48-25k	8	poly			1	horn	2.3k	26.4	$1,000.00	high sensitivity with high power sensitivity.
System 10	22 14.3 11.4	lami nated	black wood	8	46-25k 3	10	poly cone			1	horn	2.3k	41.9 each	$1,500.00	full-range point source phase coherent DMT. Bi-wired gold-plated terminals, DMT energy controlling enclosure,
System 12	25.4 16.5 11.4	lami-nated	black wood	8	44-25k 3	12	poly cone			1.25	horn	1.5k	57.3 each	$2,000.00	full-range point source phase coherent DMT. Gold-plated terminals, hard wired crossover. controlling enclosure, five-year warranty.

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
System 15	33 21.6	lami-nated	black wood	8	38-25k 3	15	paper cone			1.25	horn	1.5k	99.2 each	$3,500.00	full-range point source phase coherent DMT. Gold-plated terminals, hard wired crossover,
System 215	17.3 35.7 30.9 21.8	lami-nated	black wood	8	35-25k 3	15	paper cone			1.25	horn	250 1.5k	187	$5,500.00 each	Energy controlling enclosure, Point source phase coherent DMT 15 in. bass driver,crossover network,
TECHNICAL AUDIO DEVICES															
TSM-1	43.31 35.44 28.06	maple	black	4	29-20k	2 16	cone			2	90 40	650	319	$7,500.00	Designed for use in large studio control rooms.
TSM-2	26 31.44 24.19	maple	black	8	29-20k	16	cone			2	90 40	650	205	$5,750.00	System for small control or editing rooms.
TOA ELECTRONICS															
265-ME-AV	13.8 8.1 9.6	gray poly	black jersey	8	60-20k 3	6.3	cone	1.2	dome			3k	11.5	$398.00	Magnetically-shielded components, smooth crossover, wide dispersion pattern.
280-ME	15.7 9.3 9.3	gray poly	black jersey	8	60-20k	7.9	cone	1.2	dome	0.79	dome	1.5k 14k	15.4	$518.00	same
312-ME-AV	22.88 13.2 11.6	gray poly	black jersey	8	50-20k	11	die-cast frame	4.7	cone	1.2	dome	500 5k	35.7	$869.00	same
UREI															
809	23 16.5 13.5	black paint		8	50-17.5k 3	12	co-axial						60	$895.00	
811C	20.75 26.25 17.5	black paint		8	70-17.5k 3	12	co-axial						110	$1,890.00	
813C	35.75 31 22	black paint		8	50-17.5k 3	12	cone	12	co-axial				198	$2,590.00	
815C	32 43.5 21	black paint		8	40-17.5k	12 (2)	cone	12	co-axial				240	$3,390.00	
YAMAHA CORPORATION OF AMERICA															
NS10 MS	8.5 15 7.75	black wood	black cloth	8	60-20k	7	sheel formed			2.4 dome	soft	2k	13.2	$237.50	Industry-standard studio close-field monitors. Available for commercial version.
NS40 M	23.5 11.5 12	black wood	black cloth	8	30-20k	7 (2)	sheet formed	2.4 dome	soft dome	1.2 dome	soft 5k	1.2k	37.4	$465.00	Bigger version of the NS10MS with greater low-end response.
S10X	6.125 9.5 6.5	black	black metal	8	65-20k	4	carb fiber						6.2	$145.00	Very compact wide range system. Handles up to 150 watts of program material.
S20X	7.5 11.625 7.75	black	black metal	8	65-20k	4 (2)	carb fiber						4.6	$210.00	Compact dual-driver wide range system. material.
MS101	8.5 5.8 7.7	black metal	black	10	30-20k	4	full range						4.9	$125.00	Has mic and two line inputs, volume and tone controls.
MS202	8.5 11.5 7.7	black	black metal	20		4	full range						8.8	195.00	Wide range with mic and three line inputs, Volume and tone controls.
MS60S	10.5 17.5 9.5	EMI mater-ial	black metal	60	20-20k	8					comp horn		22	$575.00	Features Active Servo Technology giving high power and extended bass response in a compact package.

PERFORMANCE SPEAKERS

ALTEC LANSING															
937	24 18 16.3		black metal		70-15k	12	cone				const direc		49	$950.00	Two-way loudspeaker system—rugged, reinforced construction, 150 watts.
M200	17 9.5 8.5	black	black nylon		65-20k	6.5	cone				3500		17	$400.00	Easy installation in 8 ohm or 70V distributed application. Excellent for near field monitoring.
554A	9.6 7 5.3	black	black nylon		90-20k	4	cone				3500		4.6	$398.00	Compact, weather-resistant system has versatile omnimount brackets included.
M500	33 26.5 17.5	black	black	8	46-20k	10	dir. rad.				630		4	$1,398.00	Front mounted components—2-way vented system.
M400	23 17.75 17.5	black	black	8	80-20k	12	dir. rad.					2k	43	$799.00	Compact size with "big" source, 1 in throat, 150 watt power handling.
M300	22 12 9	black	black	8	50-20k	8	cone				3500		35	$550.00	Accurate sound reproduction for studio playback and nearfill applications, with 75 watts power handling.
APOGEE SOUND															
3X3	45 29 22	black epoxy	black steel	8L 8M	53-19k	15	cone	2	horn	1	horn		265		Designed for high power output, tight pattern control, warm musical response and maximum versatility.

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
AE-1	10.25 16 8	black epoxy coat	black foam coat	8	63-19k	8	cone			1	horn		18		Designed as a foreground music system and for theatrical fill applications,
AE-2	32 5	black	black	16	63-19k	8	cone			1	horn		38		Ideal choice for theatrical and church fill
AE-3	16 12.5 10	black	black	8	70-18k	10	cone			1	horn		40		For front fill speakers.
AE-4	23 14 14	black	black	8	55-16.5k	12	cone			1	horn		70		for high quality music or speech reproduction.
AE-5	23 14 16	black epoxy coat.	black foam	8	53-17k	12	cone			1	horn		78		Performs as stand alone unit. Also installed to form large arrays.
AE-10	22.5 32 24	black epoxy coat.	black foam	8	38-120k	15 (2)	cone					120	138		Designed for convenient use and easy "truck pack." Provides high acoustic output.
AE-12	30 44.75 22.5	black epoxy coat.	black foam	8	35-120k	18	cone					120	160		for large scale sound reinforcement, providing very high acoustic output.
Atlas/Soundolier															
W130T	7.25 4.56 4.375	black metal	black metal	8	95-20k	4	cone			1	ferro-fluid cone		5.5	$163.33	Thirty watt, indoor/outdoor loudspeaker system with integral 70V Tx.
W150T	9 6.31 6.56	black metal	black metal	8	75-20k	5.25	cone			1	ferro fluid cone		10	$267.42	Fifty watt, indoor/outdoor loudspeaker system with integral 70V Tx.
SEQ-844	20.44 13.125 9.125	oak/ black vinyl	black cloth	8	45-18k	8	cone			4	piezo cone	3k	22	$270.83	Tuned port extended bass enclosure; 50 watt system.
SEQ-1232	29 18.31 12.5	black vinyl veneer	black cloth	8	45-20k	12	cone			2x 5	piezo horn	3.5k	45.	$520.83	Tuned port bass reflex enclosure; 65 watt coaxial system.
BOSE CORPORATION															
402	23.25 8.12 7.25	mica foam	black	8	90-16k	4.5 drivers							15	$598.00	Designed for high-quality reinforcement of voice and music.
802II	13.5 20.5 13	mica foam	black	8	50-16k								31	$978.00	same
Acoustimass	16 22.25 23.25	poly foam	black steel		10-18/ -3dB	4.5	12					150hz	72	$3,111.00	same
CARVIN —See our ad on page 6															
973	30 22 15.25	gray/ black ozite	black metal	8	50-19k 3	15	cone	6.5	cone	3.5x 4.4x 3.5	horn	400 4k	81	$369.00	Three-way speaker system with biamp capability; 400 watts.
993	47 25 19.25	grey/ black ozite	black metal	4	45-19k 3	15 (2)	cone	6.5 (2)	cone	3.5x 4.5x 3.5	horn	400 4k	146	$649.00	Three-way system with biamp capability (2) woofers, (2) middrivers, (2) tweeters; 800 watts.
1331	11 28 19	gray/ black ozite	black metal	8	1.5-18k (horn) 60-3k (woofer)	15	cone			horn	2k	46 (horn)	131 (woofer)	$589.00	Two-piece system with biamp capability; 100 watt radial horn; 400 watt woofer.
CELESTION INDUSTRIES,INC.															
SR Com	7 8.5 7	black polymer	black	8	100-20k	5 5	cone						71	$199.00	For recording, stage or sound contracting applications. Has cone/dome radiator and edge wound voice coil.
B18-1000	18	raw frame		8	20-4k 5	18	cone						33	$600.00	Handles 1,000 watts. Double rear suspension gives greater cone excursion control.
B15-600	15	raw frame		8	25-5k 5	15	cone						30	$540.00	Same design and sound as B18-1000. Has 600 watts of real power capacity and extended bass response.
K12-200e	12	raw frame		8	40-6k 4	12 12	cone cone						8.4	$155.00	Speaker is perfect for keyboard and stage monitoring applications with its edge-wound voice coil and cambric edge
SR-1	12 22 14.5	black polymer	black	8	60-20k 2	8	cone						34	$580.00	Excellent sound quality and projection for demanding sound reinforcement or stage monitoring applications.
SR-2	28 23.5 20	gray paint		8	40-200k	18	cone						108	$950.00	The subwoofer adds massive low end punch without sacrificing portability. Available in either 1,000 or 400watts.
SRC-1	1 sp rack	gray	active system control									150	9.71	$430.00	Has an intelligent controller which provides a crossover between the SR-1 and SR-2.
SR-3	10.25 13 9.5	black polymer	black	8	70-20k 4	8	cone						201	$320.00	For use where moderate sound levels required. Handles 250 watts with SRC-1, 150 watts with SRC-3.
CERWIN-VEGA															
CVX-253	55.5 24 23.875	black paint	black metal	8	40-18k	15 (2)	cone	12x 20	horn	10x 3	horn	800 3.2k	173	$1,800.00	A full-range 3-way system with built-in passive crossovers for high performance without multi amplification.

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
CVX/H183	49.5 24 24	black paint		8	40-18k	18	cone	12x 20	horn	10x 3	horn	350 3.2k	160	$2,000.00	Fully portable using compact single throat folded horn/full range with passive crossover built in.
V-37D	36 24	gray carpet	black cloth	8	40-15k	18	cone			10x 18	horn	1.2k	98	$800.00	Good for on the road or in small and medium clubs. Includes 2 position response equalizer.
V-30D	32 24 16	grey carpet	black cloth	8	40-15k	15	cone			10x 15	horn	1.2k	75	$600.00	Front baffle woofer for greater midbass efficiency and throw/controlled coverage.
V-15B	29.25 18.25 17.375	gray carpet	black cloth	8	35-20k	15	cone	9x 14	horn	2.25	horn	2.5k 5k	47	$500.00	A versatile triple action system; has 15 in. woofer with symmetrical magnetic field with special anti-bottom backplate.
MV-15	29.75 19 17	grey carpet	black cloth	8	32-16k	15	cone	10	cone	3x 3	horn	150 3k	55	$500.00	Triple application system with vented 10 in. cone midrange features high output and natural sound quality.
L-36PE	36 24 36	gray carpet		8	30-30k	18	cone						160	$1,000.00	Has folded horn which packs high performance into a compact cabinet; 30Hz bass in a free-standing horn format.
M-1	14.5 21 7.5	gray carpet	black cloth	8	70-16k			12	cone	3x3	horn	2.5k	36	$375.00	Features an ultra-compact vented enclosure with a 12 in. driver for non-fatiguing natural midrange.
COMMUNITY LIGHT AND SOUND —See our ad on page 22															
CSX70	26.75 33.5 22	black carpet	black steel	4	45-18k	12	cone	2	comp	1	horn	4000	135	$1,066.00	Three-way passivge system featuring a 4x12 design, max. operating level of 132dB.
CSX50B	33.5 26.75 18	black carpet	black steel	8	35-500hz	18	cone			1	horn	12dB	100	$680.00	Compact subwoofer featureal 150Hzh crossover, dual high pass outputs.
CSX60B	33.5 33.5 22	black carpet	black metal	4	35-800k	15	cone					50hz	150	$1,034.00	Subwoofer operates in 35-800Hz range of 35-800Hz. Features Hi/Low pass filters and max. operating level of 132dB.
RS325i	24.31 18.44 14.625	black carpet	black metal	8	60-18k	15	cone	2	comp.	1	horn	3. 5k	51	$790.00	Compact 3-way system capable of handling 400 watts of continuous program power in range of 60-18k.
RS327I	32 19 18.125	black carpet	black metal	8	45-18k	15	cone	2	comp.	1	horn	3.5k	89	$877.00	Three-way loudspeaker system capable of handling 400 watts of program power in the range of 60-18k.
RM325i	25.125 18.75 22.625	black carpet	black metal	8	60-18k	15	cone	2	comp.	1	horn	3.5k	72	$882.00	Three-way stage monitor system capable of handling 400 watts of program power in the rangeof 60-18k.
RS880	49.5 30 22.5	black carpet	black metal	8	45-8k	15 (2)	cone	2	comp.	1	comp.	3k	210	$2,168.00	Three-way passive full-range horn horn-loaded trapezoidal enclosure with rigging hardware option.
VBS415	33 33 30	black carpet	black metal	8	25-200	15	cone		comp.			25- 50Hz	200	$1,491.00	Subwoofer for the RS880 with double spider woofers, 131dB operating level and true subwoofer range of 25-50Hz.
ELECTRO-VOICE															
FM-1202ER	24.3 19.1 11.7		black grille	8	75-20k 3	12	cone			90x 40	horn	1500	65		
SH-1512ER	31.9 24.7 16		black grille	8	50-20k 3	15	cone			90x 40	horn	1600	75		
FM1202ER	24.7 19.1 11.7		screen	8	75-20k 3	12									
FM1502ER	28.7 13.8 24.4		screen	8	65-20k 3	15									
SH1512ER	35.5 19.4 28		screen	8											
GAUSS —See our ad on page 27															
3588				8	40-18k	15	cone			1	horn	1.2k	25	$990.00	Coaxial rated at 200 watts RMS and a sensitivity of 96dB.
3288				8	40-18k	12	cone			1	horn	1.4k	24	$925.00	Coaxial rated at 200 watts RMS. Sensitivity of 91dB.
3285				8	70-15k	12	cone			1	horn	1.8k	24	$925.00	Coaxial rated at 200watts RMS compact, high power floor monitor.
INTERNATIONAL MUSIC COMPANY (ROSS)															
TX122	21 16 16	gray carpet	black metal	8	60-18.5k +/-4dB	12	cone			4x 10	comp. driver	3k	45	$249.95	Performance speakers: metal stacking corners, reinforced OSB/plywood construction.
TX152	24 18	gray carpet	black metal	8	55-18.5k +/-5dB	15	cone			4x 10	comp. driver	3k	65	$399.95	same
TX153	28 23 16	gray carpet	black metal	8	55-18.5k +/-4dB	15	cone	8	cone	4x 10	comp. driver	300Hz 3k	88	$549.95	same
TX252	32 25 17	gray carpet	black metal	8	55-18.5k +/-4dB	15	cone			4x 10	comp. driver	1.5k	65	$499.95	Performance speakers: direct radiating metal stacking corners, OSB/plywood construction.

MODEL	DIMENSIONS, H/W/D	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
TX452HL	48 25 17	gray carpet	black metal	4 +/-4dB	45-18.5k	15	cone			4x 10	comp. driver	1.5k	110	$649.95	Performance speakers: horn loaded low frequency drivers, metal stacking corners.
H118EV	43 26 18	gray carpet	black metal	4	40-18.5k +/-4dB	18	cone	8	cone	4x 10	comp. driver	300Hz 3k	125	$899.95	Performance speakers: Bi-ampable, horn loaded mid, metal stacking corners.
M152EV	17 28 14	black	black metal	8	55-18.5k +/-5dB	15	cone			4x 10	comp. driver	3k	56	$499.95	Stage monitor: metal stackng corners, titanium compression driver.
M122HS	21 16 12	black	black metal	8	60-18.5k +/-4dB	12	cone			4x 10	comp. driver	3k	30	$249.95	Stage monitor: metal stacking corner, constant directivity horn.
JBL PROFESSIONAL															
SR4732	43 25 18	fabric	black metal	4	40-20k	12	cone				horn	1.2k 6k	135	$1,695.00	Vented Gap Cooling low frequency transducers.
SR4735	36.25 25 18	fabric	black metal	8	35-17k	15	cone	8			horn	600Hz 2.8k	92	$995.00	Pure titanium diaphragm compression drivers mated to patented JBL Bi-Radial horns.
SR4738	43 25 18	fabric	black metal	4	30-17k	18	cone	10			horn	600Hz 2.2k	111.5	$1,495.00	Trapezoidal enclosure design allows tight clustering of multiple enclosure systems.
SR4718	43 25 18	fabric	black metal	4	30-3.3k	18	cone						87	$795.00	Vented Gap Cooling low frequency transducers.
SR4722	28 20 13.5	fabric	black metal	8	53-17k	12	cone				horn	1.2k	57.5	$795.00	Pure titanium diaphragm compression drivers mated to patented JBL Bi-Radial horns.
SR4725	29.5 25 18	fabric	black metal	8	36-18k	15	cone				horn	1.1k	78	$995.00	Trapezoidal enclosure design allows tight clustering of multiple enclosure systems.
MEYER SOUND LABORATORIES															
MSL-10A	85 41 35	black	black metal		40-12k 4	4x 12	cone			3x2 comp.	horn		700	$35,000.00	Provides controlled coherent coverage. High acoustical output with low distortion.
MSL-3	56.75 21.25 30	black/ gray carpet	black/ vinyl metal	4/8	70-20k 4	2x 12	cone			comp. w/ VHF array	horn		265	$4,820.00	Rugged, arrayable system capable of high power with high clarity and coherence.
UPA-1A	22.37 14.5 14.5	black	black steel	8	60-16k 4	1x 12	cone			1.4 comp.	rad. horn		66	$2,490.00	Rugged, arrayable system that is compact and versatile. Efficient operation with high power, low distortion.
UPM-1	18.125 6.75 7.125	black	black metal	16	70-20k 4	2x 5	cone			piezo electric	horn		17	$893.00	Ultra compact and lightweight with uncompromised sound quality.
S00-A	32 20 14	black	black steel		40-16k 3	1x 15	cone			comp.	rad. horn		110	$5,940.00	Complete system with stereo amplifier is easy to set up or install. Subwoofer options include 501, 502, 513.
UM-1A	14 14 22.5	black	black steel	8	60-16k 4	1x 12	cone			comp.	const. directivity		66	$2,390.00	Ultra low distortion and efficient high power with ultra flat frequency response. Floor monitor.
650-R2	45 30 22.5	black	black/ vinyl metal	4	30-100	2x 18	cone						180	$2,215.00	Subwoofer, high power, low distortion.
USW-1	21.56 31 21.31	black	black steel	4	40-100	2x 15	cone						115	$1,710.00	Subwoofer, high power, low distortion, compact.
MODULAR TECHNOLOGIES —See our ad on page 2															
RL-153-M	24 19 16	gray carpet	black metal	8	40-15k +/-3	15	cone	1	horn		piezo	2k	45	$479.00	Rugged handles.
RL-15-3PA	24 19 16	gray carpet	black metal	8	40-15k +/-3	15	cone	1	horn		piezo	2k	45	$479.00	
RL-12M	19 14 14	gray carpet	black metal	8	40-15k +/-3	12	cone			1	horn	2k	40	$399.95	Recessed handles, the ultimate support universal mount comes predrilled.
RL-12PA	19 14 14	gray carpet	black metal	8	40-15k +/-3	12	cone			1	horn	2k	40	$399.95	same
CBB-18	24 21 16	gray carpet	black metal		30-800	18								$369.00	The CBB-18 is for people who need earth-shaking bass in a package that will fit in a sedan.
CBB-15	24 21 16	gray carpet	black metal		35-1k	15							45	$19.00	Unloaded 15 in. cabinet that has portability. Big bass comes in economy sizes.
Q-15	66 20 24	gray carpet	black cloth	8	25-800	15	cone						90	$1,350.00	The 5-ft.-4-in. height is perfect for putting Mid-hi cabinets above the audience.
1524	36 36 22	gray carpet	black cloth	tri-amp	40-22k	15 (2)	cone	2	horn	4-prop.		1.2/ 5k	120	$1,350.00	Trapezoidal and fully-loaded, the 1524 comes equipped with recessed handles.

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
NEW ENGLAND AUDIO RESOURCE															
NCS-221	14 8 8	poly-ethylene	PVC	8/16	55-18k	6	metal			2	metal	3k	13	$249.50	Waterproof designs for temporary or permanent installation.
NCS-222	20 12 12	poly-ester resin	PVC	8/16	45-18k	8	metal			2	metal	5k	18	$349.50	same
PANASONIC/RAMSA															
WS-A10	6.12 9.875 6.12	black/ white	perf. metal	8	70-18k		full range			4.75	cone		5.70	$120.00	Features moded resin enclosures for portablee usage and limited outdoor outdoor exposure.
WS-A80	11.12 17.06 9.31	black/ white	perf. metal	8	65-20k	8		cone		comp driver	horn	2500	16.5	$280.00	same
WS-A200	21.93 15.54 10.75	black/ white	perf. steel	8	70-20k	8	12	cone		comp. driver	horn	2500	35	$590.00	same
WS-A240	21.93 15.54 10.75	black/ white	perf. steel	8	30-Xover		12	cone				WS-SPA	35	$510.00	same
WS-A500	21.93 15.54 10.75	gray/ white	perf. steel	8	100-20k		12	cone		comp. driver		1600	35.2	$1,300.00	same
WS-A550	21.93 15.54 10.75	gray/ white	perf. steel	8	30-Xover		12	cone		WS-SP2A			38.5	$680.00	same
PASO SOUND PRODUCTS, INC.															
C-1000	17 6.25 4.25	black	black	16	120-20k		5	cone		3	tweet	8.8	232		Directional sound column for critical critical reinforcement.
C324HP	33 6.25 4.25	beige	beige	8	100-20k		5	cone		3	tweet		16	$330.00	Applications-rugged design, high output and uniform dispersion.
PEAVEY ELECTRONICS CORPORATION —See our ad on Cover 111															
115 Int'l.	30.5 21.75 16.75	black carpet	black nylon	8	50-20k	15	cone black widow	2	horn	1	tweet	1.5k	85 8k		Three-way enclosure; full bandwidth response; back widow and 22A driver equipped;
118 Int'l.	36.75 26.625 20.5	black carpet	black nylon	8	40-20k	18	cone black	2	horn	1	tweet	800-8k	133		same
SP-2A	31.875 23.75 17.125	black	black nylon	8	60-16k	15	black widow			1	horn	800	93		Two-way enclosure; high level passive crossover; biamp capability; Integral stand adapter;
SP-4	52.5 25.75 19.25	black carpet	black nylon	4	40-16k	15 (2)	black widows			1	horn	1200	135		Wide range; 2-way enclosure; 22A driver and dual 15 in. black widow drivers;.
112PS	21.5 16.125 11	black carpet	black nylon	8	60-20k	12				1	horn	1200	46		Two-way enclosure; processor capable; high level passive crossover; biampable; durable carpet
388-S	38.375 36.5 18.25	black carpet	black metal	8	45-20k	15	scorpion	8	cone speaker	1	tweet	220-8k	161		Three-way full-range enclosure; durable carpet covering; 8 in. cone mid driver;. biamp capability.
CL-1	21.5 23.25 14.75	black	black cloth	4	70-16k	6 (6)				2	horn	1200	58		Two-way enclosure; ideal for flying installations; mounting hardware attach points; biampable.
HDH-2	28.875 22 18.125	black carpet	black metal	8 (2)	45-18k	15	black widow			drivers (4)	horn	1200	104		Two-way, processor capable enclosure; manifold component with four 22A drivers.
PANASONIC RAMSA															
WS-A70	13 21 12	black or wht paint	black or wht cloth	8	50-18k	8	cone			120x 120	horn	2k	14	$240.00	Power capacity is 80 watts. Magnetically shielded, variety of mounting options.
WS-A80	14 21.5 12	black or wht resin	black or wht metal	8	65-18k	8	cone			60x 40	horn	2.5	16	$280.00	High SPL, compact, stackable, variety of mounting options.
WS-A200	28 20 16	black or wht resin	black or wht metal	8	70-20k	12	cone			60x 40	horn	2.5	35	$590.00	125 watt power handling, compact, high SPL, stackable, variety of mounting options.
WS-A240	28 20 16	black resin	black grille	8	35-20k	12	cone						35	$510.00	Subwoofer system requires model WS-SP2A electronic crossover.
WS-A500	22 10.7 16	gray or white	metal grille	8	100-20k			12	cone		horn	1.5	40	$1200.00	A mid/high system for use with two WS-A550 low-frequency systems and WS-SP2A crossover.
WS-A550	22 10.7 16	gray or white	metal grille	8	35-X-over	12	cone						35	$630.00	

MODEL	DIMENSIONS, H/W/D	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
PROFESSIONAL AUDIO SYSTEMS															
2-18BM	48 32 24	gray carpet	black steel	4	40-200	18	cone					200	150		
PAS 18-3	38 24 24	gray carpet	black steel	8	40-18k	18	cone	10	cone	10.5x 4.5	horn	30 4k	130	$870.00	
PAS 15-2H	24 19 16	gray carpet	black steel	8	50-16k	15	cone			10.5x 4.5	horn	3k	58	$360.00	
PAS 12-2	16 22 12	gray carpet	black steel	8	100-17.5k	12	cone			10.5x 4.5	horn	3k	38	$320.00	
TOC RS-2	24 17 19	black paint	black steel	8	50-17k	15	cone	15	cone	7.25x 4.25	horn	1k	82	$2,400.00	A full-range 2-way compact speaker system designed for the professional pro rental company or quality installation.
TOC SW-2	20.5 17 23	black paint	black steel	8	60-17k	15	cone	15	cone	7.25x 4.25	horn	1k	68	$2,400.00	A full-range 2-way compact stage monitor designed for the pro rental company and large installation.
TOC EB-2	43 17 32	black paint	black steel	4	25-100	2x 15	cone					100	170	$1,600.00	A compact subwoofer designed to complement the TOC RS-2/TOC SW-2.
MRS-2	52 32 23	gray carpet	black metal	40 low 80 high	40-15k	15	cone	15	cone	20x	horn 32	800	185		A 3-way system (when using optional 2-18BM) high powered sound reinforcement system
RENKUS-HEINZ															
FRS 1S1C	20.25 30 16	black carpet	perf. metal	8	50-17k	15	cone			1	comp.	16k	75	$862.50	Has constant directivity horn
FRS121C	24 16 11.5	black carpet	perf. metal	8	60-17k	12	cone			1	comp. driver	16k	42	$862.50	same
FRS151CD	20.25 30 16	black carpet	perf. metal	8	50-17k	15	cone			2	comp. driver	1200	80	$1,147.50	same
FRS152CD	48 20 18	black carpet	perf. steel	4	50-17k	15 (2)	cone			2	comp. driver	1200	123	$1,495.00	same
SMS121C	14.5 28 17	black carpet	perf. steel	8	60-17k	12	cone			1	comp. driver	1600	54	$862.00	same
SMS121CD	14.5 28 17	black carpet	perf. metal	8	60-17k	12	cone			2	comp. driver	1200	58	$1,042.50	same
SMS151C	15.25 33.25 19	black carpet	perf. metal	8	50-17k	15	cone			1	comp. driver	1600	58	$967.50	same
SMS151CD	15.25 33.25 19	black	perf.	8	50-17k	15	cone			2	comp. driver	1200	62	$1,147.50	same
SHURE BROTHERS INC. —See our ad on Cover 1V															
3200	24.875 16.625 12.375	black vinyl	black metal	8	60-13k 5	12	cone			1	CD horn	2k	38	$470.00	Matched to Model 1200 Powermixer. Lightweight and stackable with hard-rubber corner protectors. High efficiency and high power handling capability. Rugged construction.
SUNN															
1272	18.25 22 16.5	gray ozite	black metal	16	60-20k 6	12	cone			11x 5	dual piezo	2k	32		Attenuator on unit; 30 or 60 degree cabinet design; excellent cabinet design.
1275	19.75 25.25 19.5	ozite carpet	black metal	16	60-20k 6	15	cone			11x	dual piezo	2k	38		same
1228	35.5 25.5 16.125	gray ozite	black metal	8	45-20k 5	18	cone			15x 6	horn/ comp. driver	1.25k	110		Ideal for DJ use, 18 in. woofer provides lo end punch.
SPL1282	17 25.25 19.5	gray ozite carpet	black metal	8	60-20k 5	12	cone			15x 6	horn/ comp. driver	1.2k	52		Biampable monitor, 30 or 60 degree cabinet design, titanium diaphragm driver, cast frame woofer.
1285	17.5 28 19.5	gray ozite	black metal	8	50-20k 5	15	cone			15x 6	horn/ comp. driver	1.2k	56		same
1211	28 20 14	gray ozite carpet	black metal	8	50-20k 5	15	cone			15x 6	horn/ comp. driver	1.25k	66		Includes stand adaptor, SUNN-designed titanium diaphragm driver.
SPL 1225	28.5 23.75 19.75	gray ozite	black metal	8	50-20k 5	15	cone			15x 6	horn comp. driver	1.25k	74		Trapezoidal cabinet,titaniumdiapragmdriver, cast-frame woofer.
SPL 1226	46.5 25.75 19.75	gray ozite	black metal	8	38-20k 5	2x 15	cone			15x 6	horn comp driver	1.2k	114		Same as SPL 1225 above.

MODEL	DIMENSIONS, HWD	OUTSIDE FINISH	GRILL SCREEN, FINISH	IMPEDANCE, OHMS	FREQUENCY RESPONSE, dB	BASS DRIVER, DIMENSIONS	BASS DRIVER, TYPE	MID DRIVER, DIMENSIONS	MID DRIVER, TYPE	HIGH FREQUENCY DRIVER, DIMENSIONS	HIGH FREQENCY, TYPE	CROSSOVER(S)	WEIGHT, LBS	PRICE	FEATURES
TOA ELECTRONICS, INC.															
380-SE	29.8 19.6 16.1	charc. gray	black mesh jersey	8	50-20k	15	cast frame	3.7	CD horn	3.7	horn	800, 8k	79.2	$998.00	
480-SE	32.3 22 17.7	charc. gray	black mesh jersey	8	45-20k	18	cast frame	3.7	CD horn	3.7	horn	600, 8k	99.2	$1,125.00	
300-SD	23.1 18.1 12.3	gray vinyl	black metal	8	60-20k	12	cone		CD horn/ comp. driver	3	mov coil tweet	1k, 10k	463	$618.00	Biamplification and bridging connectors, mid-frequency attenuator.
380-SD	26.8 19.4 15.4	gray vinyl	black metal	8	50-20k	15	cone		CD horn/ comp. driver	3	mov coil tweet	1k, 10k	59.5	$678.00	same
TURBOSOUND															
TXD- 520	16 11 10	blue	perf steel	8	100-18k 4	10	cone			1	soft dome	tweet	26	$665.00	Low frequency enclosure for TXD series.
TXD- 530	12 25 13	blue	perf steel	8	90-20k 4	10	cone				slot tweet		45	$1,064.00	Wide dispersion.
TXD-560	34 19 15	blue	perf. steel	8	60-18k	15	cone	10	cone		slot tweet	250- 4k	931		Compact, wide dispersion.
TXD-518	29 21 17	blue	perf. steel	8	45-250Hz	18	cone						82	$999.00	Low frequency enclosure for the TXD series.
YAMAHA CORPORATION															
S4115 HIII	30.7 25.2 18.2	black	black metal	8	45-16k	15	carb fiber			1.7	comp drvr	1.6k	97	$695.00	New version of the 2-way stage monitor.Rugged cabinet with horn, recessed handles and interlocking corners.
S2115 HIII	21 23.3 26.2	ply w/blk	black metal	8	50-16k	15	carb fiber			1.7	comp drvr	1.6k	77	$695.00	High power-handling and excellent low frequency response. Rugged 2-way system for stage monitoring.
SW118II	30.7 25.2 18.2	ply w/black	black metal	8	40-3k	18	cone					150	90	$575.00	High power subwoofer system. Rugged cabinet with recessed handles and interlocking cabinets.
S3112MT	15.7 12.4 25.2	ply w/black	black metal	8	50-20k	12	cone	6.5	cone	3.2	bullet comp. driver	1k/ 8k		$495.00	
S3115HT	30.7 25.2 18.2	ply w/black	black metal	8	40-20k	15	carbon fiber	1.7	comp. driver horn		ring rad comp.	1.6k/ 8k		$775.00	High power-handling 3-way system with wide bandwidth.
YORKVILLE SOUND															
M-160	17.9 14.6 13.6	black ozite	black metal	8	65-19k 3	10	cone			9x5	horn	4k	33	$459.00	Dual purpose electronic processor to linearize bass response or as stereo crossover with subs.
M-600	19.5 23.2 13.4	black ozite	black metal	4	50-16k	10 (2)	cone			9x 5	horn	1.8	77	$949.00	same
MX- 401	27.2 21.7	black ozite	black metal	4	45-19k	15	cone			6x 13	horn	2k	66	$869.00	same
MX-2000	45 26 19	black ozite	black metal	4	50-17k	15 (x2)	cone	11.5x 18.5	horn		slot tweet	1-7k	175	$1,799.00	Plywood construction, electronic processor, biampable, transistor protection circuit in crossover.
P-8	19 14 13	gray ozite	black metal	8	80-16k	8	cone			1	horn	5k	35	$319.00	Available in all white with truts top and side for installation.
P-12	24 18 13	gray ozite	black metal	8	70-16k	12	cone			1	tractrix horn	3.8k	46	$359.00	Tractrix horn offers even dispersion regardless of angle or placement.
P-15	30 21 20	gray ozite	black metal	8	50-16k	15	cone			1	tractrix horn	3.8k	70	$459.00	Wedge-shape cabinets.
HP-150	29 21 16	gray ozite	black metal	8	60-16k	15	cone			7x 9	horn	3.5k	75	$579.00	"M" Roll surround woofers with convex dust caps.

ADDRESSES

Altec Lansing Corporation
10500 West Reno
Oklahoma City, OK 73128

Apogee Sound Inc.
1150 Industrial Ave., Suite C
Petaluma, CA 94952

Atlas Soundolier
1859 Intertech Drive
Fenton, MO 63026

Bose Corporation
The Mountain
Framingham, MA 01701

Carvin Corporation
1155 Industrial Ave.
Escondido, CA 92025

Celestion Industries Inc.
89 Doug Brown Way
Holliston, MA 01746

Cerwin-Vega
555 E. Easy St.
Simi Valley, CA 93065

Community Light & Sound
333 East Fifth St.
Chester, PA 19013

Electro-Voice
600 Cecil St.
Buchanan, MI 49107

Fostex Corp. of America
15431 Blackburn Ave.
Norwalk, CA 90650

Gauss
9130 Glen Oaks Blvd.
Sun Valley, CA 91352

JBL Professional (UREI)
8500 Balboa Blvd.
Northridge, CA 91329

Klein & Hummel (Gotham Audio Corp.)
1790 Broadway
New York, NY 10019-1412

Martin America
21000 Devonshire St., #205
Chatsworth, CA 91311

Meyer Sound Laboratories Inc.
2832 San Pablo Ave.
Berkeley, CA 94702

Modular Technologies
303 Clymer Ave.
Morrisville, PA 19067

New England Audio Resource
569 Lisbon Road
Lisbon Falls, ME 04252

Panasonic/Ramsa
6550 Katella Ave.
Cypress, CA 90049

Paso Sound Products, Inc.
14 First St.
Pelham, NY 10803

Peavey Electronics Corp.
711 A St.
Meridian, MS 39301

Professional Audio Systems
1224 West 252nd St.
Harbor City, CA 90710

Renkus-Heinz
17191 Armstrong Ave.
Irvine, CA 92714

IMC (Ross Systems)
1316 E. Lancaster
Fort Worth, TX 76102

Shure Brothers Inc.
222 Hartrey Ave.
Evanston, IL 60202-3696

Studer Revox America Inc.
1425 Elm Hill Pike
Nashville, TN 37210

Sunn
1130 Columbia St.
Brea, CA 92621

Technical Audio Devices
2265 East 220 St.
Long Beach, CA 90810

TGI North America (Tannoy)
300 Gage Ave., Unit 1
Kitchener, Ont., Canada N2M 2C8

TOA Electronics
601 Gateway Blvd., Suite 300
South San Francisco, CA 94080

Turbosound Div. AKG Acoustics
PO Box 1383
Pleasant Valley, NY 12569

Yamaha Corporation of America
P.O Box 6600
Buena Park, CA 90622

Yorkville Sound
Witmer Industrial Estate
Niagara Falls, NY 14305

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PEOPLE, PLACES & HAPPENINGS

• **The Park Avenue Group** has started the new year off right with the opening of their new audio for video post-production facility in Memphis, TN. Offerings at this new studio will include audio sweetening for video, spot production, original and pre-recorded music, ADR, foley, sound effects, voice overs, foreign translations and 16/track synchronization services providing a fully-equipped multi-track facility along with its marketing support services...Madison Park Productions has also announced the opening of its new studios at historic Longworth Hall in downtown Cincinnati, OH. Madison Park features two studios and a control room with a window to the outside. Services include custom music, audio for video, and voice over production...A new Production Division for **Soundtracs Plc**, manufacturer of audio mixing consoles, has been opened at a new 20,000 sq. ft. facility in Glenrothes, Scotland. The new factory, which will triple capacity, will be equipped with automated production lines complete with robots...A former video production house in Australia has undergone a series of enhancements and expansion to become the largest and most sophisticated post-production house in the country. **Apocalyse 'The Final Word in Post'**, formerly known as Pro-image Post, is part of the Pro-image Group, Australia's leading network of post-production facilities.

• **The Musicians Institute** will offer a new division of the school beginning in March: **The Keyboard Institute of Technology (KIT)**. The one-year course will be structured in a manner similar to the guitar, bass and drum programs with its curriculum augmented to include special instruction in the technical aspects of the instrument. The KIT core curriculum will consist of classes in technique, reading, harmony and theory, ear training, styles and analysis and improvisational concepts. Other courses will be offered in synthesis, synthesis programming, synthesis technique and application of synthesis in today's music.

• Plans are underway to form a **Society of Motion Picture and Television Engineers (SMPTE) Japan Section. Maurice French**, SMPTE president, noted at the recent 132nd SMPTE Technical Conference and Equipment Exhibit that there has been unprecedented international growth of the Society during the past 16 months, with the formations of local SMPTE Sections in Italy, Scandinavia, Germany and the Soviet Union...Beginning this month, **Blaine Baker**, of **MPL /-PostMasters, Inc.**, takes over as SMPTE president.

• **General Cinema Corp.**, based in New York City, has installed University Sound CS810-T ceiling loudspeakers in indoor theater lobbies and PA430T paging projectors in outdoor theater lobbies at theaters across the city. The PA430T is stated to be the world's only constant directivity paging projector. Its constant directivity allows uniform coverage, fewer horns, higher intelligibility and better articulation. An omnidirectional swivel hoop system allows easy aiming in any direction...An **Akai** ADAM 24 track digital recording system has been installed at **Blank Productions** in Stamford, CT. Along with the **Yamaha** DMP7D digital board, **Sound Tools** digital hard disk recording and editing and the **Lynx Timeline** synchronizing system, Blank Productions can now create 100 percent digital masters. A **Studer** 24 track/16 track also helps Blank Productions provide digital or analog recording...**Studer ReVox'** recently released D820-48 48-track DASH Digital Recorder has been installed at **Conway Recording Studios**, perhaps Hollywood's most exclusive music recording and mixing facility...Two other Studer A820 24-track analog recorders with Dolby SR, two A810s with center track timecode and 961/962 consoles have been added to a new 44-foot tractor-trailer mobile facility dubbed the "Silver Truck," which replaces owner David Hewitt's infamous "Black Truck."

• **Fostex Corp. of America** has announced that **Mr. H. Shinohara**, president of FCA's parent, Fostex Corp., is now the company's new president. **Y. Abe**, former president and innovative pioneer in multitrack recording equipment, will devote his efforts full-time in research and development at company headquarters in Japan.

• **Lexicon, Inc.** has appointed **Dick Trainor** as vice president of operations, where he will be directly responsible for overseeing all manufacturing, customer service and field service operations of Lexicon's professional and consumer product lines. Lexicon has also promoted **Will Eggleston** to product development manager where he will assist in the design of new products and enhancement of existing product lines, act as a liaison between Lexicon's sales force and engineers, and support and participate in demonstrations and presentations of Lexicon products...**Frank Bluestein** has been named senior vice president, marketing, corporate for **AME, Inc.**, the largest full service post-production facility in the United States...**Jason Dunaway**, former director of engineering, and **Jay Nelson**, previously operations manager, were named vice president of Product Development and Marketing and vice president of Sales and Operations respectively, at **Valley International, Inc.**

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