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ANNIVERSARY ISSUE!

1967 1968 1969 1970 1971

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1972 1973 1974 1975 1976

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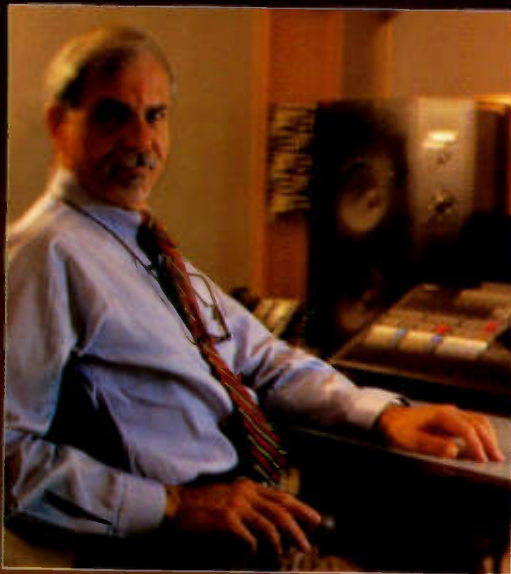
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Location photos: Frank Micciotta



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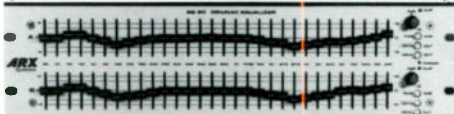
● We asked our art consultant Karen Cohn to come up with something appropriate for our 25th anniversary issue. Obviously, she more than just succeeded!

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Letters

● In the July/August issue we included a two-page questionnaire for our readers. We are currently tabulating the results.

However, a comment on one returned form caught our attention. It was this:

Here is my simple question. What is the basic difference between a so-called quality studio mic that might sell for \$1,500 and a road mic such as the Shure SM58?

Continued on page 6.



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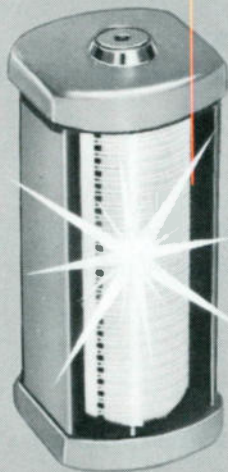
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PERESTROIKA



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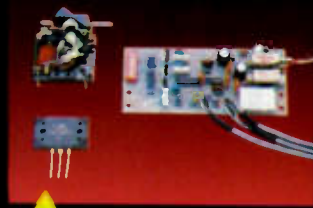
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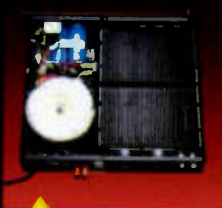
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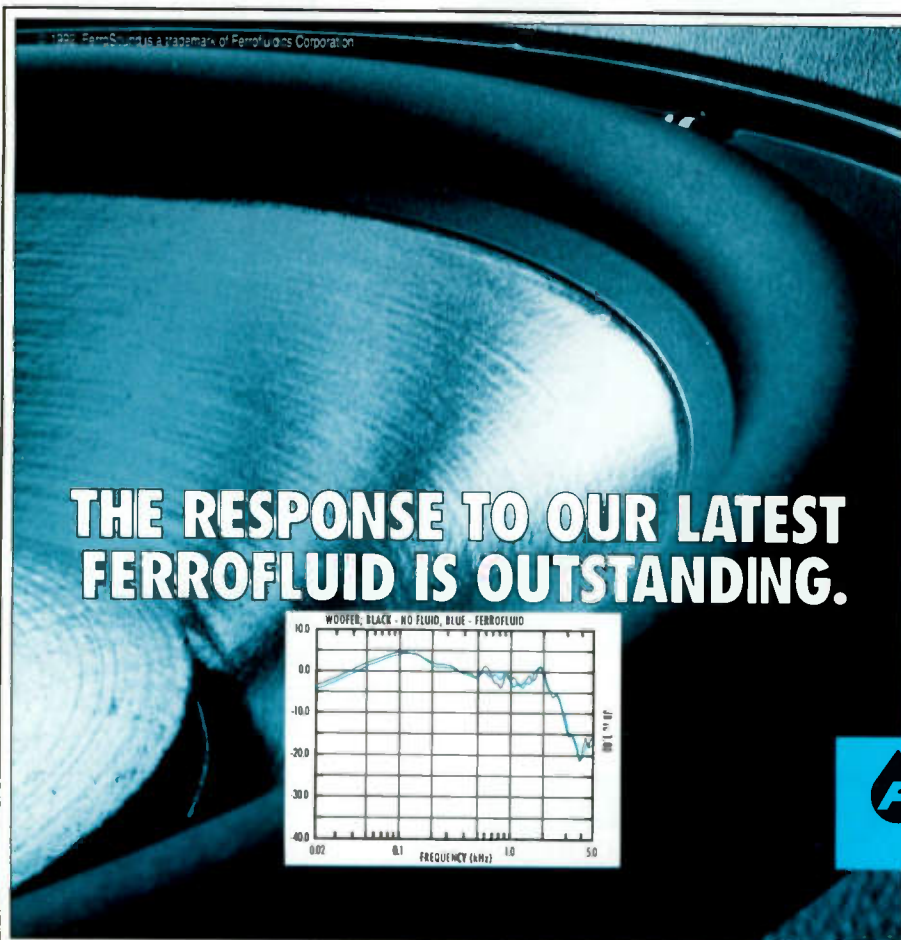


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A Guest Editorial

What Was That??? Twenty Five Years Just Whizzed By!

SHELLEY HERMAN

Twenty Five years! From my point of view it seems such a short time, but it's a quarter century. In pro-audio technology, it's a millennium! In 1967 if you wanted a console of any size larger than a Shure M67 you built it yourself or had it built. There were four types of reverb: Spring, Plate, Tape Delay, or an Echo Chamber. More often than not an echo chamber was an unused or seldom used room in the building. Very fancy places had special rooms, lined with Keane cement and rotating baffles. It may have been a bathroom that was off limits during mixdown. Sometimes this restriction wasn't observed and a new take was necessary because someone flushed at the wrong time. On-location recording meant dragging several large machines, some weighing several hundred pounds, to the location site, taking a few hours to set up, recording, then packing up all the heavy stuff and going home. Compare that with a DAT and a stereo mic that will all fit in your briefcase.

Our everyday microphones then were RCA 77s, Neumann (labeled Telefunken) U47s, and U48s, AKG C12s, Telefunken ELAM 251s, Sony C37s, and the brand new Neumann U67. We were recording on AMPEX 300, 351, AG300, and AG350 tape recorders. In the middle of the year Ampex showed its brand new AG 440 in 2, 4, and 8 track. Soon thereafter Ampex married some AG 440 electronics to its video deck and we had the first 16 track machines, the MM1000. It was so big I couldn't fit one into my studio, and had to wait for the 3M 56-16 before I could record more than 8 tracks, which I did on my Stemco, an Ampex AG440 knockoff. Studer and other Europeans were showing some recorders, but the feature that attracted the most attention was the little scissors that popped up to cut the tape when you pressed a button. Scully and 3M were just entering the market with their first models, and the primary limiters available were the CBS Labs Audiomax and Volumax and the LA2A and 1176 from UREI, which was called Universal Audio, a division of Studio Electronics Corp. in those days. Otari didn't exist, Tascam was a brand new division of TEAC consumer, and Ray Dolby was just starting to not make noise over in England.

The Beatles were just teaching us a new way to record with their Sgt. Pepper album, heavy metal was still something you learned about in high school chemistry, and "hot pants" was a state of mind, not an article of clothing.

Some of the well known recording engineers in Hollywood were: Bill Putnam, Wally Heider, Bones Howe, Guy Costa, Armin Steiner, Dave Gold, Art Partridge, Harry Bryant, Bert Gottschalk, Doug Sax, and Steve Guy. Equipment was being custom built by Flickinger, Bob Bushnell, Chuck Broneer, Bill Putnam, and Frank De-medio. The companies were Langevin, Cinema Engineering, Gately, Rytron, Audio Designs and Manufacturing, CBS Labs, all defunct, plus the ones that are still with us.

Some of the other names that were already well known were Walter "Whitey" White, Charlie Washburn, Hugh Allen, Art Davis, Sid Alder, Ollie Berliner, Walter Dick, Marv Headrick, Bud Bennett, Allen Byers, Ernie Knight (Mickey's Dad), Jack Mullin, Bart Locanthi, Bud Morris, Charlie Pruzansky, Frank Pontius, John Eargle, and Stan Ricker.

In 1967 the entire recording industry could fit into one medium size auditorium (and no one would agree how to fix the sound system.) AES conventions were a gathering of old friends, and there had not been twenty years of them yet. There was no industry magazine except for the AES Journal. Suddenly there was db Magazine. At last, Our Own Magazine! Wow, we were no longer just electronics freaks puttering around in our garages, we had arrived, we had our own magazine. Through thick and thin (mostly thin) db Magazine has held out as the first and finest publication in the field.

The primary requirement to be in the recording and sound industry is that you "gotta wanna". If you don't have a burning desire to be in this business, forget it. It's long hours, low pay, intransigent musicians, and the next guy down the street just bought a new piece of gear you don't have, so you have to go buy one. You often consume food and breathe atmosphere both totally unfit and unsafe for human beings. The rewards are small but the big one is walking into a store with your family, and finding a record with your name on the back.

All the changes we have seen since 1967 are just a drop in the bucket compared to what we will be happening in the next twenty five years. The curve is exponential, so hang on to your hats, to quote Al Jolson, "You ain't seen nothin', yet."

From page 2.

Since he mentioned Shure, we asked Shure Brothers to respond to his query. Here it is:

The difference between a \$1,500 studio mic and a road mic such as the SM58 fall mainly into two areas—performance and durability.

A studio mic is usually designed to provide a wide, flat frequency re-

sponse and wide dynamic range, will little need for relative ruggedness and durability. Also, since the studio mic is not handled by the performer, size, shape and weight are not important considerations.

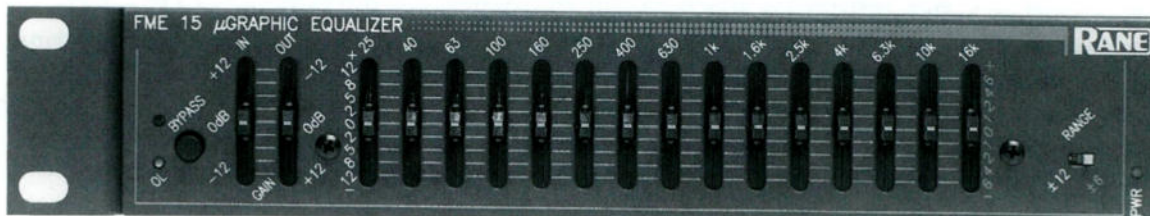
The road mic must be designed for maximum durability, but there are also important performance considerations. Frequency response is normally not as critical as in a studio mic, but other performance parameters are more important: A

good polar pattern for high gain-before-feedback, low handling noise, good hum rejection, and effective breath (pop) protection.

The replacement cost for road mics must be reasonable because of the heavy abuse, where studio mics can be fragile because they live in a carefully controlled environment.

Sandy Schroeder
Director of Microphone Products
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Country Legend Back in the Studio—Pedernales Recording Studio

COUNTRY SUPERSTAR WILLIE Nelson's, non-conformist *Texas Outlaw* image, his freely outspoken political stands, and well-publicized battles with the establishment have attracted almost as much attention as his music, often keeping him at the center of controversy. Someone less sure of who he really is might have gotten caught up in the hype and the distractions, and confused his image with himself—but not Willie. No matter how much the world has tried to put him up on a pedestal, his feet remain firmly planted on the ground.

Stars of his magnitude typically seek to isolate themselves from the public, but Willie says: "I enjoy talking to people...the key to being successful is to enjoy people." He poses for pictures with anyone who asks, and signs autographs until writer's cramp sets in. Still sensitive to the problems of everyday working people, he's raised over 15 million dollars so far to help the country's struggling farmers, through a series of Farm Aid concerts.

That being a *living legend* hasn't changed Willie in the least is a tribute to the man's strength of character. He's never lost his sense of priorities, or his sense of humor. Just as importantly, he's never stopped finding joy and inspiration in what

has always been his first love—making music. After all these years, when he picks up his guitar the result is still magic. It's happy irony that while it was his music that propelled Willie Nelson into

the craziness of stardom, it is also his music that has helped him to maintain his sanity. Where most people would go nuts, Willie's just anxious to get in the studio and start cutting the next album.

Figure 1. Willie Nelson checks out the new console.



*Tony Lufrano is a west coast freelance writer. This article is based on one which appeared in the *Tascam Users Guide of Spring/Summer 1992* and is being published by us with permission of Teac America Inc.*

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The man simply loves to play, as anyone who's ever experienced one of Willie's inspired live performances will affirm. And so he does it a lot, in a lot of different places all over the world. In recent years, one of his favorites has been Branson, Missouri, a new Mecca for live Country music that has gradually supplanted Nashville as the place for fans to see their favorite stars perform. This Spring, the 'Willie Nelson Celebrity Theatre' will open in Branson, with Willie signed on to appear on a regular basis throughout the year.

However, no matter where the road may lead him, Willie's roots are in the little town of Abbott, Texas (population: 369), where he was born and raised. It's an unpretentious, down-to-earth kind of place that hasn't changed much over the years, which probably has a lot to do with why those very same attributes apply to Willie Nelson. He's written over 2,000 songs and sold over 50 million records, but this superstar still describes himself as "just a guitar player from Abbott, Texas." And after all that he's accomplished since moving away, he still says: "Abbott is where my dreams began, and I go back to begin dreaming again."

Another large part of what makes the creative magic happen for Willie is having his own place to record, where he can relax and create. For years that place has been his Pedernales Studio, located a few miles outside of Austin in Spicewood, Texas. It has been described as Willie's "second home". But when the studio was temporarily closed down a little over a year ago, it was as though an important element of the magic had been put on hold. So naturally, its recent reopening has generated quite a bit of excitement and anticipation from Willie's friends and fans—and from Willie himself.

PEDERNALES

Pedernales really suits Willie's style like no other studio could. It was put together to his specifications, and has a relaxed atmosphere that reflects the way he likes to work. If a recording session runs out of steam, he can simply take a break, step outside and take a swim or play a round of golf. When he feels refreshed, he can go back



Figure 2. An exterior shot of the studio.

into the studio and get back to work. He doesn't have to book time, or get in and out at a certain time. There's no pressure, no self-imposed standards of success or failure. That's the way Willie likes it, and that's the way Pedernales has always been, because to do it any other way just wouldn't be Willie.

Recently, we had an opportunity to speak with longtime Pedernales house engineer, Stuart Sullivan. He described Willie's reaction to the first sessions after the studio's reopening: "I think Willie was really pleased to be able to get back in and get working. He made the comment, 'It's been fifteen short months'. The resiliency he has seems just never-ending, but for Willie to say that shows that it's been kind of hard on him. He was just pleased to be able to be back doing what he likes to do, where he likes to do it.

"A big part of it—something that gives him a lot of pleasure—is to play music with his friends. It's a lyric from one of his songs, and it's kind of corny, but it's really true. He sits down, and they just start playing. That's why when you record Willie you don't stop taping, because he doesn't want to mess with the recording aspect—he just likes to play. He's pleased to have his room back to be able to do what he loves to do. It's like being able to play shows without having all the

hassles. He seems to be really at ease there."

A veteran of hundreds of sessions with Willie, Sullivan is uniquely qualified to describe how he works in the studio, "I remember the first time I ever worked with him, he walked in after laying down a track and said 'What do you think?' And I told him that the rhythm had fluctuated a bit, and right in the middle the bass just kind of fell apart. Willie wasn't worrying about that kind of stuff. He walks in there, and like he says, if it raises the hair up on your arm, then it's fine. That's his approach. A *perfect* rhythm track and all that—none of that stuff matters. If you get those shivers, then that's it."

When Willie goes in the studio, the clock is turned off, and as Sullivan will attest, his marathon recording sessions are legendary: "We did a Delta Airlines commercial, *The Sunny Side Of The Street*, a few months ago. We worked on the commercial for four or five hours, and then we cut with the band for four or five hours, and then another artist came in and Willie and he worked together for another four or five hours. You're talking about a fourteen hour session here. He just likes to get comfortable with his band or whoever it is he's working with, and then he just records and you roll tape. You roll a lot of tape."

The most important thing seems to be that nothing interferes with the flow of his creativity: "When you're in the studio with Willie, you're trying to capture his personality and his character as much as anything else, as opposed to someone who's trying to play a specific type of music, or trying to perform a certain thing. That's not applicable here.

What you're trying to do is get his personality on tape. When Willie sings a part, it might not always sound right to me, but he knows exactly what he's doing. He has so much experience having his personality come across in the music, and that's what it's all about for him—he just is Willie. Whether you like him or you don't, he's just gonna be Willie, and he's really good at being Willie. He's had a lot of practice."

We've always been fans of Willie Nelson the artist, but since having this opportunity to get to know him better, we've come away really liking Willie Nelson the man. Life's ups and downs have given him a uniquely philosophical view of the world: "Things have a way of working themselves out—when you think it's all over, it's just beginning." The obvious corollary, that Willie applies to his life and his work, is to relax and enjoy yourself, come what may.

With the reopening of Pedernales Studio, it's good to know that he'll have plenty of opportunity to do what he likes best: play music with his friends, in a place where he feels at home. When we asked him how it was to get back into his own studio, he replied: "It feels great, like old times. With the new equipment, the place sounds better

than ever, and we're looking forward to many more records coming out of here in the future." The magic is back. For more details, read on...

THE PEDERNALES STUDIO

Many of Willie Nelson's most memorable recordings were cut at his Pedernales Studio, affectionately nicknamed *Cut & Putt* for the golf course that surrounds it. The extraordinarily laid-back atmosphere, as well as Willie's own high standards of creativity, have made this studio uniquely conducive to making music. An impressive list of hit records cut there by Willie and others helped earn Pedernales a world-class reputation.

After a brief hiatus, the studio recently reopened under new management, with Willie still very much on the scene as artist-in-residence. To maintain its world-class status into the 90's, it has been completely re-equipped with a Tascam M700 automated console, a DA800 24-track DASH recorder and an ATR80 2-in. 24-track analog recorder.

First, we spoke with Freddy Fletcher, new manager of the studio, about what makes *Cut & Putt* so special, as well as how he became associated with it. He told us a little about himself: "I'm Willie's nephew. I worked out of Nashville for about fifteen years as a studio drummer. Most of what I did up there was just some session stuff. I worked with a songwriter named Guy Clark for quite a while. I tried to stay off the road, and just did sessions and a lot of work for a couple of publishing companies.

"About eight years ago, I came down to Austin to visit the family for Christmas, and there was a studio in town that was going out of business. At that time Willie owned a place called the Austin Opera House" He said, "Why don't you pick up their equipment, and put the studio down at the Opera House?" "So we did, and it's been real successful down there. That's how I got in the business."

Freddy continued, "Now, I've signed a long-term lease to manage Pedernales. I'm just really happy to have it back open out here. There's been a lot of records

Figure 3. Freddy Fletcher at work on the new Tascam M700.



cut out of here—basically, most of Willie's records, like *Always On My Mind* and *Stardust*, and *All The Girls I've Loved Before* with Julio Iglesias."

UPCOMING PROJECTS

He discussed some of the studio's upcoming projects, "We're going to be doing several record projects in the immediate future. We've got Willie coming in, then Calvin Russell recording an album for his European label deal, and then Jazz guitarist Herb Ellis. In a couple weeks, we're going to start recording Blues singer Barbara Lynn. She's on the Antone's label, and we do most of their work."

We asked Freddy about the new multi-track system: "I basically made the decision to go with the M700 board. We had one sent down here and we demoed it against some other consoles, and it sounded real good. So we decided to go with it, and it's worked out well for everybody. We haven't had it long, but it sounds great, and so far we're very pleased. Definitely, dollar for dollar, it gives you the best value, compared to the other consoles we looked at. The support and service we've gotten from Tascam has been excellent. I'm real comfortable with it, Willie's comfortable with it, and it seems like a real good working relationship."

THE FACILITY

Freddy described the spacious Pedernales facility. "The studio is massive—about 11,000 square feet. It's got a large keyboard room, a couple of isolation rooms, and then one large room for cutting bigger groups. The building is an old country club. You can actually spread out through the whole place, and choose between a number of acoustically *live* rooms and *dead* rooms for recording."

As you'd expect at a world-class studio, the equipment is first-rate and plentiful: "In the keyboard room, we've got a Bösendorfer piano and a couple of Hammond organs, a Yamaha electric grand and a Fender Rhodes, a DX-7, the basic staple keyboards. We're pretty much self-contained. Some people will want a specific kind of synthesizer or something like that, and

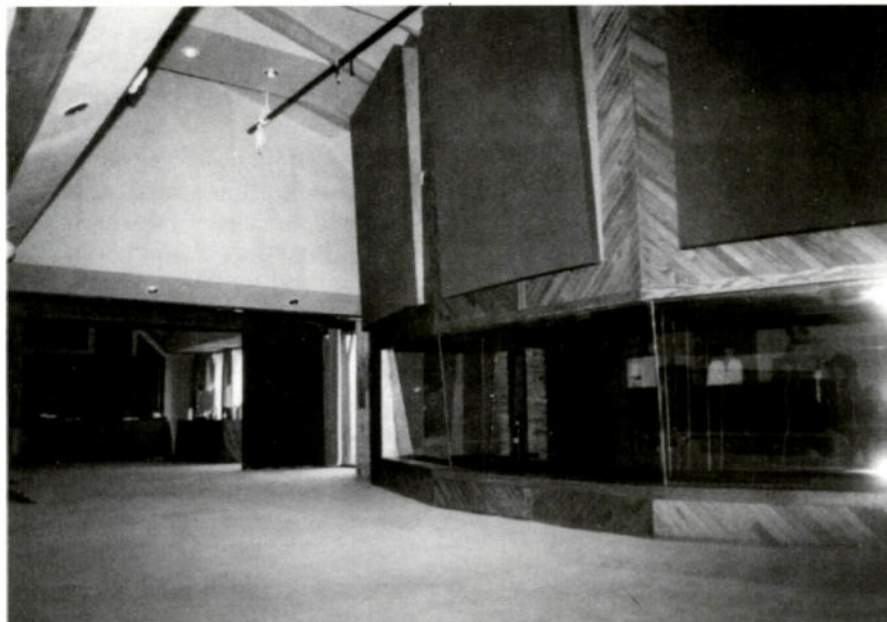
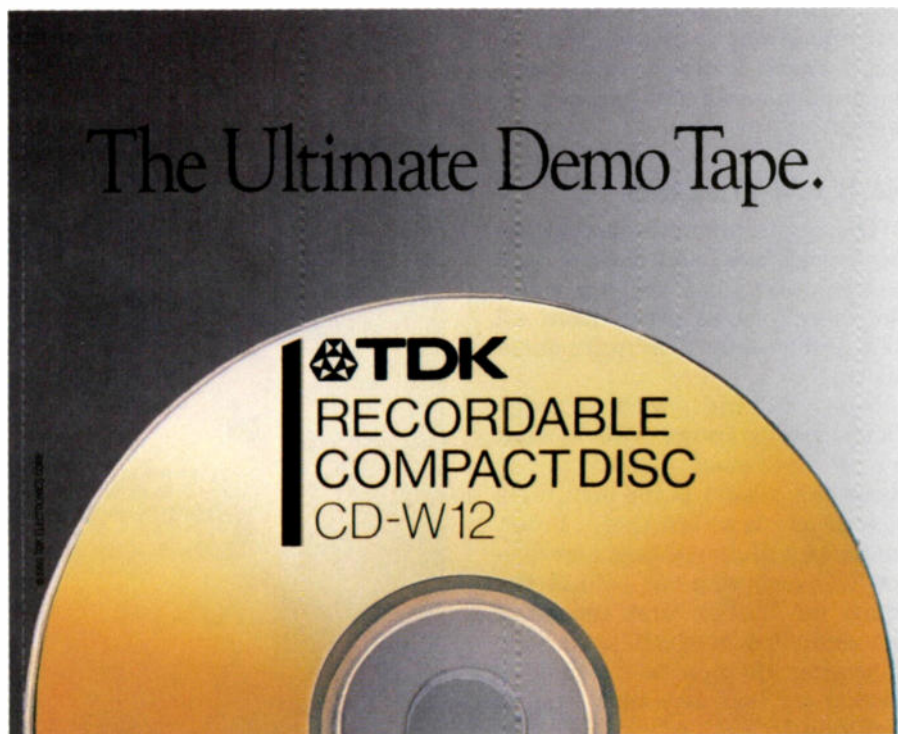


Figure 4. This interior view from the studio floor shows the spacious glass front of the control area.



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"There's quite a bit of outboard gear. We've got lots of Summit tube amplifiers, preamps, and equalizers, and Tube Tech preamps and limiters. And we've got a Lexicon 480 reverb, a Yamaha REV-5 and SPX-1000, and an Eventide Harmonizer with sampling. The beauty of this place is that you can really record through the whole area. There's a couple of EMT stereo tube plates that are hung here. And we've got a live echo chamber that's massive, like a huge shower. There's just a lot of rooms that can be utilized—and have been. I've done drums in the lobby here before."

Freddy described the amenities that make the studio truly special. "I think you have to see it. Texas hill country on a game preserve, and it's just a beautiful place to record. We have condos that are available right next door to the studio. Depending on the project and what they're doing, an artist might come in for several weeks at a time. Our philosophy is just be creative, and if you hit a snag or something, then take a break and go play a little golf."

R&R FACILITIES

"There's an olympic-sized swimming pool here, and saunas, and pretty much whatever you want. Out here, you're away from all that, and it's only 30 minutes out of Austin."

From talking with Freddy Fletcher, our impression is that one of the most special things about this studio is the genuinely nice people working there. Later, we spoke with house engineer Stuart Sullivan, who sat behind the board for Willie's first recording session in Pedernales following the reopening. He gave us a hands-on critique of how the new system performed.

"We used the M700 automated console and the DA800-24 digital recorder, and the session went very smoothly. Willie went out there and strummed and sang, and I pushed some buttons. And when he came back in to listen, we got a good sound pretty easily. It was our first session in the studio, and my experience with new studios is that mainly you chase things

around—you find bugs and you look for problems. In this case, there was little, if any bug-chasing to do.

"Even though we've got flying fader automation and all that, it's simple to use and it's flexible. This kind of layout—no effects returns, just all input modules—works fine for me. It allows you to have complete control over any input that's coming in. We have our reverbs and stuff normalled into the outer channels. The idea is to get the simplest and shortest path that you can between the sound itself and what comes back from tape. That's fundamentally important to what we're doing here.

"I was real pleased that the M700 was very smooth and natural sounding. It did not crunch the sound, or put a real thick imprint

of any particular character on there. I've worked on consoles that have a very distinctive sound, a thumbprint, that you have to try and compensate for. You end up using a lot of processing to get around it. From my experience with this board so far, I wouldn't expect to have to bring in a lot of outboard stuff just to cut with. We should be able to go with the straight console quite a bit."

NEW WORK

Sullivan talked about some upcoming projects he'll be engineering at Pedernales, "I'll start mixing tracks tomorrow for Pinetop Perkins, a piano player who played for Muddy Waters for years and years. It's an Antone's project and it's got a lot of the best local players, everybody from Kim Wilson of

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the Thunderbirds to Preston Hubbard, George Raines—the whole Antone's crew. This album also had Willy 'Big Eyes' Smith and Calvin Jones from Muddy's old band. The studio has been doing a number of sessions. We broke the ice with Willie for a few days, and then another band came in and cut some basic tracks. Now we've got about seven or eight days booked to finish up Pinetop's record. So I guess you could say the new system is working out without a hitch."

We asked about that first *breaking the ice* session with Willie: "It started off the first day with just Willie singing and playing guitar, and his sister Bobbie playing piano. The next day, we added Freddy Fletcher on the drums, David Zetner on the bass, and Bucky Meadows on guitar, along with Willie and Bobbie, and we cut full band. With an acoustic guitar and a piano and a voice, you're only able to check a certain range of the equipment. When you get full drum kit and bass guitar, more of the traditional band together, you're able to tell a lot more. I was real pleased with the sound we got on tape. The drums came across very naturally. The main thing, and for me this is the highest praise I could give any console, is that I found myself not using EQ very much.

"The majority of things just came into the preamp and went right into the tape machine, and sounded fine. Things like the overhead mics, the high hat, bass guitar, Bucky's electric guitar, the vocals—none of that had any EQ on it. The M700 sounds very smooth on the low end. That's what I look for first. The extreme top and bottom are often where you have to tweak just a little bit here and there, and I didn't really feel the need to do that very much with these tracks. The kick drum and bass combination fit very nicely to-

gether. I tried a few different things out—mic placement, mic movement—to make sure that I was pleased with the sound of both of them. Whatever we put into it, we got back, just like it went down. I usually like to run most things through some sort of a tube, whether it's a preamp, or compressor, or EQ, before I get to the digital tape machine."

"Clients come out here and have fun. They don't feel a stiff presence, or a laboratory isolation sort of thing, but it's not so hoity-toity that regular people will be afraid to touch anything."

A NATURAL SOUND

"On this session, it was very gratifying to not have to work real hard to get a natural sound. With some consoles I've worked with, you really have to struggle to get the natural sound to come through—or a decent sound, much less the *natural* sound. On this console, it was never a struggle. It was simply a matter of trying two or three different options and deciding which one sounds the best. In this case, none of them sounded too bad, which is a pretty good starting point. When I'm working with Willie, the biggest compliment I can give any equipment is that it doesn't get in his way, and you don't have to work real hard at it. You don't want to have to ask Willie to talk into his mic for 45 minutes while you check the right EQ on it. You let the man be him-

self, and you capture that. My approach is just to allow that to happen.

"I don't want to interrupt the session with technical stuff. With Willie, he just wants to get in a good mood, kind of catch a vibe with the players, and start rolling. The new equipment allowed me to do that."

THE STUDIO "FEEL"

We asked Stuart about Pedernales Studio's well-known good 'vibes': "I would say that reflects Willie about 99 percent. Back when it was first built, he had a lot of input about how he wanted it to feel. Willie wanted it to be a comfortable place for him to make music. That's why the studio is set up the way it is. It's not like one of those studios where they've got no windows and no sun, and everyone's locked away in little booths. There are floor-to-ceiling windows that look down into the pool and over the lake. During the day you can see the whole valley, and then after dark you see the glistening of the lights on the water. The whole idea here is comfort, and the aesthetic reflects Willie's personality a great deal.

"Clients come out here and have fun. They don't feel a stiff presence, or a laboratory isolation sort of thing, but it's not so hoity-toity that regular people will be afraid to touch anything."

Stuart pointed out that Pedernales Studio's reopening will benefit a lot of people not directly connected with it. "Willie has always played a real important role in the music community in Austin. He's been able to provide some things for local musicians that wouldn't normally be there, and this studio is one of the things he's provided. There's a great deal of Texas work that gets done here in Austin, and everyone's pretty excited about the things we can do here again." db





THE ELECTRONIC COTTAGE

JOHN BARILLA

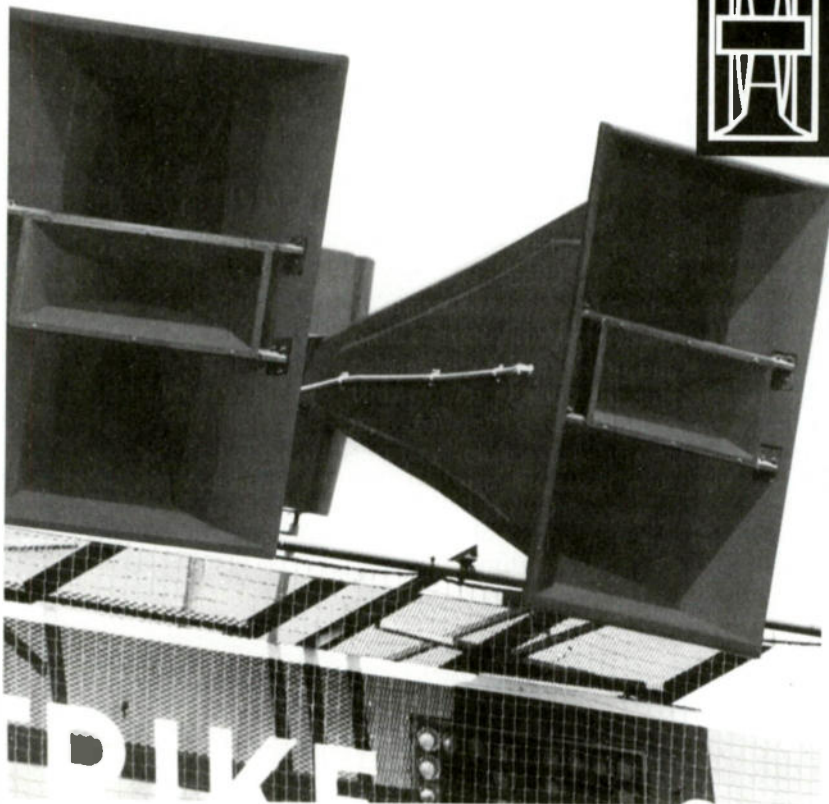
Hot Tips: Pre-Recorded Radio Broadcasts

● In this installment of Hot Tips I would like to share some techniques for doing pre-recorded radio broadcasts. Actually, I've been doing quite a bit of this stuff over the past year or so, and it has been something of a boon to my business in these recessionary times. Sure, it's not as creatively fulfilling as mixing a record, but it does require

skill to produce an effective radio broadcast; and in an era of shrinking recording budgets it makes a whole lot of sense to diversify into other audio production areas. Pre-recorded (as opposed to live) broadcasts are nice because you can work on them at your own convenience—so long as you meet the required deadline. Another plus is

that they usually don't require the involvement of many people, or a committee of self-styled producers. You just agree on a format, work out a production method and go for it. Sure, there might be a couple of bugs that have to be worked out, and each broadcast has enough unique problems to keep it interesting, but by and large, after a few

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weeks you should be able to reduce the process to a formula—with consistent results from each broadcast.

TYPICAL PRODUCTION PROCESS

While there may be some differences depending on the nature of the broadcast, a typical production process might involve:

- a—recording the raw material
- b—editing the raw material
- c—“laying-over” the edited material to multi-track and adding other sound elements
- d—mixing down to stereo or mono
- e—preparing a production master for mass duplication and distribution to various radio stations. We’ll discuss all of these five stages in more depth shortly, but I think the best way to get into it is

to illustrate the process I developed for my major radio broadcast client. The scenario goes like this:

I was approached by a religious broadcaster to help improve the quality of his radio production. This man—a Christian minister—had been broadcasting his Bible teachings for about 10 years, and up until now had handled the production chores in-house. Unfortunately, the productions also sounded a little home spun. Things like this were a dead give-away that the production was not done by an experienced hand: levels between sections did not smoothly match, transitions were abrupt, and vocal EQs were harsh. Moreover, the overall concept for the production did not project anything distinctive. It was time for a complete overhaul.

The basic requirements of this program were typical for most religious broadcasts: there was to be an introduction section featuring some identifying theme music and an announcer who introduces the featured speaker; following, is the sermon or teaching itself (which occupies the bulk of the broadcast); and finally, there is an output which features more music and an announcer summarizing the lesson and giving contact information for listeners to purchase books, tapes, etc. The program was meant to fit into 15 minute radio slots—a rather short, punchy format common on gospel radio stations. That meant that the program had to clock in at slightly under 15 minutes—optimally, 14:30—to allow for transitions, station breaks, cumulative errors and various other

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fudge-factors that radio stations have to deal with.

So my first task was to choose some appropriate music that could be used as an identifying theme in both intro and output sections. Then, I had to decide (based upon the appropriateness of musical cues) exactly how long the intro and output would be. They both should obviously be short, but they each had to be long enough to give out the pertinent information. After a little experimentation it became clear that the most effective timing would be a 1 minute intro (10 seconds of identifying music up front, then faded under for 50 seconds of voice-over), about 12 minutes of preaching from the pastor, ending with 1.5 minutes of voice-over (including a final musical flourish which fades innocuously into about 30 seconds of silence).

Interestingly, on this project, I not only produced and engineered the program, but also wrote the announcer's copy and did the voice-over as well. So I had to get into every aspect of the production. As it turned out, about 8-10 typewritten lines read well into the 1 minute intro, and 18-20 lines read well into the 1.5 minute output. (The output packed more lines per minute because the pace near the end was always faster than at the beginning; but that's something that can only be figured out by experimentation). So thus, the overall plan was laid. Now onto the nuts 'n bolts.

EDITING 12 MINUTE SCOOPS OF WISDOM

The sermon segments were not recorded in twelve-minute portions; that would be unnatural and forced. Instead, the pastor's Sunday sermon—which could be anywhere from 35 to 50 minutes—was to be used. But before even thinking about my 12 minute segments, first I had to go over the text and edit out various incongruencies—like accidentally misquoted Bible passages, coughs, dead air, etc. When the whole sermon was sufficiently free from bloopers, it was then time to fashion my 12 minute scoops of wisdom. The first problem I encountered was that 12 does not divide nicely into very many numbers; and even with a hypo-

thetically neat 36 minute sermon, the break-points do not always coincide with a dramatically effective point in the sermon. So, I quickly abandoned any notion of editing the 1/4-in. master into 12 minute segments. It became clear that to make natural break-points (and also to get the most mileage out of any length sermon), a certain amount of overlap was necessary. To illustrate, let me give an example. Suppose Sunday's sermon was 42 minutes long. How many 12 minute episodes can I derive? Initially, it would seem, only three; but with overlap we could stretch it to four and choose transition points that are more integral to the sermon. If for example, the first segment went out to about 12 minutes, the second segment could start at a carefully picked sentence 9.5 minutes from the beginning and extending 12 minutes from that point. Do something similar between the second and third segments and you will pick up the extra few minutes you need to squeeze out the 4th segment. The slight overlap is actually good for the faithful listener, because it provides a little review of the previous message—enough to establish continuity—as any good teacher would do.

THE LAYOVER

So what's a relatively painless way of creating these overlapping 12 minute segments? Simply lay approximately 12 minutes of the sermon (from whatever point is dramatically best) over to a track of your multi-track machine. Rewind the multi-track and lay another 12 minute segment on a parallel track until you've gotten as many segments as feasible out of the complete sermon. That's all there is to it! Naturally, it's best to do some processing on the way down. Since the live recording is somewhat noisier than a studio recording, I generally put it through some single-ended noise reduction unit to clean up the hiss. I also hard limit the dynamic range (to make sure nothing gets lost on the radio), EQ the voice and add a touch of the Aphex Aural Exciter (to restore some sparkle).

Since the musical bed is the same from week to week, I lay that over just once and use it again and

again. That is also EQ'd for radio with the bass pumped a little bit, but at a higher center frequency than normal so it can be felt on small speakers as well as large. Finally, on some other parallel tracks I record the voice over listening to the music for my cues to start and finish speaking. Now, all the elements of the production are residing on the multi-track machine and it's time to put them all together.

DOING THE MIX

At this point, I begin the process of mixing down to two-track (1/4 inch tape). I use two different reels—one for intro and outs, and one for the 12 minute sermon segments—and cut them together later. Why not just mix them in proper sequence? Because it actually takes less time this way. Say, for example, you had five sets of intros and outs. Each of those sets require fader moves—fade up, fade down, music level changes, etc. If you specialize and do them all at the same time, it can be done very efficiently and assembled together by a simple edit later.

Now here are a few things you must absolutely pay attention to in order to have a professional sounding product. First, the level of the announcer's voice should not be much louder or softer than the voice of whatever radio personality the show is based around—in this case, the preacher. How do you insure that? Well, here is where recording on parallel tracks comes in real handy. Just temporarily pan the announcer left and the preacher right, and even though they will never actually be speaking at the same time, listen to them simultaneously and adjust levels until the left has as much sonic impact as the right. Sometimes it may take a little EQ to balance things out, because some frequencies cut more than others. In any case, if you can hear both at the same time, it's easy enough to accomplish. I also add a subtle amount of echo and reverb primarily to the pastor's voice to restore the natural church ambience that was attenuated with the single-ended noise reduction process. I like to show a real difference in ambience between the announcer (who is obviously recorded in a stu-

dio with a tight mic) and the pastor who has a looser more roomy sound (obviously recorded live).

That being done, I shut off the pastor for now, pan my announcer back to the center and bring my music in at an appropriate level so that the announcer can be heard clearly. The beginning of the intro—where the music is by itself—I generally ride the music around 6 dB hotter until the point where the voice-over comes in, where I duck it down to the predetermined level. Now, all the decisions have been made; What remains is simply mixing all the pieces down to their reels, cutting them together and

putting 10 seconds of leader between each finished 15 minute spot.

Y'AIN'T DONE YET!

While in some cases you could claim to be done, in my case there's a bit more work to do. This pastor is actively on the radio in several different markets stateside and even abroad in the middle-east. He's on the air 5 days a week in most markets and has many radio stations to send tapes to. For this, he uses a specialty duplication house. So rather than send out our master (what if they lose it or accidentally erase it?), I make a pro-

duction master for them to use. This is actually another opportunity to tweak the program on a global level. Maybe it needs to cut a bit more; so I give it some EQ. Maybe the levels between the voice-over and the sermon still don't exactly match; no problem, I run the whole thing through a compressor. In short, I take the opportunity to do whatever I can to make the program sound smooth and yet as impact full as possible.

Radio broadcast work can be a lot of fun; especially when you know it's going on the air immediately! Instant gratification. I like it. db

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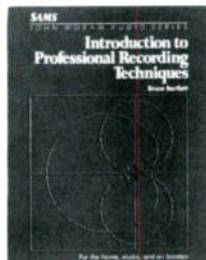
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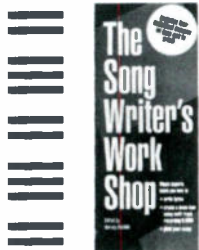
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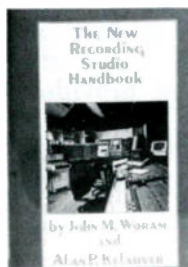
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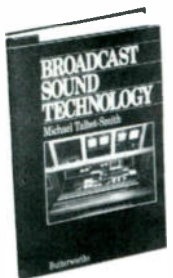


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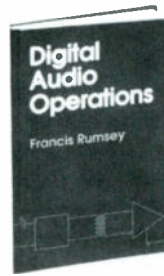


This is an introduction to the technical aspects of sound in radio and television. It examines in detail the main items in the broadcast chain: studio acoustics, microphones, loudspeakers, mixing consoles, recording and replay (analog and digital), and the principles of stereo. It offers a easy technical treatment of audio principles and broadcast hardware.

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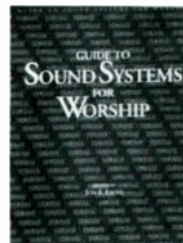
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International Sound Reinforcement—West Africa 1992, Part III

MY TRIP TO THE SAHEL, with the Holmes Brothers, took place during the month of May 1992. By that time the winds and dust of the Harmattan were gone, replaced instead by withering heat. I rendezvoused with the group at New York's JFK airport; along with USIA escort Roy Hyman, we then began our long journey to Africa. This involved an overnight flight to Brussels, Belgium; after a four and a half hour layover we connected to a Sabena flight for our six hour air flight directly to Niamey, Niger.

NIGER

As we prepared for landing at Niamey's airport, I was struck by how dry everything was. The land was colored in shades of brown layered with dust, spotted only by knurled trees and scrubby shrubs. My first lesson upon arrival was the proper pronunciation of the country's name (nee-JAIR—rhymes with *chair*). Our greeting party, led by USIS PAO (Public Affairs Officer) Claudia Anyaso and CAA (Cultural Affairs Assistant) Kadidia Konto, facilitated a quick trip through customs. One word of warning: My inoculations card, which had been completely ignored in the coastal countries, was carefully scrutinized here for a yellow fever stamp. Make sure you have one, as I did, or you might be faced with the possibility of getting one with *their* needle, an unattractive prospect in this era of AIDS.

Perhaps it was the time of our arrival, or the fact that Niamey wasn't a major African destination, but the airport was not very crowded. This enabled us to rapidly complete customs and baggage claim formalities and proceed directly to the Gaweye Hotel. Once there, Claudia organized a quick

briefing; after a brief perusal of our schedule, we adjourned for some much needed rest.

Monday, May 4, was our first performance day, and I was eager to get an early start. Claudia picked me up around 9 a.m. First, we made quick visits to our Tuesday and Wednesday venues to advance these shows. I was then dropped off at the U.S. Ambassador's residence, site of our first concert. I was introduced to Francois (the USIS a/v technician) who would assist me with set up; we took a moment to survey the area.

Our "venue" was the garden behind the residence, a blessed oasis of green lawns and beautiful flowers and trees—the patio would be our stage. I located power on the rear wall of the residence; AC was 218 volts, supplied from a U.S.-style 220-volt receptacle with a functional ground. I didn't have a matching AC plug for this, but Francois procured one from the embassy.

The sound system was already on site when we arrived, but as I began setting up I received a nasty surprise—one of the cases was missing! As it happens, this case contained the Bose support tripods and *all* the mic stands. Francois and I walked across the street to the U.S. Embassy to find Claudia—she immediately went to work tracking down the missing case.

The sound system had recently arrived from East Africa, where it had been used for another band touring Africa between the Sanders and Holmes tours. This group, *Becky Hobbs & the Heartthrobs*, carried their own stands and didn't need the stock ones. They'd left the stand case in Nairobi, Kenya; it was supposed to have been forwarded to us in Niamey. Somehow, the shipping and customs clear-

ance instructions had been mishandled, so now we were in bind. I figured that I could set the speakers up on dead case lids which had them at a lower-than-optimum level, but you do what you have to. Mic stands were another problem: there were hardly any available, and boom mic stands in particular were impossible to acquire locally. Francois did have four tall straight mic stands in his complement of sound equipment at the embassy, so I took what I could get. It was going to be an improvised situation, so I contacted the band and told them what had to be done. Here we were at the first show already having problems—not a great way to get started, but the band was really sympathetic and willing to do whatever it took to present a good show under these circumstances.

To a certain extent, I was lucky that our first show was a "representational" event at the Ambassador's. Our audience would be composed primarily of the diplomatic corps; from past experience I knew they preferred softer sound levels. The patio and garden seating area was quite cozy; even though it was outdoors, I figured I could get away with only mic'ing the vocals. For the instruments and drums, I counted on using balanced stage sound as the sound source. The guys were completely cooperative during this balancing of stage levels at sound check, doing exactly what I told them without ego (see *Figure 1*). The result was a concert thoroughly enjoyed by everyone. Both Claudia and Ambassador Jennifer Ward thanked us for our efforts at making the show so successful.

TUESDAY

Tuesday's concert was at the Franco-Nigerian Cultural Center, a complex including a library,

classrooms, workshops, and several theaters. We performed in their amphitheater, an open-air auditorium seating around 1,000. Due to a series of transportation snafus, I wasn't able to start setting up until 1 p.m., which meant dealing with the hot sun and temperatures around 100 F. The good news was that our missing case had arrived and was quickly rushed through customs—and none too soon! In this large outdoor space, I was going to require full mic'ing and every watt I could spare. Apparently, it was a popular venue: there were posters everywhere advertising a *Youssou N-Dour* concert two weeks after ours. I would have preferred additional sound equipment here, but in deference to Claudia's tight budget, I had to do without. AC power came from European-style receptacles set into the stage facing. There were outlets on both the stage right and stage left sides, but only the ones stage right had functional grounds. I measured the voltage at 222 volts; I observed several quirky dips during the day, but as darkness fell voltage began to rise, peaking at 238 by the end of the concert. My major concern here was adequate volume: I didn't really have enough PA, so I had to count on stage volume which would have to make up the difference.

When the band arrived for sound check at 5:30, I began by telling them I needed all they could give me from the stage (see *Figure 2*). Wendell in particular was very happy to hear this, as he preferred to play loud. I did have to pull back on the reins a bit, as the guitar amps could easily overpower the bass rig. The fact that our guitar rigs were opposite the bass really helped; poor Sherman didn't have to be blasted by screaming guitars. I mixed to this stage guitar level, adding guitar to the PA only for solos or soft rhythm passages. Our sound check attracted a crowd—quite a few people crowded the rear areas, wondering about this strange music they heard (see *Figure 3*). My efforts to get the most sound I could out of our gear was key—almost 2,000 people tried to jam in for the concert! There were people sitting on the walls, in the aisles, on each other's laps and



Figure 1. The Holmes Brothers soundcheck at the ambassador's residence, Niamey, Niger.

standing-room rows five-deep ringed the outer wall of the seating area. They loved the blues in Niamey—after three ovations, a thoroughly soaked and exhausted band had to call it a night, with the cheers of this enthusiastic crowd ringing in their ears.

WEDNESDAY

Wednesday's concert took place inside the 29 Juillet Stadium: it was the biggest venue I had ever played on an Arts America tour. A

large sports stadium (primarily football (soccer and track) located on the outskirts of Niamey, it could seat well over 30,000. A temporary stage was erected in the infield for us, "playing" to the stands on the south side of the stadium (see *Figure 4*). On the way over, Claudia and I discussed our planned sound augment for this show. The difference in sound created by full mic'ing was now obvious to anyone who attended both our previous shows—I'd received a lot of compli-

Figure 2. This soundcheck for the Holmes Brothers was at the Franco-Nigerian Cultural Center auditorium in Niamey, Niger.



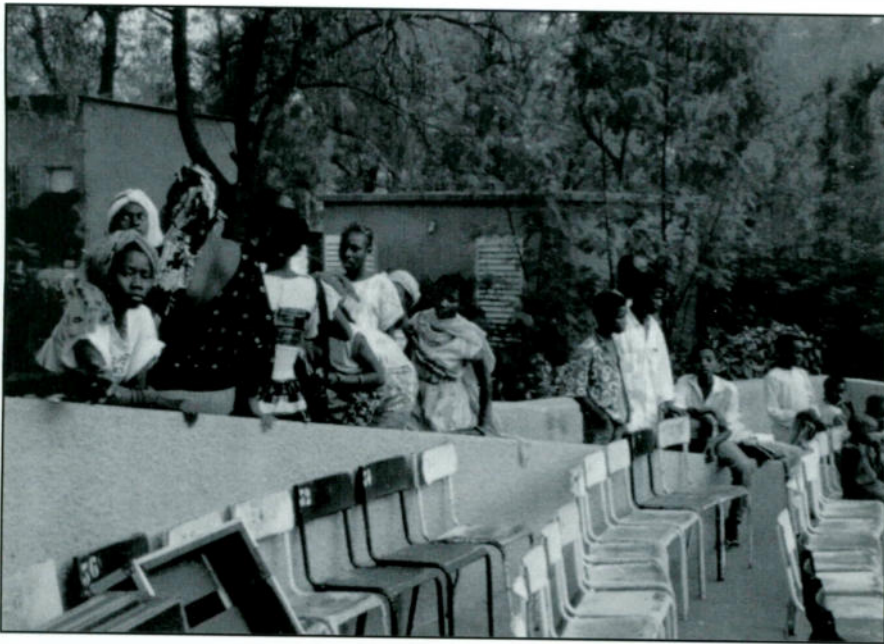


Figure 3. Many Nigerians gathered to watch the soundcheck at the Franco-Nigerian Cultural Center.

ments on our sound after Tuesday's show. but I knew I had no chance to repeat that here unless we could find some extra sound equipment to augment mine. Claudia anticipated this, and had arranged for me to use the stadium's in-house system. I was skeptical about its suitability, and when we arrived my concerns were confirmed—this system was comprised of squawker horns designed to project announcements over large, noisy crowds. Even if I could

tie in, it would be inappropriate for music. I inquired as to other equipment, and the facility director mentioned a system at the *Palais Des Sports*, a large indoor basketball arena immediately adjacent to the stadium. We walked over to have a look: lo and behold there was a portable bi-amped sound system, based around Amcron power amps. I arranged to have this system transferred to the stadium, returning to begin my stage set-up while this was being done.

Figure 4. This was the stage setup at 29 Juillet Stadium in Niamey, Niger.



Our stage was out in the open, and the sun was fierce—I made sure our amps were shaded, and covered the drums with towels. I tapped directly to a 380/220 service, located adjacent to the tv control room, for my AC power, running a long wire out to the stage and connecting a distribution box with European-style grounded outlets. Voltage was 238 volts, and proved to be the most stable power I'd yet seen in Niamey.

My "augment" PA system was comprised of four bass cabinets and two high frequency cabinets per side. The bass bins each contained a single 15-in. woofer; the highs a single driver on a 60/40 straight horn (see *Figure 5*). An SC 222 stereo bi-amp crossover fed the amps, with Amcron MT-600s for the highs and MT-1200s for the lows (see *Figure 6*). This system, while quite loud, didn't sound very good "out of the box" after some fairly radical system equalization, it was passable. My stereo capability came in very handy here; by feeding my system with the left output and graphic, the local system with the right out and graphic, I could EQ each system independently and match levels effectively. I also could precisely control which speaker system I wanted to handle each signal. The vocals were more heavily weighted towards the Bose system (which had a smoother response and much better highs), the drums and bass more heavily weighted towards the local PA (which had more power and better bass). Guitars were mixed variably, favoring the local system when a darker sound was required, the Bose system when I needed more edge. The local system really didn't have much high end past 7 kHz, so I tried to keep that in mind when assigning signals. We had the capacity to handle a crowd much larger than the one at the FNCC; unfortunately, only around 500 people showed up. This was a function of location; this stadium was located well outside of town, and most residents of Niamey either do not have or cannot readily arrange transportation.

Fortunately, the crowd made up in enthusiasm what it lacked in numbers, spurred on by a sizable

contingent of Peace Corps volunteers.

THURSDAY

Thursday, our day off, was spent relaxing, shopping, and having a look around Niamey. Several of us took a pirogue (canoe) ride on the Niger river (see *Figure 7*), which offered a close-up look at village life—in this arid land, the river is life itself.

FRIDAY

Friday, May 8, began with a leisurely morning, but come afternoon it was time to pack up, check out, and head for the Niamey Airport to prepare for our 7 p.m. departure. Roy left early with the equipment: I followed with the band around 5 p.m. To our surprise, customs didn't even bother looking at our sound equipment on the way out; since the equipment arrived in Niger as air freight and left as accompanied baggage. We'd anticipated a major hassle. Typically, when there was no uniformity in shipping, as in this case, customs is all over you. Air Afrique was most helpful in expediting our processing, a situation born from Roy's persistence in maintaining contacts with their station management team during the week. It's remarkable what constant attention, invitations to receptions, and free concert tickets can do—not only was the service excellent, but we received a discount on the cost of our excess baggage! Roy understood that positive relations with airline staff can do a lot for you in Africa.

MALI

Our flight from Niamey to Bamako, capital of Mali, took about 2 hours: there was one intermediate stop in Ouagadougou (where we would eventually go). Upon arrival at Senou International Airport, we were met PAO Bill Cowell, CAS (Cultural Affairs Specialist) Gaoussou Mariko, and other members of the SIS staff. The baggage claim area here was small, so we elected to send the band ahead: I stayed behind to supervise collection of the baggage and equipment while Bill and Roy took the group over to the Grand Hotel. When I finally caught up

Figure 5. This is the sound system used at the Niamey Stadium. The local system is located at the left, with the USIA system at the right.



with them, we held an impromptu dinner briefing in the hotel's dining room. It was decided that the band wouldn't do their morning workshop using local amps and drums: I would go over to our concert site to begin setup at the same time. Morning was definitely the time to

do any work, as the heat of the day was reputed to be intense. Boy, was I about to find out about that!

Saturday began with the group and I going separate ways: the Holmes Brothers' workshop was held at the National Institute of Arts, a high-school level institution that is

Figure 6. These are the power amps for the local system at Niamey Stadium. (Amcron is the outside the U.S. name for Crown.)





Figure 7. Wendell (left) and Sherman Holmes riding a canoe on the Niger River.

Mali's only school of fine arts. I went over to the *Carrefour des Jeunes* (Crossroads of Youth), to prepare for our 4 p.m. concert. One thing was immediately apparent—Bamako was no sleepy desert town. The walks bubbled with activity, the streets were clogged with old cars, motorbikes by the hundreds, and all sorts of animal-powered carts. Quite a contrast from Niamey, where it seemed most of the people moved on foot. There was a weather contrast too—while Niamey was hot, Bamako was *hotter!* At 10 a.m. It was al-

ready 110 F, and rain had not been seen in these parts for some time. I was quite thankful for the few trees that spotted the grounds of the CDJ. I set my mix point up underneath one to protect the mix electronics from the cruel sun. A small temporary stage was set up in front of the clubhouse, playing out towards the street. I found it necessary to place the monitors off-stage on case lids, to conserve what little stage space there was for the band. There was a small tarp above the stage; this improvised cover, tied to nearby trees and the

Figure 8. The stage setup at Carrefour des Junes in Bamako, Mali.



clubhouse, was designed to afford some sun protection for the stage (see Figure 8).

In this incredible heat I tried to move economically and drink a *lot* of fluids—Gaoussou had thoughtfully provided lots of bottled water and juices backstage. We set up several fans around the stage perimeter to provide some relief for the musicians. While searching for AC, I noticed some posters advertising Youssou N'Dour's upcoming Bamako concert on the clubhouse wall—I guess we had the same travel agent. I found AC outlets just past these posters: there were several European-style receptacles on the outside wall of the "dressing room"—which was really a small classroom/game room. Although these had ground pins, the ground was not functional, here or anywhere; I had to run a long wire to an outdoor water spigot about 75-ft. away and use that for ground. I measured voltage at 210 max: it fluctuated between 185 and 210 during the day. Our sound system, designed for 220 V, still managed to function when we hit low voltage, but with some fuzziness in the sound. The band amplifiers were not so forgiving—they worked, but at severely reduced output. Imagine over half your level disappearing in mid-song; not a situation any of us cared for, but what can you do? Chairs were set up for an audience of 400, but that quickly became 1,500 when the band started playing (see Figure 9).

I found out later that several embassy staffers couldn't drive home using their normal route; the street in front of the CDJ was blocked with people trying to get a glimpse of the band! We even had a local tv crew show up and tape most of the second half of our concert. It was quite a scene—on some of the more up-tempo numbers, many in the crowd engaged in a long line dance, which we later found out was a traditional Bambara dance. Everything was going great until our power cut out in the middle of the last song, bringing the concert to a premature end. It wasn't anything we did either: this entire section of the city was dark. The power supply in Bamako was shaky to start with; blackouts are common during the dry season. I

guess in retrospect the timing was right: it was starting to get dark, and there was no stage lighting. I packed up by flashlight, punctuating load-out with trips backstage to enjoy the sumptuous spread provided by Bill and Theresa Crowell.

After returning to the hotel to freshen up (I'd sweated through three complete sets of clothes working in this intense heat), we hustled off to a local "jazz club" at the invitation of Habib Koita, a hot local guitarist (see *Figure 10*). Habib, along with other members of his group *Bamada* attended the Holmes morning workshop and made quite an impression; we were very eager to hear their music. What transpired was one of those magic evenings you hope you are lucky enough to witness! The fireworks started when pedal steel guitarist Gib Wharton set up and joined in at Habib's request. Surrounded by the lustrous sounds of Bamada's African folk/jazz, Gib luxuriated in this unfamiliar yet beautiful music; he listened, waited, then joined in with playing so complimentary and supportive that Habib almost dropped his guitar! Huge smiles appeared on every musician's face as they dug deep, inspiring each other to reach new heights. Eventually, Sherman, Wendell, and Popsy joined in for a lengthy African/American musical exploration which culminated in a rollicking version of Ray Charles' "What I Say", with Popsy fronting the band as lead vocalist: the crowd went wild. It was at this point that Bill Crowell came over to my table with an idea—did I think it was feasible to incorporate Bamada and a similar group jam session into Sunday's concert at the U.S. Ambassador's residence? This concert was now less than 24 hours away—from a technical standpoint I didn't have any objections. When both groups finally took a break, I called Shem, Wendell, and Habib over for an impromptu "production meeting" with Bill.

We discussed several possible performance formats and how we might share gear. We agreed to finalize details at Bill's noon reception in honor of the Holmes Brothers, which many local musicians, including Bamada, would attend. Bill had the hardest job; convincing



Figure 9. The Holmes Brothers perform at Carrefour des Junes, Bamako, Mali.

the ambassador on such short notice!

At 9 a.m. Sunday morning I was on the grounds of the ambassador's residence, preparing the stage and sound system for our evening extravaganza. The stage was set up in a far corner of this beautiful complex, shaded by trees; it was positioned to play to the broadest

possible expanse of lawn (see *Figure 11*). I elected to go with minimal drum mic'ing—I'd usually do this at a diplomatic reception anyway, but I knew I'd need all the channels I could get for the potential "grand finale" tonight. Fortunately, there was a significant overlap in instrumentation between the Holmes Brothers and

Figure 10. The Nigerian guitarist and band leader Habib Koita.





Figure 11. This was the stage setup at the ambassador's residence in Bamako, Mali.

Bamada; each had electric guitar, electric bass, trap drums, and four vocals. However, Bamada had keyboard, talking drum, and Habib's acoustic guitar—each wouldn't require dedicated channels, and the acoustic guitar needed stage amplification via our monitor system. I planned on using an SM-81 for the talking drum. DI boxes for the keyboard and acoustic guitar. The stage was small to start with, so I again placed the monitors offstage on case lids to conserve space. Bill

and Ambassador Herbert Gelber showed up around 10 a.m., as I was beginning to set the stage; Bamada's addition was a "go", and I was asked to record the show for posterity. I still had to locate power; the residence's grounds crew ran a wire to the stage from an AC drop located on a post along the security wall. This was connected to a power board with numerous European-style grounded receptacles; it supplied 230 volts, was very stable, and even had a

Figure 12. Members of the Bamada and the Holmes Brothers rehearsing at the Crowell residence in Bamako, Mali.



generator backup. I got my mix point power directly from the residence, as it was closer than the stage; this was another grounded European-style receptacle. I finished up around noon, and went directly to Bill's house, where the reception was in full swing. After a refreshing shower and a change of clothes (yes, it was still 100 F +), I was ready to join in the fun.

The place was full of musicians, all eager to meet the Holmes and share musical ideas and techniques. Naturally, more great music went down; the Holmes Brothers and Amanda used the occasion to rehearse their combined "en-core" numbers (an original of Habib's and "What I Say"), and this quickly turned into group therapy as *everybody* at the reception joined in, grabbing any instruments at hand, clapping, or banging along on crockery and glassware (see Figure 12). When things finally ended at 3:30, I convinced my guys and Bamada to go over to the residence for a quick sound check. This proved to be a lifesaver, as our finalized format left no room for tweaking. The Holmes Brothers played two 40-minute sets; during what would have been a 25-minute intermission, Bamada played. The last 15 minutes of Holmes set #2 featured the group jam session, with an inspired "What I Say" that had everyone out of their chairs and dancing, led by Ambassador & Mrs. Gelber—I guess some diplomatic crowds really *do* like to boogie. One funny note—Habib handled the lead vocals on "What I Say" this time, and he only knew one verse, due to his limited English comprehension. So we were "goin' back to Arkansas" about six times!

MONDAY

Monday, May 11, marked the end of our short but sweet stay in Mali. We didn't leave empty handed, Habib and the other local musicians we'd come to know as friends, loaded us down with musical instruments and *objects d'arts* from the Bambara and Dogon tribes. Again, it was divide and conquer—Escort Hyman and I left shortly after 7 a.m. with all the luggage, equipment, and tickets; the group followed later. Although our flight didn't leave until 10:25 a.m., we

asked that the group leave the hotel by 8:45, to allow extra time for traffic jams. Yes, Bamako has busy streets, but the real problem was the Niger river bridge—it is the only major surface crossing into the city and out to the airport. With everybody flowing into town from outlying villages, it can become hopelessly clogged with foot and animal traffic in the morning and at dusk; we were able to avoid this pitfall. The check-in area at Senou Airport is small, and counters are few, so our early arrival helped insure that we were served first. Our Air Afrique flight was a bit delayed, but by 11 we were airborne and on our way to Burkina Faso.

BURKINA FASO

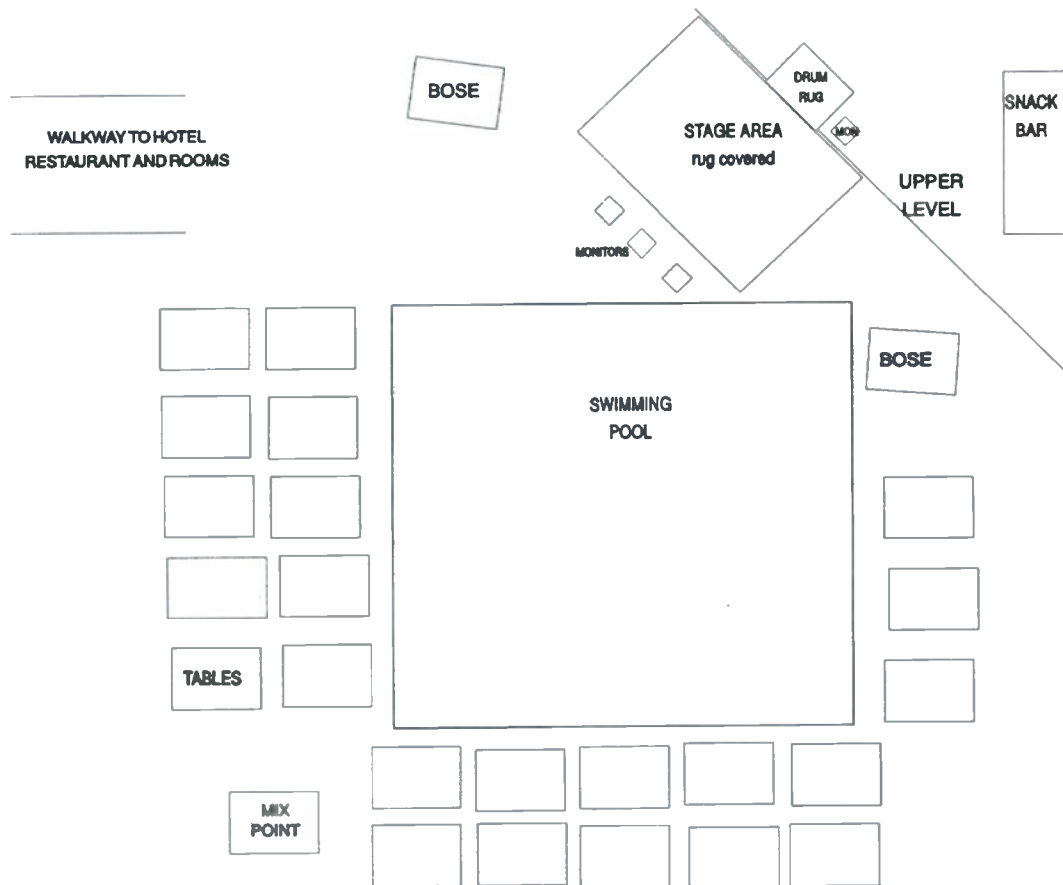
We arrived in Ouagadougou a bit past noon; PAO Tom Genton and a

large crew of embassy staffers and laborers were there to greet us. This airport was new and spacious—while the group rested comfortably, I began dealing with our stuff. I was ushered onto the airport tarmac by the embassy expediter, where I identified our luggage and equipment as it entered the baggage area. It was then loaded directly onto an embassy truck without even entering the terminal. I was asked to sign off on the equipment by customs, and that was it—by far the best entry of equipment that I'd encountered in Africa. Good thing too, time was of the essence, as we were scheduled to play a concert that night! Fortunately, this concert was at the OK Inn, the local hotel where we were staying—very convenient. We sent the band ahead while I collected our things; I followed in the equip-

ment truck less than 12 hour later. One of the things that immediately grabbed me about Ouaga was the tremendous number of mopeds—called “mobilettes” by Burkinabe—on the streets; it seems like *everybody* has one. It takes a vigilant eye when driving, too; although many major streets do have bike lanes for these mobilettes, the smaller ones do not, and many of these bikers are very aggressive drivers.

When I arrived at the hotel, I joined the group, Tom, and hotel management for a luncheon/briefing/production meeting. I discovered that our concert at the hotel had been moved back to 9:30 p.m., so the pressure was off, I had plenty of time to prepare. My concern now shifted to our concert of Wednesday, May 13, and its implications for our equipment *vis a vis*

Figure 13. The venue and stage layout at the OK Inn, Burkina Faso, Ouagadougou.



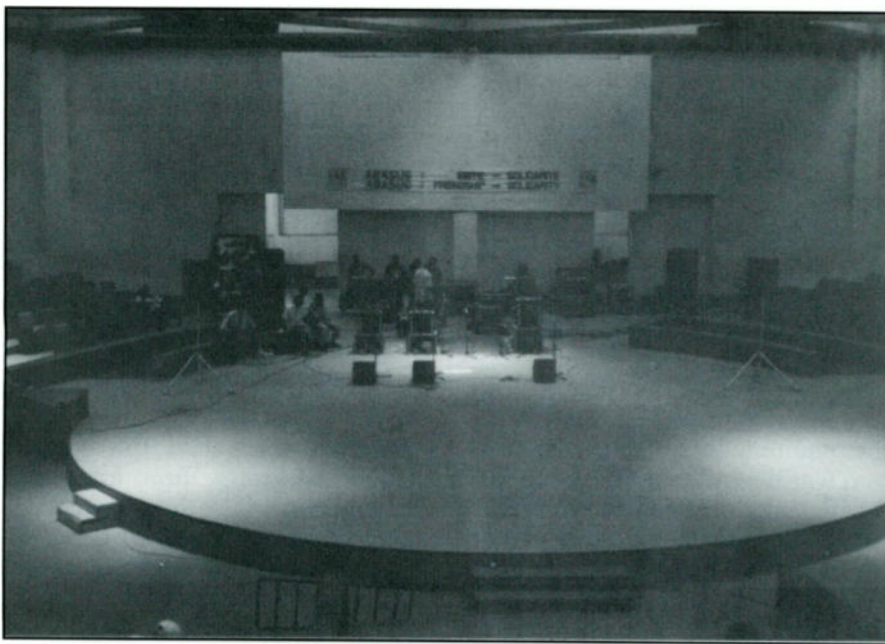


Figure 14. The stage setup at the Maison du Peuple in Ouagadougou, Burkina, Faso.

travel plans. Our next destination after Ouaga would be Lome, Togo. There were frequent flights between cities, but Tom discovered that Air Burkina, the airline scheduled to take us over on Friday, May 15, couldn't fit a case the size of my front-of-house electronics through their cargo door. There was an Air Afrique flight to Lome on Wednesday, using an AB3 Airbus that could easily handle this case, but we were scheduled to play a concert at the U.S. Ambassador's

residence that night. The next Airbus flight didn't leave until Sunday, a delay which would conflict with our Togo schedule.

Ground transportation (the drive would take about 10 hours) was ruled out because of customs difficulties at the border between these two countries. I was asked to dismantle my front-of-house case for the Air Burkina flight, placing the contents into several smaller cases that USIS-Ouaga planned to build for me; this would allow Air Burk-

ina to ship everything together. I knew this wasn't a viable option—the electronics, while rack-mountable, had most of their internal wiring and step-down transformers built into the rack. A quick look at the rear of the rack convinced everyone of my point. My suggestion was to go ahead and ship the electronics rack on the Wednesday flight—we could use electronics procured locally to make do at the ambassador's gig. Again, cooperation from the band was crucial: they agreed to use only one monitor mix at the ambassador's gig, enabling me to cut back even further than I normally would for this type of performance. My minimum requirements were now 2 channels of graphic EQ, a single DDL or reverb device, and a cassette tape deck. Tom went to work locating these while I adjourned to set up for our evenings concert.

The OK Inn is located about 7 k south of central Ouagadougou; our Dinner/concert here took place beside the pool out back of the hotel. Our "stage" was the concrete apron area at the shallow end of the pool, next to the small bar/snack shed. There were two different tiers: an upper level for the snack bar and the lower level for the "pool deck". The hotel provided a large rug to cover this area; I used a smaller rig from SIS on the upper level, using this area as a drum riser and for amplifier placement (see the diagram in Figure 13)

As such, we would play out over the pool, with the audience on either side; I had to pay particular attention to system placement here, as each PA "stack" was focused to cover primarily one side of the pool. I set my mix point at the pool's deep end, at the rear of the audience area. There were several AC outlets in the snack shed, but none of these were grounded. I found several grounded European-style outlets inside the hotel's restaurant, which I accessed by fishing my cable through a restaurant window about 75-ft. from the stage. This gave me 225 volts of fairly stable power. My biggest problem proved to be complaints from people pool side when I checked the system with program music. The dinner portion of our program began at 8 p.m.; I was asked by hotel management to

Figure 15. This is the workshop held at the Benton residence in Ouagadougou, Burkina, Faso



play some background music through the system during dinner. I opted for some soft blues to set the mood. Our performance was delayed for half an hour to allow more people to arrive—they never did. Perhaps it was the remote location, or the high ticket price, but it was our smallest crowd of the tour. There were several experts in the crowd who knew the blues, and the band actually took their requests! One good thing did come out of the show—there were several members of the local media there, and a tv crew arrived to tape several songs and the reaction of the local VIPs to them. This publicity proved invaluable at later concerts.

TUESDAY

Tuesday was another split day: I left the hotel at 9 a.m. to setup for our evening show, while the band went over to Tom's house for a late morning workshop with local musicians, including the local group which would open for us. There would be a luncheon for all of us after the workshop. I hoped to complete setup in time to make lunch, then have everyone come over for soundcheck after that. Our concert venue, the *Maison du Peuple*, seated 3,000 in a configuration that was almost in-the-round. Seating surrounded the stage for a good 260 degrees, which made my coverage situation a bit problematical. There was a small house sound system, based around Peavey SP-4 speakers and CS-800 amplifiers. I elected to place these speakers upstage and use them to cover the side stage audience areas, while using my Bose system downstage of the band to cover the straight-on audience area (see *Figure 14*). This hall was very boomy sounding, with a reverb time of almost 3 seconds. I found some grounded European-style receptacles on the stage left border wall that supplied 230 volts: there was some fluctuation, with dips as low as 210. One nice thing about working here was that I had a sizable crew to help me—I was done and over at Tom's house by noon. A jam session was in full swing when I arrived (see *Figure 15*); after enjoying the music for awhile, Tom in-

vited me into his home office to introduce Christophe Drontler, the a/v technician for the French Cultural Center in Ouaga. Christoph had the equipment I needed for tomorrow's concert: 2 Klark-Teknik $\frac{1}{3}$ -octave mono graphics, a Roland and DDL and cassette tape deck, all packaged in a small rack. We arranged for an embassy driver to pick up and deliver this gear to the ambassador's residence early in the morning, in plenty of time for my scheduled set-up. The cost—several free tickets for the Holmes evening show. Tom and I finalized plans to ship my house rack on to Lome—I agreed to pack it for shipping and set it aside during my post-concert pack. When we finished the lunch around 3 p.m.. I rounded up all the musicians and returned to the Maison for sound check.

On the way into the hall, Gib pointed out a Youssou N'Dour poster; sure enough, he was going to play in Ouagadougou within the week. Hey, was this guy following us or what? I did the Holmes soundcheck first, then supervised the set-up of our opener, which was an amalgamation of several local groups. There was some similarity (two electric guitars, electric bass, and trap drums). but there were also two complete percussion rigs, a keyboard, and acoustic guitar. I took the acoustic guitar and keyboard direct, using the monitor system for stage amplification. Fortunately, there were only three vocalists, so I was able to use Gib's vocal mic as a drum mic, along with some of my extra SM-81s. All the publicity generated by our previous show, plus the low ticket prices and central location of the Maison du Peuple, contributed to a crowd of almost 1,000. Wendell got them to clap along early in the evening, and they remained enthusiastic. The guys were a bit surprised by the applause which greeted the opening verse of classics like Sam & Dave's "When Something Is Wrong With My Baby" and Hank Williams' "I Saw The Light". Yes, these songs *were* known in Burkina Faso, which was just another lesson in how small the world has become.

Wednesday's concert proved to be another "concert by the pool". I set

the group up on the deck of the ambassador's pool, paralleling the pool's side wall. We played out to a small expanse of lawn; folding chairs were set up to seat 200. I pulled my power from inside the residence, only 50-ft. from the stage, this was a European-style receptacle, providing 230 volts of relatively stable power. This part of Ouaga, where most of the embassies are located and where most of the diplomats live, had a special power grid that limited fluctuations. There was no cover of any sort over the stage; not really a problem in the dry Sahel, but it had actually rained briefly in parts of Ouaga the night before. We elected to take a chance and stay by the pool rather than move inside the residence to a smaller space. We did have some mad moments later in the day when things clouded up, but the rain held off and it proved to be a beautiful night for a concert.

The diplomatic community was out in full force for this one, and every seat was filled. My only problem was with my mix point location: under a tree which proved an excellent parking area for the bats which were out in force at dusk. There may have been no precipitation this night, but the bat guano felt like rain where I was: I ended up with a towel on my head and another over the console, mixing under cover as it were! After packing up and saying our goodbyes to the ambassador, we returned to the OK Inn to prepare for a night out. Thursday, May 14. was a day off before we travelled to Togo on Friday. With a day to recuperate, it was off to sample the night life of Ouagadougou, a town with more clubs than Niamey and Bamako combined. Before taking off, I confirmed with Tom that our electronics rack had indeed made the Air Afrique flight to Togo. I could now look forward to a good night and day of R & R.

NEXT ISSUE

Continue along with Ed's 1992 African adventures as he visits the coastal countries of Senegal, Guinea, Togo, and Benin with the Pharoah Sanders Quartet & the Holmes Brothers. db

The Whys And Hows Of Ferrofluids In Loudspeakers

SPEAKER MANUFACTURERS constantly mention their use of ferrofluids in advertising and briefly describe the benefits in their literature. But after 15 years of supplying ferrofluid to the audio industry and with over 100 million speakers treated, few sales floor personnel have more than an inkling of what function ferrofluid really serves in a speaker. So following herewith is a primer for audio sales consultants and others on the effects of magnetic fluids. In it, we will explain what ferrofluids are, why they are used in woofers and tweeters, and, briefly, what recent advancements have been registered in this technology.

WHAT ARE FERROFLUIDS?

Ferrofluids, sub-microscopic magnetic particles suspended in a lubricating oil, were first created in research for NASA. Ferrofluidics Corp. was founded in 1968 with a license from NASA to research the technical and market development of magnetic fluid technology. Magnetic fluid applications include high-performance bearings and seals, such as used in computer hard disk drives and optical scanners. While ferrofluids' use and application may be familiar to computer and speaker engineers, the advantages are not as commonly known to audio people.

HEAT BUILD-UP IN SPEAKERS

The heat sinks in receivers and power amplifiers are a familiar sight, as most amplifiers are 75 percent efficient, with the wasted 25 percent energy resulting in heat. An amplifier that consumes 100 watts will put out about 75 watts of audio power and 25 watts of heat. When the 75 watts of audio are connected to a speaker, almost all of the power results in

heat, with only a tiny amount of signal actually being converted to sound. Only the most efficient speakers achieve efficiencies of five percent, with most dome tweeters and woofers performing closer to two percent.

So let's say we have a 10-in. woofer with a 1.5-in.-diameter voice-coil. The speaker is now connected to its amplifier and tested at a one-watt level for impedance and frequency response. Next, the power is cranked up. Even after just a few minutes, when the speaker is retested, the impedance will be at least double—and most likely even higher. The crossover network point will have shifted significantly. Not only have the characteristics of the speaker system's crossover changed, but the woofers' response has changed, typically with a falloff in its upper range. All of these anomalies are caused by voice-coil heating. The heat generated by the amplifier power passing through the voice-coil is partially transferred to the steel top plate

of the speaker's magnetic system, and eventually carried throughout the speaker.

Unfortunately, air is not an adequate conductor of this heat and it builds up faster than the air can carry it away from the voice-coil. Changes in impedance are not the only problem with hot voice-coils, as the heat causes the coil to expand, resulting in the likelihood of scraping the top plate—and failure.

Ferrofluid immerses the voice-coil in a thermally conductive fluid and pulls the heat off the coil fast, reducing or eliminating reliability problems and changes in performance that occur due to heat build-up. Ferrofluid stays in the gap due to the strong magnetic field of the gap.

WHICH DRIVERS USE FERROFLUIDS?

Tweeters and midranges are the most commonly known recipients of ferrofluids. If a ferrofluid is too viscous, then the top-end response of the tweeter

Figure 1. Audio engineers run a vast array of speaker tests, free to customers. Damping, heat transfer, impedance and ferrofluid compatibility are checked.



Barry D. Moskowitz is business manager of Ferrofluidics' Technology Division and Michael Klasco is a company consultant. This article originally appeared in Audio/Video International.

could be over-damped. On the other hand, just the right viscosity will damp out resonance in a tweeter, smoothing response and reducing harmonic distortion. Ferrofluidics Corp. offers a free design service for speaker manufacturers to aid in pre-production testing of ferrofluid compatibility with loudspeakers.

ARE THERE OTHER BENEFITS TO FERROFLUIDS?

Manufacturers who use ferrofluids have found that production yields are enhanced and field warranty returns are significantly reduced. During the late 1970s and 1980s it was believed that this was entirely due to "magneto-static force". The ferrofluid, being magnetically responsive, is attracted to the flux field and pushes back when the coil starts to become off center in the gap, thereby acting as a restoring force to maintain concentricity. Reports based on practical experiences of many manufacturers using ferrofluid have revealed dramatic increases in production yields and decreased field returns. This is only partially due to the levitation effect of ferrofluid (magneto-static force), but also due to reduction in voice-coil operating temperature, keeping the voice-coil from expanding and then scraping the top plate. Even the simple lubrication effect of the fluid is partially responsible for the reduced abrasiveness of coil/top plate collisions. There are still other benefits—for instance, ferrofluid deters dirt or particles from entering the gap and even inhibits corrosion of the coil and gap.

RECENT DEVELOPMENTS IN FERROFLUIDS

In pro-audio, high power levels have driven the development of ferrofluids that can function at extremely high temperatures (400 degrees Fahrenheit or more) without evaporating or gumming up. At home and in their cars many enthusiastic music-lovers overdrive their sound systems into overload and hard clipping, which increases the heating of the speaker's voice-coil. This not only stresses the voice-coil, but also, the ferrofluid. To withstand the resulting intense temperatures, Ferrofluidics has introduced its APG 900 series, boasting long-term high-temperature operation.

Many speaker manufacturers have had very positive results with ferrofluids in both tweeters and in midranges, but

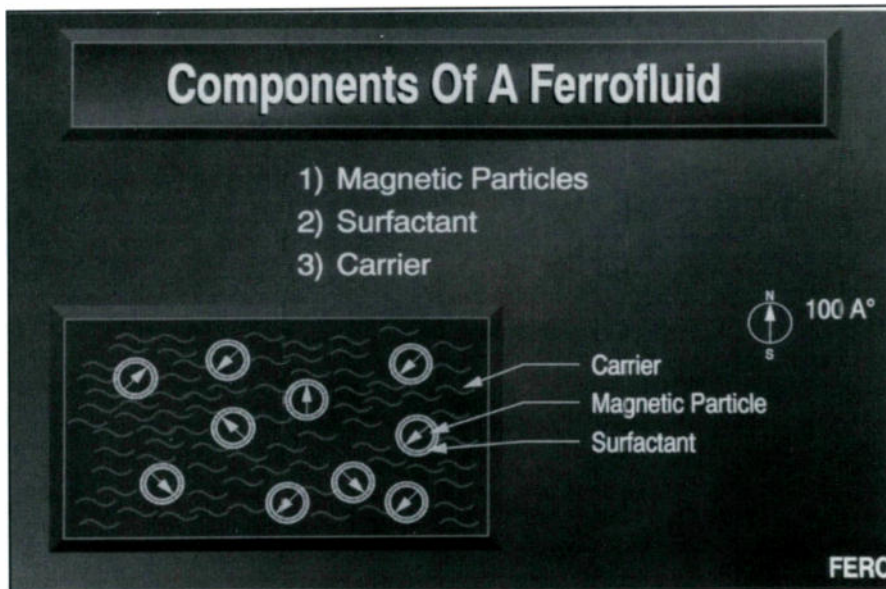


Figure 2. This shows the components of a ferrofluid

some wanted a ferrofluid more appropriate for woofers. Low viscosity and high saturation magnetization was asked for, in order to stay in the gap even at large excursions without requiring extensive changes to existing woofer designs. These requirements, in addition to stringent thermal requirements, made for a difficult technical challenge. Ferrofluidics spent thousands of research man-hours to complete development in 1991 of APG027 woofer ferrofluid.

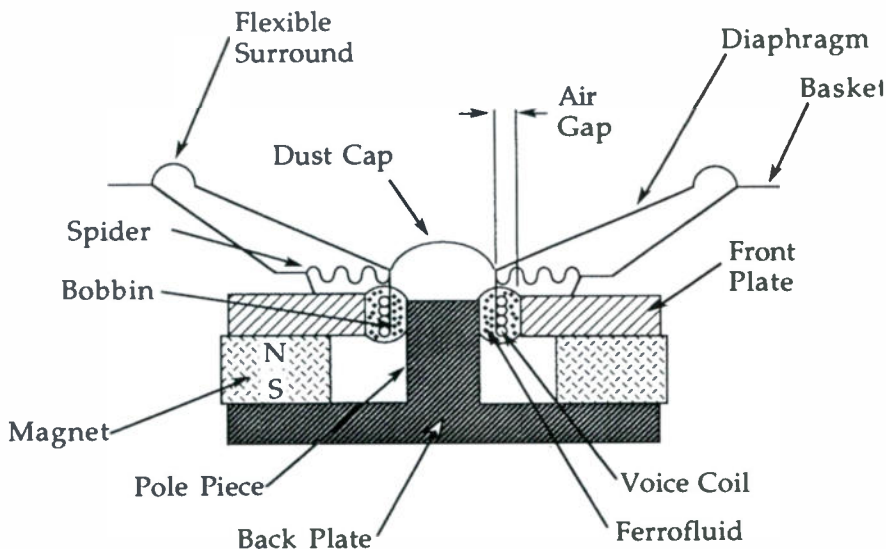
Ferrofluids increase power handling, stabilize sound quality even at high sound levels, smooth frequency response, reduce distortion and improve transient response. The actual manufac-

turing cost of materials and labor of using ferrofluids is only pennies per speaker.

The only real cost to the speaker manufacturer is what care he expends in careful design by specifying the appropriate selection and application of ferrofluid to a speaker.

To date, over 100 million speakers have benefited from the application of ferrofluids. Among speaker engineers, it is an accepted technique for performance enhancement, and ongoing research is being conducted by Ferrofluidics Corp. to further advance both the performance and its successful application. db

Figure 3. The location of ferrofluid in a speaker.



BearTracks Recording Studio at Ten Years

Thriving and growing during a dramatic decade of profound and fundamental changes in the recording studio industry, BearTracks Recording Studio in Suffern, NY, celebrated its tenth anniversary this year.

BEARTRACKS IS LOCATED IN A beautiful, private country setting in the woods only 30 minutes from midtown Manhattan, BearTracks has remained dedicated to the single, guiding principle on which it was founded 10 years ago—providing the ideal creative environment for album projects by major label recording artists. BearTracks is owned by saxophonist Jay Beckenstein, the guiding light of the world-renowned jazz band Spyro Gyra, who opened the studio in 1982 with the late Richard Calandra.

“When we first opened, we dedicated ourselves solely to providing the ideal creative environment for album projects by major label recording artists,” said Beckenstein. “Now, ten years later, we’re delighted that BearTracks still continues to attract the same high caliber of artists, producers, and engineers.”

Beckenstein’s original philosophy on which the studio was founded has been embraced by many top rock and jazz artists over the years, from Julian Lennon and Bruce Hornsby to Billy Cobham, Bob James, Taylor Dane, and Firehouse. Some of the most recent artists include a wide selection of new artists, like David Wilcox, Killer Dwarfs, Young Turk, Eye And I, and Jeremy Wall. Spyro Gyra also recently finished recording its third album for GRP Records at BearTracks.

Randolph P. Savicky is President of RPS Communications, a public relations and marketing company specializing in the professional audio, recording, and music industries. RPS Communications is located in Centerport, NY.

The studio has also been a second home to a wide range of other demanding artists during the past decade, from the Harlem Boys Choir and classical clarinetist Richard Stoltzman to Japanese artist Ryuichi Sakamoto, who scored the Academy Award-winning film, *The Last Emperor*. Sakamoto’s sessions at BearTracks combined West African drummers, Indian tabla players, Spanish guitarists, American jazz musicians, and a singer from Okinawa in a true *world music* session.

HOSTING A PRESIDENT

BearTracks is also one of the only studios in the world to have hosted a presidential recording session. Richard Nixon recorded a books-on-tape project for Simon & Schuster at the studio, working in the morning, while Firehouse used the studio in the afternoon.

Many top producers and engineers have worked at BearTracks over the years, from Roy Thomas Baker to Eddie Kramer. David Prater, who produced both of the hit Firehouse albums at BearTracks as well as the new Dream Theater album, has become a regular at the facility.

“After recording Firehouse’s multi-platinum debut album at BearTracks, it was only natural that we returned there for the second album,” said Prater. “BearTracks is perfect. It’s a beautiful studio to work in, the staff’s great, and we can fully concentrate on recording, without any distractions. It’s a lot like an English residential facility.

“BearTracks was conceived, designed, and built totally with the recording artist in mind,” said Beckenstein. “It’s my philosophy that total privacy, a great sounding

room, superior equipment, and a concerned and caring staff are the ideal elements for artists who want to concentrate 100 percent on creativity, without any outside distractions, when they’re working on an album,” he continued. “At the same time, we’re only a half-hour from New York and all it has to offer,” he continued.

“We have the best of both worlds at BearTracks, and artists can easily take advantage of them both during a session.

“These are the principles we founded BearTracks on, and we feel these principles are even more important in today’s music and recording industry,” he concluded.

Beckenstein explained that after the success of the first Spyro Gyra album, it was natural for him to want to reinvest in the band and its recording future by opening their own recording studio. Although originally from Buffalo, NY, Beckenstein and Calandra considered themselves New York City producers first and foremost.

THE STUDIO

“When we looked for a studio site, we wanted a rural setting, but within a close proximity to New York City,” he said. “We truly wanted to capture the best of both worlds—to be able to walk in the woods for two days without seeing another human being, while at the same time being only a short distance from the energy of the city, the music, entertainment, and arts capital of the world.

“Once we found this property, which is unique, we decided to build a state-of-the-art studio, rather than just follow our original idea, which was to build a producer’s studio,” he continued. “We wanted to match the unbelievable acoustics of the huge live room and

its natural stone walls with the very best equipment, so we invested in a Solid State Logic console, Studer tape machines, and top quality outboard gear and microphones.

"At BearTracks, we feel we've created the ideal atmosphere for recording live music and live musicians in the perfect acoustic setting," he added.

BearTracks' huge 1,700 square foot oak and cedar studio was created within a massive stone barn and farm house complex. This was originally built by European stone masons at the turn of the century.

The main recording area features a 27-foot high cathedral ceiling, and two walls of the 30 foot by 47 foot main recording area retain their original stonework. Five windows overlook the surrounding woods and New York State's 43,000 acre Harriman State Park, which borders the rear of the studio. "It's an unusually large recording room, the best live room I've ever been in," Beckenstein said. "We feel it's the studio's best feature, enabling a group of live musicians to play and interact together in real-time, with that special magic captured on tape. It's a room that truly sets it apart from all of the other studios in the world."

"The studio really offers a relaxed, natural atmosphere for any type of recording session," said Chris Bubacz, BearTracks' Studio Manager for the past four years. "The room interacts well with live musicians, with a nice and even sound activity.

"Six-piece bands can easily be recorded live so musicians can play live and hear themselves and each other in the room," he added.

In order to individualize the acoustics of the room to each artist's particular needs and desires, a unique series of movable baffles was custom-designed by Larry Swist, who's engineered many of Spyro Gyra's albums. These baffles allow the height of the cathedral ceiling to be adjusted anywhere down to 14 feet.

In addition to this room, BearTracks offers three live echo chambers, including two dug into the mountainside behind the studio. These *concrete bomb shelters*, which were originally root cellars before the advent of refrigeration,

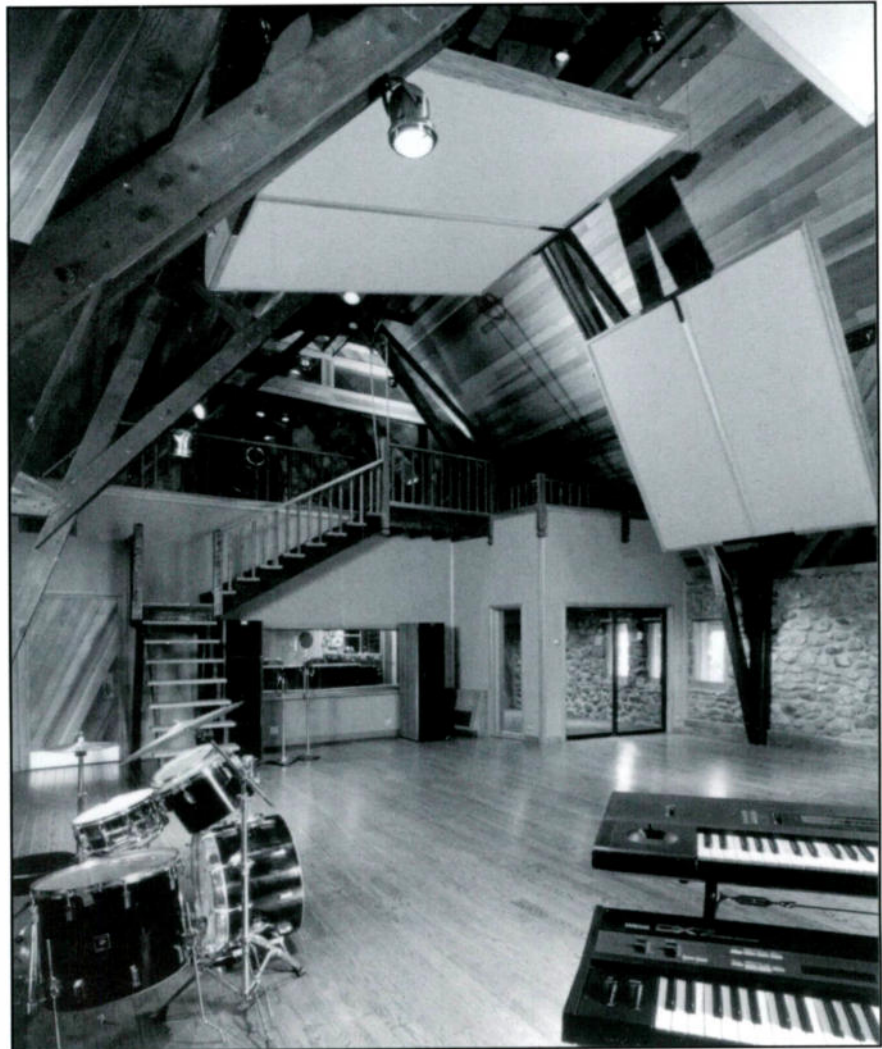


Figure 1. The studio is 1,700 square feet and has a 27-foot cathedral ceiling.

offer unmatched acoustic spaces and endless recording possibilities.

"A private producer's lounge will soon be completed", Bubacz noted.

CONTROL

The George Augspurger-designed control room includes a full range of both new and vintage recording equipment. A Solid State Logic E Series console with G Series Studio Computer and software, the newest Studer A820 multi-tracks—with 48 tracks of Dolby Spectral Recording (SR)—and two Studer A80 MkIII two-track tape recorders with Dolby SR and A noise reduction are featured.

A full selection of outboard equipment includes Neve and Focusrite EQs and Fairchild limiters. The custom-designed Augspurger monitoring system incorporates TAD and JBL components, and more

than 50 microphones, including Neumann tubes, are on-hand for sessions.

"Our decision to upgrade our SSL console with the new G Series Computer and software earlier this year was based on meeting our client's needs for the latest in studio technology," said Bubacz. "We strive to stay on the cutting edge so that our clients can be more creative and more productive.

"The G Series software works much faster than the original E Series software, so the whole production process is faster", Bubacz noted.

"This allows mixes to be completed more efficiently, while at the same time offering tremendous flexibility and creativity.

"Earlier this year, we also added the new Studer A820-24 analog multi-tracks to guarantee the highest quality audio," said



Figure 2. The George Augspurger-designed control room features a full range of both new and vintage recording equipment.

Bubacz. "In fact, we're one of the first facilities to offer two of Studer's newest analog multi-tracks and 48 channels of Dolby SR.

"Under very rigorous tests and demonstrations, the Studer A820-24 has proven itself to be a high quality, sonically excellent, and extremely rugged machine, with an abundance of extraordinary features," he added.

"These include built-in Dolby SR, automatic alignment of all audio parameters, including Dolby SR alignment, extremely fast transport speeds of 0- 600 in./sec. in just four seconds, and full microprocessor control. All of our equipment is meticulously maintained by our experienced full-time maintenance staff," Bubacz said.

"We feel that this is extremely important. A top studio must provide its clients with the very best equipment, meticulously maintained and problem-free, to ensure the highest quality and most productive recording sessions," he added.

Bubacz noted that all of BearTracks' equipment is included in their studio rate, and that they have also recently been adding more outboard gear to meet clients'

needs, not only for tracking, but for mixing sessions as well. "We like giving a 'all-in-one' rate so clients know up front exactly what the rate will be," Bubacz explained. "We don't want our clients to be surprised by charges they didn't expect!"

To relax during or after a session, Bubacz noted that BearTracks offers a full range of facilities. These include an outdoor swimming pool, barbecue area, indoor sauna, shower, video arcade games, stereo system, color television, and video cassette recorder. Full kitchen facilities are also available.

Also, depending on the season, hiking, swimming, skiing, or ice skating is also available in Harri-man State Park.

But a world-class studio is more than its equipment and its amenities, Bubacz explained.

"Great equipment must be backed by great service," he said. "Our technical and office support staffs are highly sensitive to our clients' unique needs and are there to serve them in any way they can.

"At BearTracks, we go out of our way to make sure that each and every one of our clients is entirely satisfied—every time," he continued. "We want BearTracks to be

part of their album's artistic and commercial success.

"As we enter our second decade, our commitment to our clients and to meeting their needs with the ideal creative recording environment, backed by the best and most caring staff anywhere, remains stronger than ever," Beckenstein concluded.

STARS SHINE AT BEAR-TRACKS

BearTracks Donates Studio For Cash & Williams Video Shoots For Benefit Children's Album

BearTracks Recording Studio recently donated its studio for two separate video shoots by Rosanne Cash and Deniece Williams as part of the children's benefit album *Till Their Eyes Shine (The Lullaby Album)* on Columbia Records.

Featuring more than a dozen female recording artists, the album will benefit the Institute for Intercultural Understanding and its *Voiceless Victims* project, which teaches children who are victims of war or inner city poverty to express themselves through art and poetry. The Institute was founded by Jan Arnow in Louisville, KY.

The album was the idea of Cash, Arnow, and producer/coordinator Don DeVito.

Ginger Group Productions in New York handled the video shoots at BearTracks. "All of us at BearTracks are honored to have contributed our facilities to this wonderful project and to have hosted two outstanding artists like Rosanne Cash and Deniece Williams," said Chris Bubacz, BearTracks' Studio Manager. "We truly hope that *The Lullaby Album* will help the Institute, its *Voiceless Victims* project, and the children who need their help." In addition to Cash and Williams, the multi-generational and multi-ethnic performers who appear on *Till Their Eyes Shine* include Mary-Chapin Carpenter, Gloria Estefan, Emmylou Harris, Carole King, Kate and Anna McGarrigle, Laura Nyro, Maura O'Connell, Brenda Russell, Sweet Honey in the Rock, and Dionne Warwick. Each artist contributed her own traditional or original lullaby to the album. db

Twenty-Five Years From Now

As part of our celebration of 25-years of publishing db Magazine we asked a number of industry movers and shakers to give us comments on what they believe the next 25 years will bring.

I believe the recording field will grow to include more and more home audio enthusiasts. They will be using PC-based audio systems for recording, mixing and mastering. The use of digital audio, and especially data compression, will continue to lower the expectations of what constitutes "good" audio. Consequently, there will be a small but significant number of professionals who will continue to demand realism and musicality.

*Marvin Caesar
President
Aphex Systems
Sun Valley, California*

While everyone else is gushing about projected technological frills, let me suggest that the audio industry is not immune to global economics and social trends. I believe we are nearing the practical limits of technological growth—not because such growth is impossible, but because it is rapidly becoming irrelevant. People are no longer impressed by awesome sounds. They're hungry for real music, with real content, performed by real musicians. My advice to would-be engineers and producers is this: better bone-

up on your microphone technique, you're gonna need it.

*John Barilla
Senior Editor
db Magazine*

I believe that the most important technology that will drive the distribution of audio in the next quarter century will be *data reduction*, or perceptual encoding. The crowding of transmission channels, not to mention digital radio and television, virtually mandate this. While many of our first experiences with it may not have been satisfactory, it is an important field that we had all better get in step with, so that we can track the rapid developments and improvements now being made.

*John Eargle
JME Consulting Corp.
Hollywood, California*

The use of sophisticated digital equipment in the live sound arena will increase exponentially. I look for more products such as the Crown IQ system, the Yamaha 2040 digital crossover, and the electronic programmable equalizer to ac-

celerate the evolution of system control. I also expect to see tools such as these become affordable to the mid- and low-level users. I anticipate that major component manufacturers will develop 1,200-watt cone speakers and 400-watt compression drivers in an attempt to keep up with continuing construction of smaller speaker cabinets with tremendous output capacity. Sound systems will shrink in size, small but powerful "point source" systems will replace the giant multiple-cabinet arrays of today. We will see American groups routinely touring South America, Africa and Asia; more foreign groups will visit the U.S.

*"Big" Ed Learned
Ypsilanti, Ohio*

In professional audio more recording formats will be introduced over the period and eventual shake down to three or four digital formats by the end of 25 years. The formats will differ in size and capacity based on differenced in user need and cost requirements. Long length serial formats will still be magnetic tape based, but shorter recording time needs will be stored on magneto-optic formats. MO and other disc formats will also be used where fast random access is required.

Consumer audio recording will be supplied to the consumer with pictures, no music videos, but something simpler and supportive of the mood and emotions that the music is intended to create. These pictures will be computer motion stills or simulations. Customers will access these in their homes from libraries, over fiber-optic cables for instantaneous playback on their multi-media entertainment center, at any time they wish.

Delos (Del) A. Eilers

*Senior Technical Service Specialist
Consumer and Professional Video and
Audio Technology Division
3M Company
St. Paul, Minnesota*

The coming 25 years will see the end of the era of reel-to-reel tape recorders and analog consoles and copper wire. The cost of digital will be with the reach of everyone. The digital recording consoles of the future will not only be much smaller and less expensive than the giant analog consoles of today, but much more powerful, and also include a built-in storage medium instead of tape. Of course, connecting any external equipment will utilize fiber optics.

*Ben Rizzi
Master Sound Astoria
Astoria, New York*

In my opinion, miniaturization of electronic components will be the most pervasive single aspect of audio equipment in the next 25 years. Digital storage and processing technologies will play the major role in expanding the applications and solving the electroacoustical problems, but we expect analog electronics to remain for many applications. In general, consumers will become increasingly accustomed to wide-band response in audio products, driving the demand for better sound quality. And the emerging global marketplace will hopefully lead to a resolution of the conflicting maze of standards and regulations, in order to achieve compatibility and heightened interactive communication would wide.

*Jim Kogen
President
Shure Brothers, Inc.
Evanston, Illinois*



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DB9301

db Buyer's Guide

Compressors/Limiters, Noise Gates, Noise Reduction, Miscellaneous

On the pages that follow, we present this issue's Buyer's Guide on Compressors/Limiters, Noise Gates, Noise-Reduction equipment, Miscellaneous, Digital Workstations. The information contained is supplied by the respective manufacturers. Further, if a manufacturer that you seek is not listed, the chances are strong that, as many times as we tried, we could not get information from them.

COMPRESSORS/LIMITERS

ALESIS STUDIO ELECTRONICS

The Micro Limiter features full stereo; soft-kneed limiter/compressor with unique attack and decay characteristics; Input, Release and Output controls, as well as an in/out switch and 20 kHz bandwidth.

Dimensions: 1.75 in. x 6.3 in. x 6.25 in.

Weight: 1.5 lbs.

Price: \$149.00

APHEX SYSTEMS LTD.

The Model 320 Compellor is a compressor/leveler/peak limiter featuring dual mono/stereo operation, leveling speed and peak limiter switchable on front panel; servo balanced inputs and outputs; operates at -10 dBv, +4 and +8 dBu.

Dimensions: 1.75 in. x 19 in. x 10 in.

Price: \$1,350.00

The Model 651 Expressor is a single channel compressor/limiter with a high-frequency expander. Features full function compressor with control of threshold, ratio, attack and release. Special HFX allows for dynamic "decompression" of selectable high frequency range.

Dimensions: 1.75 in. x 19 in. x 9 in.

Price: \$495.00

The Model 720 Dominator II is a precision multiband peak limiter. Stereo peak limiter is used as final protection in audio chain; absolute peak ceiling with no over shoot; adjustable ceiling level; density; release time; servo balanced inputs and outputs.

Dimensions: 1.75 in. x 19 in. x 9 in.

Price: \$1,350.00

ARX SYSTEMS See our ad on page 2

The Quadcomp features four compressor/limiters with variable ratio threshold and output gain in the one package. With full LED gain reduction metering and balanced inputs and outputs.

Dimensions: 1.75 in. x 19 in. x 6 in.

Weight: 5 lbs.

Price: \$799.00

The Afterburner features two channels of compressor/limiter with variable ratio and threshold and output gain. The Afterburner can be switched into "Mono" mode allowing separate Dynamics control of low and high frequencies. Also features balanced inputs and outputs on jacks and XLRs.

Dimensions: 1.75 in. x 19 in. x 6 in.

Weight: 5 lbs.

Price: \$599.00

DDP-1 is a dual channel dynamic processor with gate, compressor and peak limiter, Features include in/out level metering, separate gain reduction metering, sidechain inserts, and balanced inputs and outputs on XLR and jack connectors.

Dimensions: 1.75 in. x 19 in. x 6 in.

Weight: 5 lbs.

Price: \$799.00

A Correction

In our Directory of compressor/limiters in the September/October issue we inadvertently left out AB Systems graphic equalizers. They produce a full line.

The model 231 graphic equalizer offers range, voltage, ground lift, balanced XLR, all at attractive price levels.

Price: \$599.00

BROOKE SIREN SYSTEMS, A DIVISION OF AKG ACOUSTICS, INC.

The DPR-402 two-channel compressor/limiter features high-frequency de-esser and wide band de-esser with peak limiting; adjustable speed; dynamics program manipulation; and full LED metering for both input and output.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 9 lbs.

Price: \$1,339.00

The DPR-404 four-channel compressor features a de-esser with high frequency de-essing. Each channel includes threshold control; below threshold metering; ratio control; gain reduction meter; clip LED; gain control and linking.

Dimensions: 1.75 in. x 19 in. x 11 in.

Weight: 8 lbs. 2 oz.

Price: \$1,399.00

dbx, A DIVISION OF AKG ACOUSTICS, INC.

The 160XT features a dual display system that monitors true RMS input or output levels with a 19 LED display while simultaneously monitoring gain reduction over a 40 dB range. Choice of OverEasy or classic hard-knee compression.

Dimensions: 1.75 in. x 19 in. x 9.25 in.

Weight: 6.5 lbs.

Price: \$459.00

The 163X features OverEasy compression action with key operating parameters integrated and controlled by a single slide control. Designed for operation at nominal studio levels from -30 dBu to +10 dBu.

Dimensions: 1.75 in. x 19 in. x 9.25 in.

Weight: 2.5 lbs.

Price: \$169.00

The 165A features OverEasy compression and PeakStop peak blocking. Also features automatic and fully adjustable manual attack and release rate controls with matched RMS detectors for true power summing when stereo strapped.

Dimensions: 3.5 in. x 19 in. x 9.25 in.

Weight: 6.5 lbs.

Price: \$999.00

The 166 is a dual-channel compressor with an expander gate before each compressor. The combination of noise gate, OverEasy compressor and PeakStop limiting provides complete control of the input dynamics.

Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 6.5 in.

Price: \$629.00

DOD/DIGITECH/AUDIO LOGIC

The Audio Logic 266 compressor/limiter/gate features program dependent attack and release times for the compressor/limiter; feed forward gain control; side chain input and outputs; stereo link; and direct input to output bypass.

Dimensions: 1.75 in. x 17 in. x 6 in.

Price: \$500.00

The Audio Logic 660 compressor/limiter/gate features feed forward gain control; side chain input and outputs; stereo link; variable attack time; variable release time; and -40 dBu to +20 dBu compressor threshold control.

Dimensions: 1.75 in. x 17 in. x 6 in.

Price: \$340.00

FURMAN SOUND, INC.

The Model LC-X expander/compressor/limiter also includes a de-esser and hard limiter. Controls include three threshold; two ratio; attack, release; and output. Features switchable LED meter; side chain jacks; bypass switch; de-ess button; stereo interconnect; and on/off transient muting. Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 7 lbs.

Price: \$369.00

The Model LC-6 stereo limiter/compressor/gate is a two-channel unit that may be switched for stereo operation. Controls include input, output, compress, threshold, gate threshold, attack, release and ratio. Includes LED meters and side chain jacks; ground lift switch. Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 7 lbs.

Price: \$439.00

The Model LC-3A limiter/compressor includes input, output, attack, release and ratio controls. Has LED meter to indicate gain reduction; overload and power indicators; side chain jacks; de-ess button; ground lift switch; optional balanced configuration.

Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 7 lbs.

Price: \$269.00

JBL PROFESSIONAL

Model 7110 is a single channel limiter/compressor for both peak and average gain reduction. Features Smart Slope compression circuitry; "Automatic Preset" feature; input/output/gain reduction metering in single rack space chassis.

Price: \$495.00

Model 7112 is a dual channel limiter/compressor for both peak and average gain reduction. Features Smart Slope compression circuitry; "Automatic Preset" feature; input/output/gain reduction metering; and selectable "link" for multi-unit chaining.

Price: to be announced

Model 7122 is a dual channel frequency selectable limiter/compressor/expander that provides both peak and average gain reduction; Smart Slope compression circuitry; "Automatic Preset" feature; input/output/gain reduction metering; and selectable "link" for multi-unit chaining.

Price: to be announced

Model LA-4 Electro-Optical Attenuator compressor/limiter features selectable compression ratios; full VU metering; input overload indicator; and simple stereo coupling. Rack-mountable alone or in pairs in two rack spaces.

Price: \$730.00

The 1176LN is a single channel peak limiter with selectable compression ratios; adjustable attack and release times; balanced input and transformer-balanced output; standard 19 in. rack mount in two spaces.

Price: \$830.00

The 1178 is a dual channel peak limiter with selectable compression ratios; adjustable attack and release times; balanced input and transformer-balanced output; standard 19 in. rack mount in two rack spaces.

Price: \$1,390.00

The Model 562 Feedback Suppressor has a single channel, with five independently adjustable notch filters; high and low cut end filters; protective peak clipper; headroom indicator; bypass option and single rack space chassis.

Price: \$890.00

LT SOUND

Model CLX-2 is a feed-forward compressor/limiter incorporating the Allison EGC-101 VCA. Features include simultaneous operation of both compressor and limiter.

Dimensions: 1.75 in. x 19 in. x 7.25 in.

Weight: 8 lbs.

Price: \$995.00

Model ACC-2 is similar to the CLX-2, but incorporates an expander as well. An outboard oscillator is included for tremolo and stereo panning.

Dimensions: 3.5 in. x 19 in. x 7.25 in.

Weight: 11 lbs.

Price: \$1,250.00

Model SL-2 is a stereo limiter/expander with features including simultaneous limiting and expansion functions, de-essing and

stereo or independent operation.

Dimensions: 1.75 in. x 19 in. x 7.25 in.

Weight: 7 lbs.

Price: \$395.00

ORBAN, A DIVISION OF AKG ACOUSTICS, INC.

The 412A controls interact to simplify and speed setup, and to prevent errors. Peak limiting and compressor functions are cross-coupled to eliminate potential pumping and modulation effects.

Dimensions: 1.75 in. x 19 in. x 5.3 in.

Weight: 5 lbs.

Price: \$525.00

The 414A is a stereo/dual version of 412A.

Dimensions: 3.5 in. x 19 in. x 5.3 in.

Price: \$800.00

The 422A features adjustable attack/release time and compression ratio. Selectable linear or exponential release time characteristic; defeatable release gate with adjustable threshold causes gain to move slowly toward user-adjustable value during pauses, preventing noise rush-up, pumping and breathing.

Dimensions: 3.5 in. x 19 in. x 10 in.

Weight: 10 lbs.

Price: \$680.00

The 424A is a dual/stereo version of the 422A.

Dimensions: 3.5 in. x 19 in. x 10 in.

Weight: 10 lbs.

Price: \$1,150.00

The 464A rides gain and limits peaks. Provides input attenuator, gate threshold, release time and shape, pre-emphasis, output level, AGC rate and RF limiting—all can be tailored to a specific installation/application.

Dimensions: 1.75 in. x 19 in. x 9.625 in.

Weight: 8 lbs.

Price: \$1,200.00

PEAVEY ELECTRONICS CORPORATION/AUDIO MEDIA RESEARCH

The CDS 2 dual channel compressor/limiter/de-esser features compression ratio control; switchable attack/release time; "soft knee" type compression; side chain capability; stereo/mono operation.

Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 6 lbs.

Price: \$249.99

RANE CORPORATION See our ad on page 6

The FPL Program Limiter from the Flex Series in the HR format provides four independent channels of servo-lock limiting. Each channel independently switchable to AutoSlave mode, which links the side chains of all selected channels.

Dimensions: 1.75 in. x 8.5 in. x 8 in.

Weight: 4 lbs.

Price: not available

ROCKTRON CORPORATION

The Model 360 features compression, peak limiting and Hush II noise reduction; stereo master; unbalanced ¼ in. jacks; and gain reduction metering.

Dimensions: 19 in. single rack space

Price: \$569.00

The Model 321 features compression; peak limiting; stereo master; unbalanced ¼ in. jacks; and gain reduction metering.

Dimensions: 19 in. single rack space

Price: \$499.00

Model 300A features peak limiting ratio; attack; release and threshold controls; Hush II noise reduction; gain reduction metering; side chain input and output.

Dimensions: 19 in. single space

Price: \$419.00

Model 300G is foot switchable; features peak limiting ratio; attack; release and threshold controls; Hush II noise reduction; gain reduction metering and sidechain input and output.

Dimensions: 19 in. single space

Model 311 is a mono compressor/expander with input gain switch; slave/master switch; is foot switchable; and has gain reduction metering.

Dimensions: 19 in. single space

The Model CE2 is a compressor/expander with mono; stereo strappable gain reduction metering and a clip indicator.

Dimensions: 1/2 rack

Price: \$219.00

RSP TECHNOLOGIES

The Model 2200 features multiband compression; leveling; peak limiting; Hush noise reduction; 1/4 balanced/unbalanced and XLR I/O; stereo master; and crossover point of 500 Hz or 2 kHz.

Dimensions: 19 in. single rack space

Price: \$899.00

SOUNDTECH

The ST200CL compressor/limiter features stereo/mono; compressor on/off switches; gain reduction meter; variable gate; threshold; compression ratio; attack; release; input/output levels; balanced XLR/unbalanced 1/4 in. inputs/outputs.

Dimensions: 1.75 in. x 19 in. x 7 in.

Weight: 6 lbs.

Price: \$349.90

SYMETRIX

Model 501 Peak/RMS compressor/limiter includes separate processors for simultaneous compression and Infinity:1 peak limiting. It provides absolute overload protection. Balanced and unbalanced ins/outs make interfacing easy.

Dimensions: 1.75 in. x 19 in. x 4.5 in.

Weight: 7 lbs.

Price: \$349.00

Model 501-01 is the same as the 501, but with transformer-coupled outputs.

Dimensions: 1.75 in. x 19 in. x 4.5 in.

Weight: 7 lbs.

Price: \$349.00

Model 525 dual gated compressor/limiter is a two-channel or true stereo device with program-controlled attack and release times. The compressor/limiter governs levels, while the expander/gate eliminates "breathing" and extraneous noise. Has side chain accessibility.

Dimensions: 1.75 in. x 19 in. x 4.5 in.

Weight: 7 lbs.

Price: \$539.00

Model SX208 stereo compressor/limiter is easy to use with straightforward controls. Program-driven attack and release times help produce wide dynamic range and low distortion. Balanced and unbalanced signal connections make setup fast.

Dimensions: 1.5 in. x 8.2 in. x 6 in.

Weight: 5 lbs.

Price: \$299.00

NOISE GATES

ALESIS STUDIO ELECTRONICS

The Micro Gate features keyable stereo in, stereo out, noise gate with Threshold, Delay and Rate controls; smooth, quiet operation; 20 kHz bandwidth; In/Out switch.

Dimensions: 1.75 in. x 6.3 in. x 6.25 in.

Weight: 1.5 lbs.

Price: \$149.00

APHEX SYSTEMS LTD.

Model 612 Expander/Gate is dual channel with switchable high/low cut filters in side chain; full function with controls for attack, hold and release times; key listen, duck and stereo line switches; servo balanced in and out.

Price: \$795.00

ARX SYSTEMS See our ad on page 6.

The Sixgate offers six channels of independent noise gating with variable threshold; attenuation and release times; balanced jack in and out; and LED indication of operating status as well as a hardwire bypass. Other features also available.

Dimensions: 1.75 in. x 19 in. x 6 in.

Weight: 5 lbs.

Price: \$649.00

AUDIO MEDIA RESEARCH

The NGT 2 dual channel noise gate features side chain input and insert capability; synch trigger outputs; complete parameter control; bypass switches; variable attack/release time.

Dimensions: 1.75 in. x 11 in. x 8 in.

Weight: 6 lbs.

Price: \$199.99

The NGT 4000 is a four-channel VCA-based noise gate/downward expander with complete control of threshold; attack; release; hold-off time; attenuation; gain trim; and side chain frequency contour; side chain signal shaping or processing; and electronically balanced inputs/outputs.

Price: \$299.00

BROOKE SIREN SYSTEMS, A DIVISION OF AKG ACOUSTICS, INC.

The DPR-502 features two channels with key filters; an internal/external key source; key listening; gating or ducking; peak and average active window metering; threshold control; range control; gate profile section; auto attack mode switch; and auto dynamic enhancement.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 10 lbs.

Price: \$1,359.00

The DPR-504 four-channel noise gate features a parametric key filter; key filter listening; simultaneous key level; threshold metering with average and peak metering; gate status LED; release/hold switch (hold tracks proportionally with release times); attack; switchable auto/fast.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 11 lbs. 10 oz.

Price: \$1,359.00

dbx, A DIVISION OF AKG ACOUSTICS, INC.

The 363X features two channels with separate threshold; hold and release controls plus key monitor; key engage; stereo couple and bypass for stereo or dual independent operation. Allows removal of unwanted background sounds.

Dimensions: 1.75 in. x 8.5 in. x 7.25 in.

Weight: 2.5 lbs.

Price: \$269.00

The 904 uses dbx's OverEasy action for smooth onset of gating. Attenuation limit, attack and release rates, and threshold are all adjustable. Also features programmed latch mode.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$499.00

DOD/DIGITECH/AUDIO LOGIC

The Audio Logic 440 Quad Noise Gate features -60 dBu to +20 dBu threshold; 0 dB to 90 dB attenuation; 50 microsecond to 50 millisecond attack time; 50 millisecond to 5 second release time; feed-forward gain control; and separate key input for each channel.

Dimensions: 1.75 in. x 17 in. x 6 in.

Price: \$400.00

FURMAN SOUND, INC.

The Model QN-44 quad noise gate features threshold; attack; release; and depth controls with "channel on" indicator. Key input jacks are provided for special effects. Features extremely low noise and distortion.

Dimensions: 1.75 in. x 19 in. x 8 in.

Weight: 7 lbs.

Price: \$429.00

PEAVEY ELECTRONICS CORPORATION

The GateKeeper has five channels with automatic dedicated gate. Each channel has adjustable gate threshold and adjustable release time; threshold adjustable 10 dBv to constant on; electronically differential input, S.E. output.

Dimensions: 1.75 in. x 19 in. x 9.25 in.

Weight: 7 lbs.

Price: \$299.99

SYMETRIX INC.

Model 564E is a four-channel expander/gate with professional features like "frequency-conscious" operation. A unique rotary control turns each channel into a gate or downward expander with a twist of the knob.

Dimensions: 1.75 in. x 19 in. x 10 in.

Weight: 11 lbs.

Price: \$989.00

NOISE REDUCTION EQUIPMENT

AUDIO MEDIA RESEARCH

The Q Factor features two bypass switches; three dual concentric controls per module for precision adjustment of threshold and slope, plus attenuation of dynamic low pass filters and downward expanders. Electronically balanced inputs/outputs; two noise reduction systems in one chassis.

Price: \$349.99

dbx, A DIVISION OF AKG ACOUSTICS, INC.

The 140X has two-channel Type II Noise Reduction. Patented RMS detection makes the system virtually immune to phase shift-related tracking problems. Tailoring of detector bandwidth prevents mistracking on broadcast quality media with limited high and low-end frequency response.

Dimensions: 1.75 in. x 8.5 in. x 7.25 in.

Weight: 6.5 lbs.

Price: \$319.00

The 150X features two channels each of encode and decode electronics in a single package. Industry standard Type-I NR, compatible with all earlier Type-I systems.

Dimensions: 1.75 in. x 8.5 in. x 7.25 in.

Weight: 2.5 lbs.

Price: \$319.00

The 911 incorporates one channel of encode and one channel of decode circuitry in the dbx Type-I format. Type-I provides as much as 40 dB of noise reduction for typical wide bandwidth media operating at 15 ips or faster.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$239.00

The 941A has two channels of Type-II encoding. Tailored for greater than 40 dB of noise reduction with most broadcast

media.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$259.00

The 942A is the same as 941A, except it provides two channels of Type-II decoding.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$269.00

The 563X reduces the steady-state hiss created by analog tape, guitar signal processors, samplers, digital keyboards and sound effect tapes discriminates between unwanted hiss and desired high frequency signals on sound effect tapes. Stereo strappable.

Dimensions: 1.75 in. x 8.5 in. x 7.25 in.

Weight: 2.5 lbs.

Price: \$229.00

The 929 is designed for use in the F900A powered frame systems. Provides two channels of effective single-ended reduction of constant hiss from the output of analog tape recorders; multiple signal processors; noise digital samplers and storage devices.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$399.00

DOLBY LABORATORIES INC.

The Model 422 Reference Encoder/Decoder provides four channels of Dolby B-, C- and S-type noise reduction in a 1-U high frame. Contains signal generator providing calibration tones corresponding to selected NR type. Features include overall frequency response of 20 Hz to 15 kHz 1 dB, encode-decode at any level. Electronically balanced input circuits and electronically balanced and floating output circuits.

Dimensions: 1.75 in. x 19 in. x 10.2 in.

Weight: 13 lbs.

Price: not available

The XP SR Series features up to 24 channels of Dolby SR (Cat. No. 431 modules); individual channel bypass; uncal controls and Auto Compare circuitry. Interchange with Cat. No. 331 modules for Dolby A-type noise reduction. Also features overall frequency response of 20 Hz to 20 kHz, 1 dB, encode-decode at any level.

Dimensions: the card frame is 8.75 in. x 19 in. x 18.25 in.; the PS3 power supply is 3.5 in. x 19 in. x 18.75 in.

Weight: the XP 8 is 28 lbs; the XP 16 is 40 lbs.; and the PS3 is 30 lbs.

Prices: the XP 8 is \$11,790.00; the XP 16 is \$17,800.00; the XP 24 is \$22,500.00 the No. 431 Module is \$925.00; and the No. 280 Module is \$900.00.

The MT Series features up to 24 channels of switchable Dolby SR and A-type noise reduction; software-controlled automatic alignment; flexible assignment of any number of channels to separate groups for multi-machine use; electronically balanced/floating input and output stages and Auto Compare circuitry; overall frequency response of 20 Hz to 20 kHz, 1 dB; and encode-decode at any level.

Dimensions: the card frame, which accommodates up to 24 Cat. No. 445 modules, is 8.75 in. x 19 in. x 19 in.; the PS4 power supply/control unit is 3.5 in. x 19 in. x 19 in.

Weight: 31 lbs.

Prices: \$29,775.00; the MT 8 is \$14,225.00; the MT 16 is \$22,015.00; and the Cat. No. 445 is \$1,240.00.

Model 363 features two-channel switchable Dolby SR and a Dolby A-type noise reduction unit with two channels in a 1-U high frame; automatic record/play changeover; built-in Dolby noise/tone generators; auto-compare test facility and transformerless balanced input and output circuits. Basic specifications include overall frequency response of 20 Hz to 20 kHz 1 dB; encode-decode at any level. Available in three versions: Model 363—SR/A (Cat. No. 300) with switchable Dolby SR and Dolby A-type; Model 363—SR (Cat. No. 350) SR only and Model 363—A (Cat. No. 450) A-type only.

Dimensions: 1.75 in. x 19 in. x 10.2 in.

Weight: 14 lbs.

Price: \$2,995.00

Model DP501/DP502 Audio Coding Units provide audio at 128 kbits/sec. per channel. Ideal for transmission systems requiring both high audio signal transparency and low, spectrum-efficient data rates. Includes Data rate of 128 kbits/sec. per channel; frequency response of 20 Hz to 15 kHz 0.2 dB; dynamic range greater than 90 dB.

Dimensions: 1.75 in. x 19 in. x 10 in.

Price: \$2,990.00

Model SDU4 is designed for reference monitoring of Dolby Stereo or Dolby Surround program material. Accepts two-track matrix-encoded signal as its input and generates four output signals: left, center, right and surround. Overall frequency response is 20 to 20 kHz 1 dB (L, C and R); 100 Hz to 7 kHz 3 dB (surround output).

Dimensions: 1.75 in. x 0.875 in. x 10.25 in.

Weight: 11 lbs.

Price: \$2,200.00

PACKBURN ELECTRONICS INC.

The Model 323A Audio Noise Processor has three processors plus other features for optimum noise reduction from all types of disk recordings.

Dimensions: 7 in. x 19 in. x 10 in.

Weight: 18 lbs.

Price: \$2,650.00

ROCKTRON CORPORATION

The Hush 8x features eight separate channels of single-ended noise reduction; single rack space; -10 or +4 operation; fast/slow release; balanced or unbalanced four stereo master/slave switches.

Dimensions: 19 in. single space

Price: \$799.00

The Pro Hush is MIDI programmable single-ended noise reduction; two channels; 60 dB of noise reduction; complete MIDI control.

Dimensions: 19 in. single space

Price: \$749.00

The Hush IICX is stereo and features 60 dB of noise reduction; stereo master; slow/fast release; threshold and sensitivity adjustments; gain reduction and bandwidth filter metering.

Dimensions: 19 in. single space

Price: \$439.00

The Hush IIBX is mono, featuring 60 dB of noise reduction; gain reduction and bandwidth filter metering.

Dimensions: 19 in. single space

Price: \$329.00

The Hush IIX has 50 dB of noise reduction; slow/fast release; -10, +4 reference switch; gain reduction and bandwidth filter metering.

Dimensions: 1/2 rack single space

Price: \$219.00

The 180A encode/decode tape noise reduction unit features an eight channel encode/decode system; operates at 15 ips to 30 ips; has headroom of +20 dB for use with either +4 dB or -10 dB tape machines.

Dimensions: 19 in. single space

Price: \$799.00

RSP TECHNOLOGIES

The Hush 2000 features multiband single-ended noise reduction with variable expander, release and ratio; filter has variable sensitivity and release; has stereo link; stereo link balanced 1/4 in. and XLR.

Dimensions: 19 in. single space

Price: \$799.00

SYMETRIX INC.

Model 511A is a two-channel or true stereo single-ended noise reduction system. Its dynamic high-frequency filter and downward expander reduce hum, hiss, RF buzz and other noise by up to 30 dB, anywhere in the signal chain.

Dimensions: 1.75 in. x 19 in. x 7 in.

Weight: 9 lbs.

Price: \$599.00

MISCELLANEOUS

APHEX SYSTEMS LTD.

Model 250 Aural Exciter Type III is a professional signal enhancer with adjustable harmonics mixing, timbre. Features servo-balanced in/out; relay bypass; and dual NR modes.

Dimensions: 1.75 in. x 19 in. x 9 in.

Price: \$995.00

The 9000 Series Modular Signal Processing System features: the 9000R unpowered rack with eleven slots; the 9251 Aural Exciter Module with single channel; 9301 Compellor Module with single channel; the 9611 Expander/Gate Module with single channel; the 9651 Expressor Module with a single channel compressor; the 9901 Parametric Equalizer with three bands and single channel; and the 9000PS power supply.

Dimensions: the 9000R is 5.25 in. x 19 in. x 8.5 in.

Prices: the 9000R is \$379.00; the 9251 is \$449.00; the 9301 is \$549.00; the 9611 is \$449.00; the 9651 is \$449.00; the 9901 is \$449.00; and the 9000PS is \$499.00

ARX SYSTEMS See our ad on page 2.

DI-1 is a stand-alone direct box with gain control, plus phantom, battery or dc power pack options, massive headroom, easy battery changing, rugged roadworthy casing.

Dimensions: 2 in. x 4 in. x 5 in.

Weight: 2 lbs.

Price: under \$200.00

DI-2 is identical to DI-1 above but stereo. Weight is about the same, and price will be only a little bit more.

The DI-6s is six active direct boxes, a 6:1 line mixer and a 1:6 splitter in one RU, with multiple balanced outputs, individual ground lifts, master volume and headphone output.

Dimensions: 1.75 in. x 19 in. x 6 in.

Weight: 5 lbs.

Price: \$549.00

AUDIO MEDIA RESEARCH

The CDS 2000 is a two-channel VCA-based compressor/de-esser/limiter/expander. Features independent control of compressor, limiter, de-esser and downward expander threshold; also side chain signal shaping or processing. Electronically balanced inputs/outputs.

Price: to be announced

BROOKE SIREN SYSTEMS, A DIVISION OF AKG ACOUSTICS, INC.

The FDS-310 Sweepable Frequency Dividing System is a two-way stereo or three-way mono, sweepable crossover system built around 24 dB/octave Linkwitz-Riley filters. Internal jumpers change all frequency ranges down in divisions of 10.

Dimensions: 1.75 in. x 19 in. x 8.5 in.

Weight: 7 lbs.

Price: \$659.00

The FDS-360 Integrated Frequency Dividing and Limiting System features separate MID filter frequency band limiting; polarity switching; up to 360 degrees of phase correction; auto muting circuit; mono low linking; LEDs for limiting, signal, mutes and modes status; and interchangeable frequency cards.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 9 lbs.

Price: \$1,529.00

The TCS-803 Multi Tap Time Corrector is a mono triple-tap digital delay line designed for applications in which full range audio programs have to be delayed for multiple speaker installations.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 10 lbs.

Price: \$1,695.00

The TCS-804 Dual Time Corrector is a two-channel dual-tap or single-channel quad-tap digital delay line designed for critical speaker systems displacement and "Delay towers" distance correction in large arenas.

Dimensions: 1.75 in. x 19 in. x 9 in.

Weight: 10 lbs. 5.2 oz.

Price: \$2,995.00

The AR-130 Phase Check System frequency range can be selected to match that of the equipment being tested. Detector unit can be connected directly to microphone cable or power amplifier outputs.

Dimensions: 3.94 in. x 2.95 in. x 1.5 in.

Weight: 10.6 lbs. excluding batteries

Price: \$635.00

dbx, A DIVISION OF AKG ACOUSTICS, INC.

The 263X De-Esser is designed to provide control of problem "ess-filled" vocals. Single-slider action sets the exact amount of sibilance reduction by ear, with visual confirmation from LEDs.

Dimensions: 1.75 in. x 8.5 in. x 7.25 in.

Weight: 2.5 lbs.

Price: \$169.00

The 902 De-Esser uses patented dbx sibilance detection circuitry. By comparing the RMS energy of signals above and below a user-selected crossover point, the 902 detects undesirable sibilance regardless of level.

Dimensions: 5.25 in. x 1.5 in. x 9.5 in.

Weight: 0.75 lbs.

Price: \$449.00

JBL PROFESSIONAL

The 7942 features 1 in/2 out Digital Delay line; ten microsecond to four second resolution; eighteen bit sigma-delta technology with 64X oversampled convertors; precision calibrated attenuators; and "lockout" protection circuitry.

Price: to be announced

The 7944 is a 2 in/4 out Digital Delay line with ten microsecond to four second resolution; eighteen bit sigma-delta technology with 64X oversampled converters; 422 based remote capability; digital output bitstream (AES/EBU) expansion; precision calibrated attenuators; and "lockout" protection circuitry.

Price: to be announced

ORBAN, A DIVISION OF AKG ACOUSTICS, INC.

The 222A Stereo Enhancer detects/enhances psychoacoustic directional cues present in stereo program material. Increases brightness, impact and definition of music, with no increase in sensitivity to vertical tracing distortion during disc playback.

Dimensions: 1.75 in. x 19 in. x 10.5 in.

Weight: 6.75 lbs.

Price: \$975.00

The 245F Stereo Synthesizer creates a pseudo-stereo effect from any mono source. Total mono/stereo compatibility. Saves tracks in multi-track recording situations. Allows for stereo cart transfers with no phasing problems.

Dimensions: 1.75 in. x 19 in. x 9.625 in.

Weight: 7 lbs.

Price: \$445.00

The 275A automatic stereo synthesizer works by detecting absence of audio on one channel, or presence of mono in both channels. Smooth cross-fading between true and synthesized stereo; automatic detection and correction of polarity-reversed stereo inputs.

Dimensions: 1.75 in. x 19 in. x 9.625 in.

Weight: 12 lbs.

Price: \$2,400.00

The 536A De-Esser features two channels of effective, inaudible de-essing over a 15 dB input range; dual-LED gain reduction metering; dynamic range typically 105 dB; very low distortion, effective RF suppression.

Dimensions: 1.75 in. x 19 in. x 5.75 in.

Weight: 5 lbs.

Price: \$650.00

RANE CORPORATION See our ad on page 6.

The DC 24 Dynamic Controller consists of a stereo servo-lock limiter; stereo compressor and stereo expander/noise gate.

Also included are a 24 dB/octave crossover, three-pin balanced inputs and outputs, side chain access, slave switch, bypass and gain reduction metering.

Dimensions: 1.75 in. x 19 in. x 5.3 in.

Weight: 5 lbs.

Price: \$549.00

ROCKTRON CORPORATION

The Intellifex features 24 bit 164X's oversampling; 100 dB dynamic range; complete MIDI control; 1.5 sec. delay; 8-tap chorus; reverb; 4-voice pitch shift; ducking; mixing functions; and digital Hush.

Dimensions: 19 in. single space

Price: \$1,149.00

The RX20 is a stereo exciter/imager; Hush II; frequency/phase mode; mix; ¼ in. unbalanced I/O; input process metering.

Dimensions: 19 in. single rack space

Price: not available

The S212 line mixer has twelve channels. Each channel has level; pan; bass; and treble.

Dimensions: 19 in. single space

Price: not available

RSP TECHNOLOGIES

The 2400 features a multiband enhancer; Hush II; unique sum/difference mode; high and low mix; phase/frequency mode; balanced/unbalanced ¼ in. and XLR I/O; and input process metering.

Dimensions: 19 in. single rack space

Price: not available

SYMETRIX INC.

Model 528 Voice Processor will enhance mic and line levels. Includes a preamp; de-esser; compressor/limiter; downward expander; 3-band parametric EQ and +48 V phantom power for condenser mics.

Dimensions: 1.75 in. x 19 in. x 7.5 in.

Weight: 9 lbs.

Price: \$679.00

Model SX206 Multi-Dynamics Processor can operate in compressor/limiter; gate; downward expander; ducker or slave mode. Manual attack and release controls are dynamically sensitive thanks to unique active integrators.

Dimensions: 1.5 in. x 8.2 in. x 6 in.

Weight: 5 lbs.

Price: \$329.00

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San Leandro, CA 94577

Alesis Studio Electronics

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Los Angeles, CA 90016

Aphex Systems Ltd.

11068 Randall Street
Sun Valley, CA 91352

ARX Systems (USA)

P.O. Box 842
Silverado, CA 92676

Audio Media Research

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Meridian, MS 39301

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Division of AKG Acoustics, Inc.**

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San Leandro, CA 94577

**dbx, A Division of AKG
Acoustics**

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San Leandro, CA 94577

Digital Audio Labs, Inc.

6311 Wayzata Boulevard
Suite 330
St. Louis Park, MN 55416

DOD/DigiTech/Audio Logic

5639 South Riley Lane
Salt Lake City, UT 84107

Dolby Laboratories Inc.

100 Potrero Avenue
San Francisco, CA 94103

Doremi Laboratories, Inc.

4927 North Glen Arden Avenue
Covina, CA 91724

Furman Sound, Inc.

30 Rich Street
Greenbrae, CA 94904

JBL Professional

P.O. Box 2200
8500 Balboa Boulevard
Northridge, CA 91329
Waltham, MA 02154

LT Sound

7980 LT Parkway
Lithonia, GA 30058

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Packburn Electronics, Inc.

P.O. Box 335
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**Peavey Electronics
Corporation**

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Meridian, MS 39301

Rane Corporation

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NEW PRODUCTS

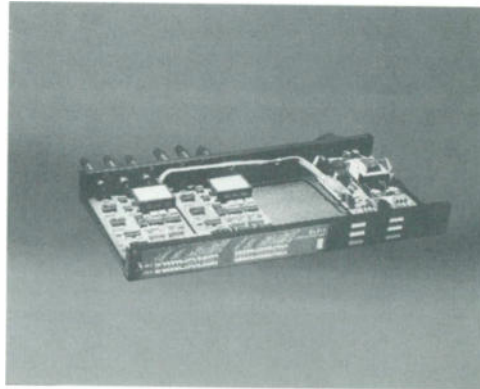
ELF-1

● “ELF” Extended Low Frequency technology offers flat frequency response sub woofers, all available in quality wood cabinet finishes, with response to 8 Hz, and in very small enclosures. The pictured ELF-1 dual-channel integrator combines with single and/or double 18-in. loudspeakers for zero delay, and zero phase shift. A full line of time-aligned full range speaker systems is also offered, in both wood and/or standard black finishes.

Mfr: Bag End Loudspeaker Systems

Price: Depending on configuration.

Circle 60 on Reader Service Card



MASTERING FOR DIGITAL COMPACT CASSETTE DUPLICATION

● The Philips DCC Mastering and Text Editing System enables the basic timecode and PQ codes used for CD to be added to DCC. Text for the format is input using a screen editor developed by Philips. A 3.5 in. floppy disk is supplied to the mastering facility along with the audio program, which is on standard U-matic cassette tape. The system also includes Philips DCC Downloader, Duplitronics Digital Bin, Lyric's DCC Slave and the Philips-Lyric Quality Control System for both blank and pre-recorded tapes.

Mfr: Media Technology Systems

Price: Depending on applications

Circle 68 on Reader Service Card



DIGITAL AUDIO TAPE

● The latest developments in metal-particle technology have been applied to these PDP DAT cassette tapes. New ultra-fine magnetic particles provide improved playback output and also improve signal-to-noise ratio. A new HD&R binder system better adheres the individual metal particle to film backing to reduce the build-up of dust which can produce dropouts. A new surface treatment lowers dropout levels further, realizing low block error rates of 5×10^{-4} . The PDP tapes are available in 30, 46, 60, 90 and 120 lengths.

Mfr: Sony Pro Tape Division

Price: Depending on length and packaging

Circle 64 on Reader Service Card



STEREO SATELLITE SYSTEM

● Wharfedale's 2130 System is made up of two high-performance satellite speakers and sub-bass unit. Each ported satellite contains from mounted and side mounted $\frac{3}{4}$ -in. dome tweeters, precisely aligned at 90 degrees, and a 3-in. mid-range driver. Response is 150 Hz to 20 kHz. The sub-bass unit houses two 8-in. drivers that push the bass response of the system to 40 Hz. Power handling for the entire system is 80 watts, and 1 watt of pink noise produces 89 dB SPL. A complete line of mounting hardware is available.

Mfr: Optim Audio

Price: Depending on accessories

Circle 65 on Reader Service Card



TWO-WAY ACTIVE MONITOR

● The 1032A is an active two-way near-field monitor. The unit includes the company's patented DCW (Directivity Control Waveguide) which helps maintain frequency constant power radiation for optimum off-axis listening and minimum room interaction. A 10-in. bass driver and 1-in. high-frequency dome driver, and bi-amped 160W low end and 120W tweeter power is included. Low frequency response is -3 dB at 42 Hz. A pair of monitors measured at 1 meter produce an SPL of 124 dB.

Mfr: Genelec

Price: to be announced

Circle 61 on Reader Service Card



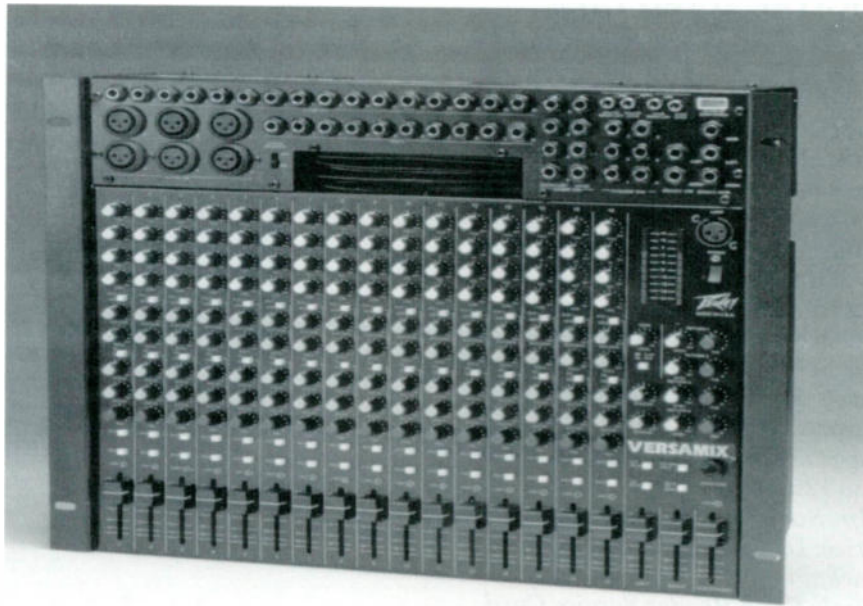
AUDIO MIXER

● Each channel on this new Versamix features front panel placement of the gain trim as well as high, mid and low frequency equalization. Each channel also has one aux send that is switchable to pre or post fader/eq aux sends; pan control, mute/alt send switch, solo switch, clip LED, and a 45 mm fader. Six of the inputs have low-impedance XLR-type inputs, mic preamps, or all sixteen channels can be used for line inputs. A post fader insert point is available on channels 1-8, delivering a choice of either effects patching capability or direct outs for recording. Console or rack-mounting is standard.

Mfr: Peavey Electronics

Price: to be announced

Circle 66 on Reader Service Card



DIGITAL REVERB

● This is claimed to be the world's first fully programmable and hardware/software expandable reverb/effects unit. True stereo inputs and four discrete outputs provide the TSR-24 with an expanded level of processing power. Other features include a dedicated MIDI processor, built in MIDI merging, MIDI input filtering, and MIDI transmit and receive LED indicators. All effects and parameters are available for MIDI continuous control. Accessory cards are available for more RAM memory and/or dynamic RAM.

Mfr: DigiTech

Price: \$800.00

Circle 67 on Reader Service Card



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If you are a manufacturer and want your new product listed in this section, send the release, include the suggested list and there must be a photo or diagram included.

Send to New Products Department, db Magazine, 203 Commack Road, Suite 1010, Commack NY 11725.

Historical Perspectives

● A mere twenty-five years ago, a pro-audio magazine was born—November 1967.

In that premier issue, we had asked a number of industry authorities to give us their impressions of the state-of-the-art in their disciplines. It's interesting and informative to take a new look twenty-five years later on just how accurate they were and how much technology has moved forward in the last twenty-five years. It should also be noted that, in almost every case, the original author is no longer associated with the company mentioned. In fact, several of the companies no longer exist!

What will the next twenty-five years bring to pro audio? Elsewhere in this issue, others are predicting what those next twenty-five will bring to pro audio.

Audio Amplification

—Paul Weathers*

Amplification has come a long way since carbon amplifiers. And each era considered its state of the art as perfect. How close to an ideal product are we now?

Before Thermionic Vacuum Tubes

Most of us in the audio profession take for granted that audio amplification is a practically perfected art in the chain of recorded, transmitted and reproduced sound. Compared to the early efforts of engineers before vacuum tubes were developed, the audio amplifier of even 30 years ago seemed perfect. The first successful sound amplification was accomplished by the use of highly resonant carbon amplifiers. These were the first "solid-state" amplifiers and were current amplifiers of low impedance. They operated in the same way that carbon microphones operate by varying the pressure on carbon granules. The carbon granules provided a variable resistance inversely proportional to the applied pressure used to modulate a current flowing through the carbon granules. In the case of a carbon microphone the pressure is applied directly by the diaphragm. In the amplifier application the pressure is applied by an electromagnetic transducer to produce current amplification.

Vacuum-Tube Amplification

The vacuum tube was the first development which made possible the amplification of tiny voltages at high impedance with relatively little noise and distortion. In fact a good class "A" vacuum-tube amplifier in the 1920's could boast of distortion figures of under 2% and most engineers felt that very little needed to be done since these amplifiers were so far advanced over any transducers available.

Inverse Feedback

Fortunately there are many engineers who are never satisfied with what others consider perfection. Out of the laboratories of engineers dedicated to progress came *inverse feedback*, a fundamental development which completely revolutionized the audio industry in the early 1930's and

made possible a really tremendous advancement in the audio art. This development was, in fact, so fundamental that it is the basis for all present day "nearly perfect" amplification systems, whether they be vacuum tube or solid state.

How Can Amplifiers Be Further Improved?

The weakest link in the chain of an audio amplification system is the coupling the input and output of amplifiers to the transducers or modulating systems. Although transformers have been greatly improved by advanced winding techniques and magnetic materials, they have not completely solved the problem of matching transducers to the input or output of otherwise nearly perfect amplifiers. One might wonder, why bother with the most perfect link in the audio chain? Concentrate on the transducers so that their impedances do not change with frequency, or combine the amplifier with the transducer to improve the control of the transducer by intergrated feedback. In fact, much is being done to perfect transducers by closer integration with amplifiers, but when electrical isolation is required, coupling by transformers, (even with their limitations) is the accepted practice.

The Development Of Solid-State Devices

The development of solid-state devices is undoubtedly as great an advancement in the audio art as was inverse feedback as a perfecting technique. Solid-state amplification makes possible the matching of power amplifiers to low-impedance loads without using bulky power output transformers with their characteristic hysteresis loop and limited frequency range. The elimination of the output transformer makes possible an all-encompassing inverse feedback loop from transducer to input stage to provide less critical

*Weathers Research and Development Co.
Cherry Hill, New Jersey

matching to output transducers and the virtual elimination of distortion within the loop. Concentrated feedback around one or two stages is often combined with over-all output to input feedback to keep phase shift within bounds.

Input matching in solid-state amplifiers is now more versatile than with vacuum tubes and, in cases where electrical isolation is not needed, without using transformers. A solid-state device can be selected which will match low-impedance transducers for minimum noise and maximum energy transfer or, when high-impedance inputs are required, to match high-impedance devices even up to many megohms, there is a solid-state circuit to effect a perfect match.

Are the arguments which we sometimes hear that vacuum-tube sound is superior to transistor sound valid? There are also those who are just as certain that there are some subtle phenomena associated with transistor sound which makes it superior to vacuum-tube sound. These are arguments reminiscent of *triode sound versus pentode sound* in the 1930's. The differences are based upon easily measurable parameters and has nothing to do with whether the amplification is solid state or vacuum tube, triode or pentode. Most of the effects noticed are traceable to:

1. *Difference in damping factor on the output transducer.*
2. *Slow recovery of circuits when overloaded by short duration transients.*
3. *Regeneration or positive feedback at some part of the amplified spectrum.*
4. *Development of parasitics when excited by certain signals.*
5. *Instability of the power supply in its relationship to linearity of the amplification system as polarizing voltages vary with signal.*

Although variation in damping factor represents one of the most obvious differences between triodes and pentodes as output devices, engineers found that strategically applied inverse feedback could easily eliminate this difference. However, unless careful attention was given to phase shift, very often the amount of inverse feedback had to be increased to the point where parasitics might develop at super-audible frequencies or regeneration might occur at subaudible frequencies thus producing conditions described above in 2, 4, and sometimes 5.

It became a well-known fact that reasonably good results could be obtained by almost any engineer when triodes as output devices are used but it takes a highly experienced and talented engineer to design a superb sounding pentode or beam-power output tube power amplifier employing optimum feedback capable of feeding a resistive or reactive load with complete stability.

It has been demonstrated that solid-state power amplifiers using no output transformers can exceed the damping characteristics of the best triode power amplifiers, even when using feedback. The difference is in the elimination of the transformer. With solid-state amplifiers the damping factor can be so great that the power amplifier controls the movements of loudspeakers with extreme accuracy at low frequencies resulting in sound with less coloration; a noticeable improvement to the discriminating listener.

There are those who will argue that a certain amount of coloration is desirable in a sound system. Coloration by choice is the important objective, since the lack of coloration is the more desirable achievement. Coloration can be added in a variety of ways to any sound system if it is desired but coloration should not be the criterion in choosing between "triodes *versus* pentodes" or "vacuum

tubes *versus* transistors". All of the differences between triode, pentode and transistor amplifiers can be measured or visually observed on oscilloscopes. These differences can be so minimized by careful design that listening tests comparing triodes, pentodes, beam power and transistors sound so neatly alike that a blindfold test completely confuses the most critical observers. One reason for this is that the most perfect program material and the most perfect transducers have far more distortion and coloration than that contributed by the differences in the various but highly perfected amplifiers under comparison.

Solid state provides the designer with so many new approaches to the perfect amplifier that there is little doubt in the minds of progressive engineers that solid state has taken over in audio leaving vacuum tubes as one of the great stepping stones in the search for perfect electronic amplification.

An examination of some of the advantages of solid state and the myriad of new circuits made possible to improve audio, leaves the imaginative engineer almost spellbound with the possibilities of miniaturization, elimination of heat, pinpoint control of polarizing potentials, elimination of noises due to long lengths of connecting wire, plug in modules for easy servicing, integration of amplifiers with transducers and general reduction in costs.

Miniaturization is not just an advantage in portable equipment. The new IC's eliminate many components and reduce the stray noise pickup area making possible a simplification of shielding to attain a new perfection in noise rejection. The elimination of heat makes possible closer spacing of components along with vastly longer life. Housings can be smaller, requiring little or no ventilation, at less cost.

Zener diodes make possible pinpoint control of polarizing voltages and when combined with transistors, can provide filtering and isolation of voltage sensitive circuits literally not possible by other means.

FET's

FET's take away one of the principal advantages which tubes had over solid-state devices i.e. high-input impedance and low noise. Some vacuum tubes still have a slight edge over FET's in high gain applications for consistently low noise, but the fact that laboratory samples of FET's have approached and exceeded the quietest vacuum tubes is an indication that it is only a matter of time, by perfecting production techniques, that FET's will replace vacuum tubes for all high-impedance input applications. FET's have other characteristics of great interest to audio designers. It is possible to incorporate them in automatic compression or expansion circuits without utilizing balancing devices to eliminate control transients and the degree of compression and expansion can go much farther than was possible with more complicated circuitry using the old familiar techniques of balancing out control transients.

It is conceivable that a low-level pilot tone pitched above audibility and modulated by the compressor can be utilized in reproduction to recreate the original dynamic range with minimal time lags in the control circuits and without undesirable transients. This is an area which should be explored more thoroughly.

The characteristics of FET's and other solid-state devices lend themselves to automatic control of dynamic range.

frequency range, and activation of additional transducers to produce dynamic effects never before attained.

State-of-the-art amplifiers can be manufactured so that little servicing will ever be required but the service technician will be under a tremendous handicap to correct a non functioning amplifier whose parts he cannot see and whose wiring junctions are smaller and closer together than the end of his finest probe. That is unless a plug-in modular substitution system is used.

This brings us to the final Utopian concept. Let us make all amplifiers in modular form and have the modules plug in using techniques which have been highly perfected in the computer field. Modern connectors have become so perfect that they are consistently as good as connections soldered by hand.

There are those who will dispute this statement but these connectors are used in critical application where failure could be disastrous and have proven their dependability. Besides, vacuum tubes have been plugged in, even in the most critical applications. Why not modules containing circuits?

The Ideal Amplifier

To sum up, the state of the art amplifier of today can have:

1. *A fully regulated power supply with no measurable ripple and practically zero source impedance, making class "B" amplifiers attain even greater perfection.*
2. *Capability of matching to selected output load impedances without output transformers (except for line*

feeding amplifiers requiring balanced lines and exact line matching).

3. *Capability of matching input impedances with maximum transfer efficiency and low noise from a few hundred to many megohms.*
4. *Modular construction for substitution servicing.*
5. *Compact, to take up a minimum of room, with a minimum of required ventilation.*
6. *Output damping characteristics so great that the output load looks back into a virtual short circuit, so that the lack of coloration of output transducers is limited only by the transducer's series resistance.*

The resistance of the audio industry to changing technology is no longer as persistent as it was a decade ago. In fact, the avalanche of advanced technology has been applied so rapidly during the past three years that obsolescence of equipment has progressed at an unprecedented rate. Also, service technicians have been unable to keep pace with rapidly advancing technology and they are looking for some sound answers to their pyramiding maintenance problems.

It is very important that these highly advanced products be more easily assimilated and maintained at their peak of perfection without requiring an engineer in constant attendance. It is highly important that state-of-the-art products include simplification of application and maintenance to assure a continued peak of performance. The hardware and information is available in quantity and quality. It is up to the design engineer to break away from traditional concepts which have outlived their usefulness thus making maximum use of the new tools at their command.

THE STATE OF THE ART

Disc Mastering

Sidney L. Silver*

The author covers the basic elements—lathes, cutterheads, cutting styli, and instantaneous recording discs, in his discourse on the current state of the art.

In the process of transferring taped material to an acetate record for mastering purposes, the prime consideration is to make certain that none of the high quality of the master tape is lost in the process. To achieve consistent, reliable results with a minimum of service or attention, computer technology is now being utilized to provide complete automation of the entire recording system in performing the functions of switching, timing, counting and programming.

By merely depressing a button, it is possible to initiate a series of events which include dropping the cutterhead, cutting a coarse spiral lead-in groove to a fixed diameter, recording the program material, cutting coarse spirals for

banding if necessary, cutting a coarse spiral lead-out groove, and finally lifting the cutterhead at a predetermined diameter. Other functions automatically performed are pitch and depth control and on-off switching of the vacuum, stylus head, and tape machine.

In this article, some of the salient features of recording equipment available in today's market will be discussed, as well as some of the more recent technical improvements.

*United Nations
Telecommunications Sect.
New York, N. Y.

Recording Lathes

Generally, the drive mechanism consists of a hysteresis-synchronous motor, utilizing belt coupling for speed selection. Belt-driven units are characterized by extremely low rumble (vertical and lateral) figures, of the order of -70dB below a 5 cm/sec. signal. To minimize belt stretching problems when switching from 33 1/3 to 45 or 78 rpm, a two-speed motor is sometimes employed instead of the usual single-speed units. By this means, the motor pulley sizes are kept dimensionally close to each other, so that changes in motor speed compensate for the otherwise large differences in pulley diameters.

Since low wow and flutter figures (typically .02% peak-to-peak) must be maintained, the turntable is designed for maximum flywheel effect and is adequately isolated from the drive mechanism by a mechanical vibration filter assembly. Ideally, the turntable is fabricated of an aluminum casting to eliminate the problem of magnetic attraction between turntable and the cutterhead. Annular rings are machined at various diameters for the purpose of suction holddown, to accommodate record blanks from 7-in. to 16-in. in diameter. Provision is easily made to shut off the holddown action at the outer diameters when not required, thereby eliminating objectionable escaping air noise.

Normally, the turntable drive system is connected by mechanical linkage to the feedscrew assembly via a planetary drive and gear assembly. Some designs, however, incorporate a self-powered feedscrew for guiding the cutterhead carriage, entirely independent of the mechanical linkage from the turntable's drive system. In this arrangement, a separate motor powers the feedscrew, thus eliminating any extra load on the drive system. There are also models in which an auxiliary feedscrew is employed for the inspection microscope, which travels in with the cutter and allows a "standstill" groove effect for easy groove inspection.

Monophonic lateral recordings are commonly mastered with variable groove pitch in order to fully utilize the available recording area. This may be accomplished automatically by a servo-controlled system which derives its feed from an advance playback head reproducing the program material one or two seconds ahead of the cutterhead. The system thus provides a coarser pitch in anticipation of high-amplitude low-frequency passages during the tape-to-disc mastering operation. In some designs, pitch is continuously variable from 32 to 800 lines-per-inch with the ability to manually record over 1000 lines-per-inch if necessary.

Stereo recording, however, involves both lateral and vertical stylus excursions so that in addition to control of groove pitch, control of groove depth is also required. In stereo cutterheads which employ advance-ball suspension, variable depth control may be achieved by operating a solenoid on the advance-ball assembly. This type of suspension, however, is prone to rumble caused by undesirable vertical modulation of the cutterhead, due to any unevenness of the acetate surface. Furthermore, a condition known as "scoring" may occur when a dirt deposit adheres to the sapphire advance ball, plowing through the soft lacquer as the ball rides the acetate blank. To offset these problems, some carriages accommodate a floating- or moving-coil suspension assembly to either replace or work in combination with the advance-ball suspension.

Two typical examples of such sophisticated recording

equipment are the Scully Automatic Disc Recording Lathe and the Neumann AM-66 Computer-Controlled Lathe.

Cutterheads

The need for a reliable, rugged cutting head is of major importance if we are to meet the increasing demands for quality disc recording. Particular care must be taken in cutterhead design to achieve stable operation under widely varying environments, without danger of burnout or mechanical damage.

In modern professional cutterheads, the force to actuate the cutting stylus is provided either by a moving coil attached to a fixed armature, or a fixed coil and moving armature, either in a magnetic field. The two types are classified respectively as *dynamic* or *magnetic* transducers. In the dynamic configuration, the mechanical resonant peak lies in the 800 to 1500 Hz range and is effectively removed by *motional feedback*. This arrangement consists of an amplitude-sensitive feedback coil magnetically shielded from the driving coil and placed in close proximity to the stylus chuck. The feedback signal, which is directly proportional to stylus motion, is amplified and fed back (out of phase) to the input of the driving amplifier, thus correcting changes in level and response. An advantage of this technique is that no loading effect is imposed on the driving coil, so that a wide effective range of feedback control is obtained with good linearity throughout the usable frequency range. Harmonic distortion levels with dynamic cutting systems are significantly less than 1%. Dynamic cutters in common industry use are the Westrex 2-B monophonic and the Neumann SX-45 stereo cutting systems.

In *magnetic* cutting systems, the resonant peak generally lies in the 4 to 8 KHz range and may be damped out by silicone damping material in the form of plastic, grease, or fluid, sealed into the gaps between the armature and pole pieces. Cutterhead feedback may be provided by a secondary winding placed closer to the armature than the cutter driving coil. This feedback arrangement is *non-motional* since the secondary winding senses only armature saturation. Any distortion created within the armature due to eddy currents or other magnetic circuit losses is thereby reduced.

Magnetic cutters are somewhat sensitive to the acetate loading effects which increase with decreasing linear velocity, so that the high frequencies are attenuated at the inner diameters of the disc. In some cutterhead designs, this condition is avoided by increasing the stiffness of armature motion so that the resonant frequency is raised to about 10 kHz. Unfortunately, this results in reduced sensitivity so that the power requirements of the driving amplifier are greatly increased. Although magnetic cutting systems are more rugged and considerably less costly than dynamic types, they are less sensitive and display higher harmonic distortion levels (of the order of 2 to 4%). Among the magnetic types commercially available are the Haeco SC-1 and Gramplan "D" cutters.

Cutting Styli

Present-day research is being directed toward the development of the perfect recording stylus. Sapphire is still considered to be the most suitable material available for producing a very fine cutting edge. This is mainly due to its crystalline structure, which is characterized by a lack

of grain and absence of cleavage planes, thus enabling the material to be ground to a sharply acute angle.

The common hot-stylus technique offers a practical solution to the problems of achieving higher frequency response, longer stylus life, and better signal-to-noise ratio. With this technique, a substantial reduction in surface noise is indeed obtained, particularly at the inner diameters of the recording disc. A further advantage is that it minimizes mechanical loading on the cutterhead, thus increasing the efficiency of the cutting system.

In a more recent development, the conventional flat-faced stylus surface is replaced by a *scooped* stylus, in which the cutting face is ground in a circular arc. The curved surface helps to eliminate some of the errors caused in the vertical radial motion of the stylus by reducing the deviation of the cutting face from the perpendicular to the disc surface.

Discs

Curiously, there has been relatively little change in the basic formulation of instantaneous recording discs over the past thirty years. So-called "acetate" discs, which actually are fabricated of plasticized nitrocellulose lacquer on an aluminum substrate, are still regarded as the best instantaneous recording medium. Major progress, however, has been achieved in recently improved coating techniques leading to flatter, cleaner surfaces. For example, improved drying equipment with rigid control of air flow and tem-

perature, together with improved lacquer filtration methods, have greatly contributed to the fabrication of defect-free discs.

Electronic Elements

Despite the recent trend toward micro-miniaturization and transistor design, some recording systems have retained vacuum tubes and spacious layouts. In any case, the driving system for the cutterhead must provide the necessary power (typically 75 to 100 watts-per-channel) if we are to cut the entire frequency spectrum without clipping. Driving amplifiers are characterized by large open-loop gain, with heavy feedback to insure low dynamic impedance and phase-shift reduction of all stages. A useful innovation is the stylus oscilloscope which instantaneously monitors the output signal and indicates the overload level to which the system can be pushed. RIAA equalization from 30 Hz to 1 kHz and constant-velocity equalization from 1 kHz to 15 kHz is provided by passive networks (usually mounted on a plug-in card) for precise correction of individual cutting systems.

The development of disc recording to its present state-of-the-art has required relatively little electronic sophistication compared to the difficult mechanical and electromechanical problems that have had to be solved. Even with present-day mastering techniques, disc recording technology is continually progressing in a continuing search for superior performance.

Sound Reinforcement

THE STATE OF THE ART

—Martin Dickstein*

The elements that make up a sound reinforcement system have come a long way since the days of the cupped hand. But the present state of the art is merely a stopping point. Where do we go from here?

Back in the very, very old days, it was necessary to be within "earshot" of a sound's originating point. Earshot depended for the most part on the frequency characteristics, loudness, wind direction, surrounding noises, terrain or location of source and listener, just as it does today, whether the receiving device is an ear or mechanism. In those days, though, earshot distance actually meant to an ear. There was no way to preserve the sound for later listening, nor was there any way to extend the distance. If anyone wanted to hear the sound they had to be there, fairly close to the source. Attempts to increase the "throw" distance through the

use of cupped hands or other horn-like devices helped the situation a little. In time, it was learned that sounds could be directed somewhat toward the listeners if the source was located in front of something such as a hill or structure. Carefully shaped and strategically placed vases in the proximity of performers, prevailing winds, and higher but closer seating areas were used in further attempts to permit more listeners to hear the sounds originating from the source.

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Through the many years that followed, more attempts were made to enlarge the listening area, but meeting halls, auditoria, concert halls, churches and amphitheaters had to be built to take advantage of natural acoustics to "spread the word." It was not until the availability of electronic amplification that something was done to substantially enlarge the listening area.

Recordings could now be made using a microphone which changed sound impulses to electrical impulses. These recordings could be played through speakers which distributed sound to listeners in a fairly good size area. When movies started to talk, though, a real need for "big sound" became apparent. Theaters could seat pretty big crowds to see the screens, but now it became necessary that all these people also be able to hear the voices, sounds, and music. Larger speakers, higher-output microphones, and more powerful amplifiers had to be developed. And they were.

This solved some problems but, as seems to happen in almost every field, created new ones.

As microphones came into use for addressing live audiences, methods had to be found to make the mikes smaller in order to avoid hiding the speaker or performer. Lapel microphones, lavaliers to hang around the neck, and button-hold mikes were designed to permit the speaker or singer free use of the hands during a performance. As sensitivity of microphones improved it became necessary to manufacture units with different pickup patterns so that some had very narrow cones of sensitivity, some could pick up through greater angles and some were made to be non-restrictive, or omnidirectional.

Many types of microphones are now made for music, offering better frequency response in the bass range or high-frequency range or with smooth response through a very wide band of frequencies. Some distort sound less than others during loud, impact sounds. Others have pre-emphasis in the voice range built in. Still others are made to pick up through an extremely narrow angle but at a greater distance. Each microphone manufacturer today tries to cover a particular market or use with a variety of types and shapes especially designed and engineered for each application.

For locations where microphones are used near loudspeakers or in highly reverberant areas, the choice is a combination of narrow pickup angle, smooth frequency response and high front-to-rear rejection ratio to diminish the possibility of acoustic feedback. Today, microphones are made with these singular characteristics, combining those qualities that make them particularly suited for individual requirements, in almost all sizes and shapes and at almost any price.

Amplification

Many changes in the construction of microphones were caused by, and resulted in, changes made in the amplifier units developed to raise the minute power output of the microphone to the level necessary to drive a loudspeaker strongly enough to enlarge the listening area by a substantial amount. Early amplifier designs for power applications were made to match existing microphones and speakers. The desired power output was achieved first with existing tubes and components through the use of some known circuits, then with modified circuits and newly developed tubes, new ideas on impedance matching, energy

transfer, interstage coupling and feedback.

Inherent tube and circuitry noise was slowly eliminated with the development of new materials for use in filaments, grids, resistors, and the resulting modifications in power supplies and filtering methods. Frequency response was broadened to provide smoother lows and more natural highs. Components were designed to withstand the heat developed by high-power tubes.

Mixing circuits were devised to offer greater possibilities for multi-source originations. Special filters were designed to compensate for recording characteristics. Mixer units were separated from the power chassis to permit the more delicate low-voltage circuitry to operate to its own best advantage without interference from tube heat and power transformers. Bridging circuitry and matching networks were calculated and engineered to permit flexibility of inputs. Power amplifiers could not be located at a distance from the mixing unit whenever desired without any appreciable loss of quality or energy.

Amplifiers were modified to reduce distortion, increase frequency response, provide higher power and take up less space. Preamplifier mixers were also modified to operate with a greater frequency range and lower noise and distortion level.

As power ratings of amplifiers were increased to provide greater audience coverage, constant-voltage output systems were devised to allow more and more speakers to be added without loss of level.

Separate mixer/amplifier units and packaged, or combined, mixer-amplifier equipments are now available from many manufacturers in various price ranges depending on the application.

With the arrival of stereophonic reproduction, mixers and amplifiers have been again redesigned to permit two and three channels to be available on units built to the same dimensions as previous mono equipment, and with a minimum of cross-channel interference.

The disassociation of mixer from amplifier has permitted the development of equipment specifically to solve some of the problems incurred in multi-input and high-level speaker output systems. Limiters and compressors have come into fairly extensive use to prevent sharp bursts of sound from distorting the quality of reproduction or damaging the equipment. In the same way, expanders to raise the level of the source sound automatically if it should fall below a predetermined point, are now common.

Most recently, equalizers of various types have been engineered to permit a greater opportunity to emphasize desired frequencies and eliminate undesired ones. In reverberant auditoria greater intelligibility can be realized by raising the relative importance of certain frequencies and diminishing the level of others, thus limiting the discrete ones causing the disturbing reverberation and, as a result, permitting higher levels of output in the desired ranges. Less sophisticated equalizers are available that operate on calculated curves at fewer, but carefully selected, frequencies from those units that are specifically designed to permit exceptionally sharp operation at a great number of frequencies.

In recent studies of acoustics and reverberation, it has been found that if output frequencies can be made slightly different from the original ones, by an amount insufficient to be heard, then feedback can be reduced. This will allow higher output levels. The result is the development of a frequency shifter which raises each input frequency

by 5 Hertz at the output. Levels can then be increased as much as 3 dB, or more, for greater audience coverage.

Solid State

In most recent years, preamplifiers, amplifiers, compressors and even power supplies have undergone a most revolutionary change with development of the transistor. In its infancy, the transistor introduced its own sound characteristic when used in audio equipment. It also could not withstand the punishment that a tube could when something happened in the internal circuitry of the equipment or in the speaker lines. With further development, this device is now being used in almost all equipment. New circuitry has been devised to keep the transistor from breaking down in the event the equipment becomes defective, or if trouble develops in the output lines, or even if there is a sudden power surge. Transistors of various designs and internal structures have been developed for special applications and while some are still being made that cannot be handled without special precautions, for the most part, these tiny units have made such inroads that they have almost taken over completely.

Audio equipment can now be made smaller, lighter, with very good frequency and noise characteristics, but not yet quite at the same price as the tube equipment.

Since the heat developed by a transistor is much less than that given off by a tube of equivalent operation, more equipment can be mounted in smaller housings. Nevertheless, all transistor equipment should still be protected from being overheated by any tube units which may be used in the same system.

Speakers

As other units of a sound distribution system have changed, so did the speaker. Extremely bulky, inefficient loudspeakers with coil-generated fields changed to smaller, lighter, more efficient units with permanent magnets. Cone material changed along with the type of suspension of open ends. Frequency response improved, rattle was eliminated in better speakers during peaks, shapes of magnets changed as new materials were found to create stronger fields in a smaller space, and efficiency improved as less power was required to move the cone. Speakers, as with microphones, have been developed for different applications, with unique specifications of frequency response and smoothness, power ratings, angle of dispersion, efficiency and size. Smoothness of the response curve is desired to reduce feedback when used in the vicinity of open microphones. Concepts of speaker housings and their internal structure, front openings and sizes, dimensions and material have undergone study and modification to improve particular characteristics deemed necessary by the variety of applications.

A study was also made of the interaction of sound waves when speakers were located close together. It was found that a mounting of several speakers in a particular arrangement provides characteristics unique to that arrangement. A linear array, with speaker centers a definite distance apart, creates a "spotlight" effect with the vertical angle less than that of a single speaker alone. That angle decreases as the number of speakers increases.

Sound columns are now used in areas where reverberation time is high to direct the sound towards the audience

and to decrease the wasted sound energy which would otherwise hit the ceiling or floor and create reflected, disturbing sound patterns. Straight line and curved speaker arrays, multiple speaker arrangements, filter networks and other concepts have sprung from the original theory in an effort to produce units that will suit an application range or fit a price category. Still, specially designed units are required when the circumstances are sufficiently unique to warrant this engineering, as for example tremendous audiences in large outdoor areas or music halls where highest fidelity is required at each seat.

As more and more equipment has been developed and produced in each phase of sound distribution systems, it has become obvious that standardization is required. Microphone output impedance must match preamplifier inputs, amplifier outputs must match speakers, preamplifier outputs and amplifier inputs, as well as those of intermediate equipment, must also match for proper operation of a complete system. Characteristics of equipment, depending on several variables, have to be defined at particular points of measurement.

Prognostications?

Now that all these concepts, systems, equipment and many of the standards have become accepted, tried and developed to meet a great variety of uses and conditions, have we gone as far as we can in sound reinforcement and public address? Can anything more be done to improve what is now available to compare with the strides in development up to now? Further miniaturization seems to be part of the answer.

Will mikes be made with mini-transmitters to eliminate the use of connecting cables altogether? Will receiver-amplifiers be further diminished in size through the use of multi-function modules so that they can be located at each speaker instead of in central racks? Will speakers become smaller to permit them to be hidden entirely? Will new studies of acoustics, reverberation, sound transmission and dispersion create havoc with present standards? Or will future studies of the ear and its operation, the response of the brain and greater use of psychedelic sound provide the new incentives for the developments yet to come? It might prove interesting to live long enough to hear for ourselves.



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